RECLAMATION
Managing Water in the West

Elephant Butte Reservoir Five-Year Operational Plan

Biological Assessment

U.S. Department of the Interior
Bureau of Reclamation
Albuquerque Area Office

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MISSION STATEMENTS

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Cover: Rio Grande temporary channel flowing into the reservoir pool at the "Narrows" of Elephant Butte Reservoir, Sierra County, New Mexico. Photo taken 11 September 2008. (*Photo/ R. Doster*)

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Chapter 1: Project Purpose & Overview

Elephant Butte Reservoir currently holds just under 35% of its total storage capacity as a result of prolonged drought in the Southwest. Over the past decade as Elephant Butte Reservoir has receded, large areas of vegetation have become established, and flourished, in the wake of the reservoir pool. Some of this habitat has proven to be ideal for use by the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*; flycatcher or SWFL). When moisture returns to the Rio Grande valley in New Mexico, it is anticipated that Elephant Butte Reservoir will again hold more water. When water levels rise, due in part to the way in which the reservoir is operated by the Bureau of Reclamation (Reclamation), the flycatcher population at Elephant Butte Reservoir will be affected. Thus, this Biological Assessment evaluates the potential impacts from reservoir operations, over a five-year period, to the flycatcher. While not the focus of this assessment, the following species were also given consideration: the endangered Rio Grande silvery minnow (*Hybognathus amarus*), the candidate-for-listing Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*), and the recently-delisted Bald Eagle (*Haliaeetus leucocephalus*).

Chapter 2: Proposed Action

2.1 Rio Grande Project Reservoirs Operational Plan

Reclamation's Rio Grande Project reservoirs operational plan is a valuable tool for projecting and estimating the storage levels of Elephant Butte and Caballo reservoirs, as well as proposed releases from the dams for Caballo Reservoir storage management and irrigation demand on the Rio Grande Project in any one year. The plan is developed in both a daily time-step and monthly time-step.

The operational plan is simply a mass-balance of known and unknown data. The actual or historical daily and monthly flow data for Cochiti Dam releases, San Marcial flows, and Elephant Butte Dam releases are obtained from the U.S. Geological Survey (USGS). Evaporation losses for both reservoirs are obtained from field data at each dam. Releases from Caballo Dam are obtained from Reclamation's gauging station below Caballo Dam. Each reservoir's daily and monthly water surface elevation is obtained from each dam's monitoring equipment, and the elevation is converted to a storage content utilizing Reclamation's 2007 area-capacity tables for both reservoirs. The calculated data for the actual or historical portion of the operational plan is the net losses between Cochiti Dam releases and San Marcial flows, the total release from Caballo Dam, and each reservoir's storage contents.

The projected or estimated portion of the operational plan is developed in close coordination with the Natural Resources Conservation Service (NRCS), the National Weather Service (NWS), the U.S. Army Corps of Engineers (COE), Reclamation's Albuquerque Area Office (AAO), the State of Colorado in Alamosa, the State of New Mexico in Albuquerque and Santa Fe, the USGS in Las Cruces, NM, Reclamation's Elephant Butte Field Division office at Elephant Butte Dam, Elephant Butte Irrigation District (EBID), El Paso County Water Improvement District No. 1

(EP #1), the International Boundary and Water Commission (IBWC) in El Paso, TX, and Mexico.

Data and information received from the various agencies and entities are crucial in developing a reasonable projected or estimated operational plan for the remainder of any one year. The following is a general list of data or information collected or received that are crucial in developing the operational plan:

1. Spring runoff forecasts at Del Norte, Platoro Reservoir, Lobatos, El Vado Reservoir, Otowi, and San Marcial (NRCS and NWS).
2. Flow data and operations of Platoro, El Vado, Abiquiu, Cochiti, Jemez Canyon Reservoirs, as well as Upper Rio Grande Water Operations Model (URGWOM) output for San Marcial stations (COE).
3. Flow data and operations of El Vado, Abiquiu, Cochiti, and Middle Rio Grande Conservancy District (MRGCD) facilities in the middle valley (Reclamation's AAO and State of NM).
4. Flow data and operations of Platoro Reservoir and deliveries to Lobatos (State of CO).
5. Flow data and information from Elephant Butte Dam and Reservoir, Caballo Dam and Reservoir, gauging stations below Elephant Butte and Caballo dams, and river gauging stations on the Rio Grande from Caballo Dam to Fort Quitman, TX (Reclamation's Elephant Butte and El Paso field offices, USGS, IBWC, Mexico, EBID, and EP #1).
6. Irrigation demand and orders for delivery of storage water out of Caballo Reservoir (EBID, EP #1, IBWC, and Mexico).

Spring runoff forecasts at Otowi and San Marcial are adjusted for upstream reservoir regulation, additional depletions and return flows in the middle valley above Elephant Butte Reservoir, and other river operations such as flows to meet the Rio Grande silvery minnow biological opinion requirements. Developed flows at San Marcial are compared with the COE's URGWOM model output, and are adjusted as necessary and appropriate.

Reclamation's El Paso field office meets once a month during the irrigation season with the watermasters of the Rio Grande Project (EBID, EP #1, City of El Paso, IBWC, and Hudspeth County Conservation and Reclamation District) to discuss river operations, delivery of Project water supply, and other Rio Grande Project operational issues. Information from the watermasters, such as estimated irrigation orders and beginning and shut down periods, is essential in developing the operational plan.

Also, Reclamation's El Paso Field Office meets once a month during the irrigation season with IBWC, Mexico, the two U. S. irrigation districts (EBID and EP #1), and the City of El Paso to discuss the current Rio Grande Project operational plan and water supply. Information from the group, such as scheduled changes for delivery, shut down of orders and releases from Caballo Dam, beginning and end of irrigation season for each Project water user, current amount of lands being irrigated for the irrigation season, and status of deliveries to Project canal headings on the Rio Grande and the efficiency of delivering the Project water supply, is essential in developing the operational plan.

The operational plan is updated at least once a week, and during the spring runoff period (March – July), the plan may be updated more than weekly. Reclamation transmits the Rio Grande Project reservoirs operational plan to all interested parties monthly by mail.

2.2 Reclamation's Rio Grande Project Reservoirs Operational Discretion

Reclamation's discretion in the operations of the Rio Grande Project reservoirs is extremely limited as evidenced by the constraints and restrictions listed in Appendix A. The only discretionary measure in Reclamation's operational criteria is a pre-release of storage water from Elephant Butte Reservoir for flood control purposes. When Reclamation, in coordination with upstream river and reservoir management agencies, anticipates a large volume of flood waters above Elephant Butte Reservoir to enter and exceed the top of the prudent flood space, Reclamation will pre-release an appropriate amount of water such that a temporary space in the reservoir is made available to be filled by the anticipated volume entering the reservoir (Appendix A). Therefore the final storage level at Elephant Butte Reservoir doesn't exceed the top of the prudent flood space and flooding below Elephant Butte Dam and at Caballo Reservoir are controlled. Ultimately, whatever drawdown in the Elephant Butte Reservoir storage level is accomplished by this pre-release operation is only temporary, because the storage level will rise again to the top of the prudent flood space.

Reclamation will continue to meet with the U.S. Fish and Wildlife Service (USFWS) annually to discuss the present year's Rio Grande Project reservoirs operations and any anticipated impacts primarily to the Southwestern Willow Flycatcher and its habitat, but also to the Rio Grande silvery minnow, Western Yellow-billed Cuckoo, and Bald Eagle. In order to properly project Elephant Butte Reservoir's water surface elevations for the coming year, Reclamation will utilize its Rio Grande Project reservoirs operational plan as a tool for projections of the Elephant Butte Reservoir's water surface elevations. In May each year, Reclamation presents its latest Rio Grande Project reservoirs operational plan to the public in a series of public meetings held locally within the Rio Grande Project area.

2.3 Development of the Five-year Operation Plan

2.3.1 Hydrology

Upper Rio Grande Basin hydrology is highly variable. Historically, long periods of drought and lack of sufficient snowpack and resultant runoff have driven storage at Elephant Butte Reservoir to lower levels and produced less than full supplies for irrigation on the Rio Grande Project for many years. Generally, the Rio Grande Compact does "spread the pain" of drought years and the "sharing of excess flows" in wet periods equally between the three signatory States while recognizing the senior right in the upper Rio Grande Basin which is the Rio Grande Project.

Historic elevations in Figure 1 show the impact of low runoffs to Elephant Butte Reservoir and the resultant reservoir water surface elevations since the reservoir first started storing water in 1915. From 1915 to 1945, the Project's irrigated lands were not fully developed, so the storage levels remained relatively full. The reservoir filled and spilled for the first time in May 1942.

With lands fully developed and put under irrigation production in 1946, full irrigation demand each year became possible. However, the upper Rio Grande Basin went into a prolonged drought in the late 1940s and the drought intensified in the 1950s with the lowest storage ever on record on 6 August 1954. It took another 25 years for the storage in Elephant Butte Reservoir to recover so that Reclamation could allocate full supplies again for irrigation on the Project.

Conversely, the wettest period on record occurred in the 1980s and the first half of the 1990s. The second time that Elephant Butte Reservoir filled and spilled was in July 1985. It remained full and spilling through 1988. This is unprecedented considering the historical hydrology of the upper Basin. A short dry period ensued, but Elephant Butte Reservoir filled and spilled again in 1994 and 1995. Since then, the basin has been in a, long-term drought for the last 13 years.

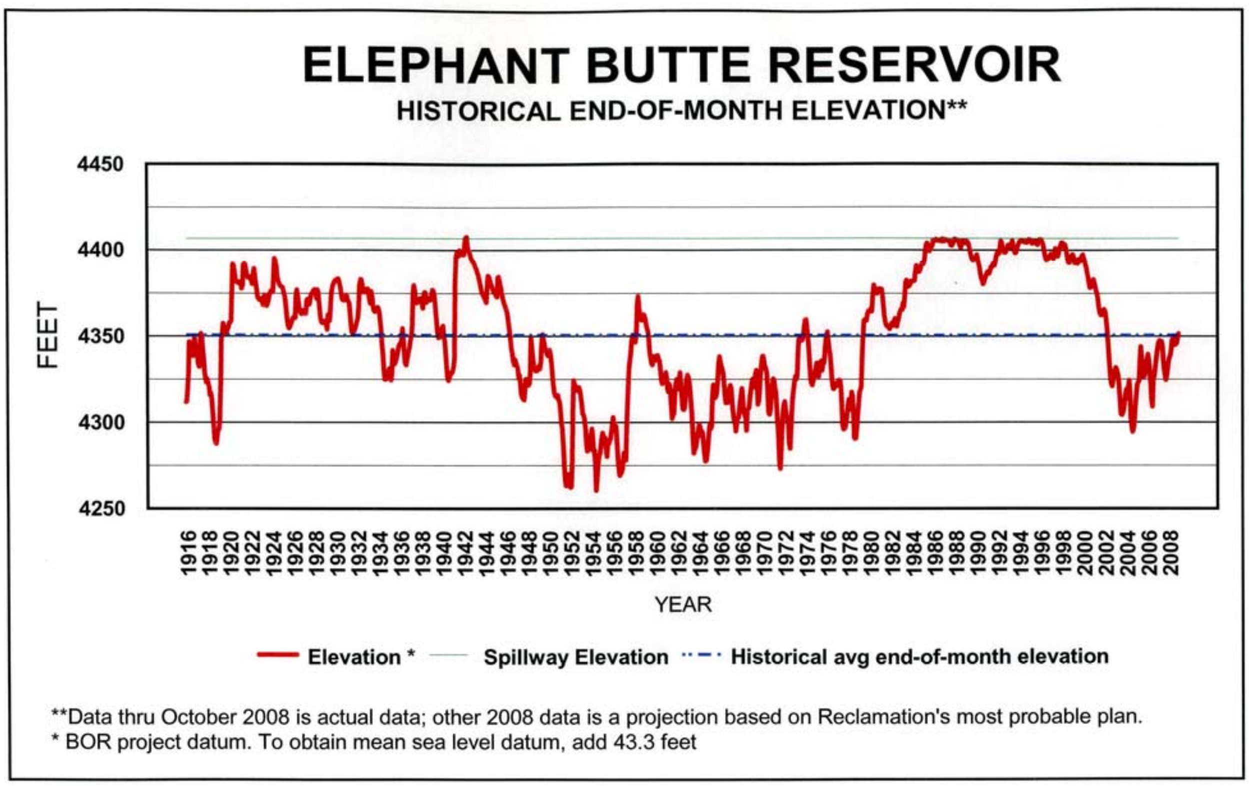


Figure 1. Historic end-of-month elevations for Elephant Butte Reservoir.

Hydrology of the upper Rio Grande Basin (above Elephant Butte Reservoir) is highly variable and subject to relatively long periods of drought. San Marcial gauging stations (combined flow of the Low Flow Conveyance Channel and Rio Grande Floodway) is the inflow to Elephant Butte Reservoir. Reclamation (El Paso Field Division) utilizes these flow data to develop and update the Rio Grande Project reservoirs operational plan (consisting of Elephant Butte and Caballo reservoirs).

Historically, San Marcial floodway gauging station period of record is 1895 to the present – over 113 years of flow data (Figure 2). San Marcial low flow conveyance channel gauging station period of record is 1954 to the present – over 54 years of flow data. These records represent both long periods of drought and wet years. San Marcial flow is highly influenced by upstream reservoir regulation and irrigation diversions and return flows. The Rio Grande Compact influences the timing and quantity of flow at San Marcial. Summer monsoon rainfall also influences flow at the stations, again which are highly variable from year to year. Nearly 70% of the annual flow at San Marcial occurs during the spring runoff period (March – July). Spring runoff into Elephant Butte Reservoir originates from snowpack melt in the mountains of northern New Mexico and southern Colorado. It is obvious that the Rio Grande Project depends heavily on each year's spring runoff to make an irrigation supply for the Project water users.

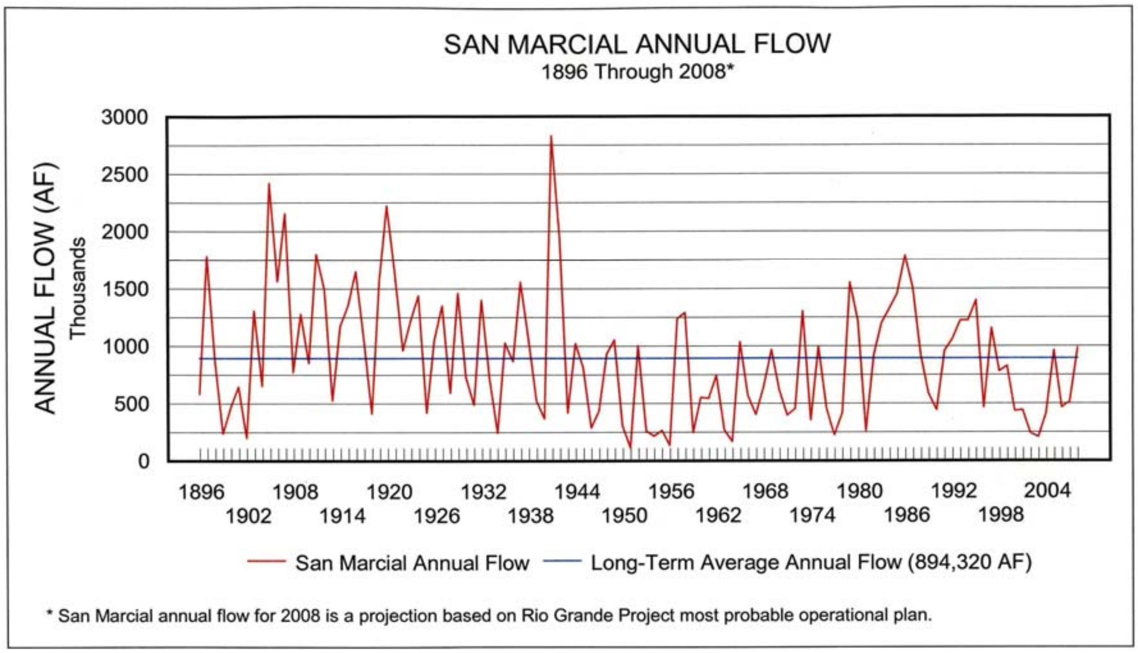


Figure 2. Annual flow data (1895 – present) for the Rio Grande at San Marcial, NM.

In order to truly represent inflows to Elephant Butte Reservoir in projected five-year periods that are realistic and reasonable, Reclamation decided that a range of historical flows should be analyzed into the next five years. These historic flows represent dry, average, and wet trends. Results would be tabulated and plotted which would yield an "envelope" or range of water surface elevations at Elephant Butte Reservoir upon which biologists could evaluate impacts to the Southwestern Willow Flycatcher and its habitat within Elephant Butte Reservoir over the next five years of operation of the Rio Grande Project.

As mentioned above, a majority of the annual flow at San Marcial is derived from the spring runoff in the upper Rio Grande Basin. In observing the current trend of inflows to Elephant Butte Reservoir, Figure 3 depicts spring runoffs (March – July) at San Marcial for 1979 – 2008.

The upper Rio Grande Basin has been in a drought since 1996. Only three years in the last 13 have experienced above-normal spring runoff at San Marcial. Reclamation decided that the historical flows of 2004 – 2008 would represent an "average" trend going into the next five years. These years also represent the variability in the hydrology of the current drought and to a degree may also represent current climate change trends.

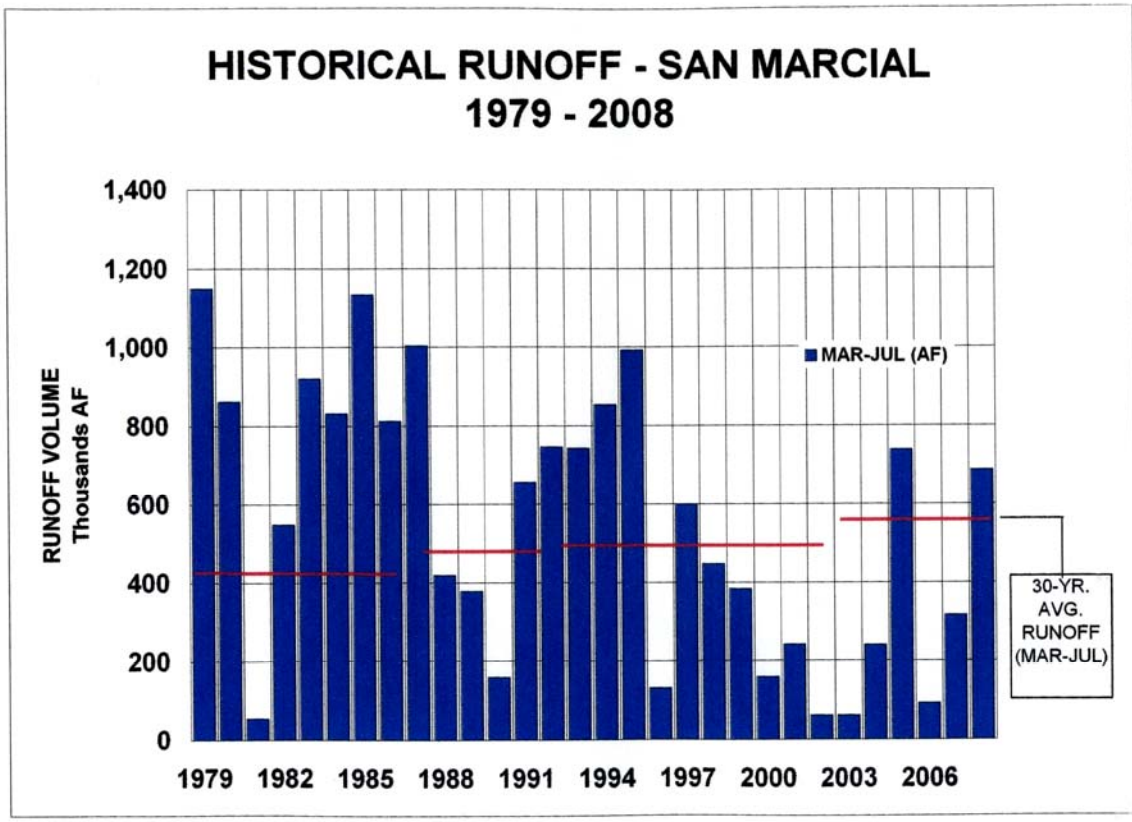


Figure 3. Spring runoff events at San Marcial, NM, between 1979 and present.

To determine a representative five-year period for a "dry trend," Reclamation selected the historical flows of 1953 – 1957. Since there are no data supporting the idea that the current drought is ending, Reclamation looked at the last prolonged drought on the Rio Grande Project – from the late 1940s to the late 1970s. Reclamation selected the period from 1953 to 1957, because it was a dry period of time with low spring runoffs to Elephant Butte Reservoir for a majority of the five-year period. Also, in the early years of the prolonged drought 1952 was an above normal spring runoff at San Marcial and the total Project storage at the end of 1952 was similar to 2008. Finally, this historical five-year period ends with an above normal runoff year (1957).

To determine a representative five-year period for a "wet trend," Reclamation selected the historical flows of 1978 – 1982. It is not reasonable to assume that the next five years will be extremely high runoff years like the decade of the 1980s. However, Reclamation believes it is prudent and reasonable to assume that there is a possibility entering into that extremely wet period of historical hydrology in the upper Rio Grande Basin. Therefore, Reclamation selected the years 1978 – 1982 because there were more above-normal spring runoff years in that period, and they preceded the extremely wet period of the 1980s.

2.3.2 Status and Monitoring of San Juan-Chama Water and Rio Grande Compact Credit Waters at Elephant Butte Reservoir

San Juan-Chama Project (SJ-C) contractors may store SJ-C water in Elephant Butte Reservoir pursuant to a 1981 Public law which authorizes the Secretary of the Interior to enter into contracts with SJ-C contractors for such purposes. The City of Albuquerque (now Albuquerque Bernalillo County Water Users Authority; ABCWUA) has a contract with the Secretary, through Reclamation, to store up to 50,000 acre-feet (AF) in Elephant Butte Reservoir. The ABCWUA and Reclamation are developing a contract to renew this 50,000 AF storage agreement for another 25 years. The City of Santa Fe has also requested a contract with Reclamation for storage of up to 50,000 AF of its SJ-C water in Elephant Butte Reservoir. Reclamation is developing a basis for negotiation of such a contract.

A public law in 1974 created a 50,000 AF space in Elephant Butte Reservoir for recreational purposes. Although the law's provision for the initial 50,000 acre-feet of SJ-C water to be released to establish the pool, and up to 6,000 acre-feet annually thereafter for evaporation losses, for a period of ten years, has expired, the space for the pool itself has not. Theoretically, SJ-C contractors could request Reclamation to move SJ-C water allocated and delivered to them into the recreation pool. If the ABCWUA contract is renewed, and if the proposed contract with the City of Santa Fe is executed, and if the maximum amount of water were stored in the recreation pool, there could exist potentially 150,000 acre-feet of storage space in Elephant Butte Reservoir occupied by SJ-C water.

In the development of each five-year plan for the operations of the Rio Grande Project reservoirs, Reclamation keeps track of the evaporation losses on the total amount of SJ-C water in Elephant Butte Reservoir each month, and projects any SJ-C water movement in and out of this total SJ-C pool of water in the reservoir. The evaporation calculations are identical to Reclamation's accounting of the SJ-C water in Elephant Butte Reservoir for Rio Grande Compact purposes. Reclamation also keeps track of the yearly deliveries for Colorado and New Mexico for Rio Grande Compact purposes. These projected calculations are identical to the Rio Grande Compact accounting procedures and regulations, and historical flows utilized are adjusted, as necessary, to reflect current trends of river and irrigation operations for Colorado and New Mexico. The combined total amount of water in Elephant Butte Reservoir that is SJ-C water and Rio Grande Compact credits is considered not available for allocation and release for irrigation on the Rio Grande Project in any year and establishes a "low point" at Elephant Butte Reservoir which Reclamation cannot draw below for operational purposes.

2.3.3 Rio Grande Project Reservoirs Operational Criteria and Guidelines

In order to reasonably and fully develop a projected five-year plan of the Rio Grande Project reservoirs operations, consideration must be given to a number of key criteria and items. Each year's projected Rio Grande Project reservoirs operational plan is simply a mass balance of known and unknown data for both Elephant Butte and Caballo Reservoirs. Known data are: Cochiti Dam releases; San Marcial flows; and, reservoir evaporation and associated losses for both reservoirs. Projected data include: Elephant Butte Dam releases; and, Caballo Dam irrigation and excess releases. Calculated data are: net losses between Cochiti Dam releases and

San Marcial flows; Elephant Butte Reservoir end of month storage content; Caballo Reservoir total release; and, Caballo Reservoir end of month storage content.

A projection of Elephant Butte Reservoir's "low point" (SJ-C and Rio Grande Compact credits) must be known to establish reasonable flow releases from the reservoirs for irrigation on the Rio Grande Project.

The following gauging stations' historical flows for the appropriate five-year period being considered are utilized and analyzed with the development of the five-year plans: Rio Grande near Del Norte, Conejos River near Mogote, Los Pinos River at Ortiz, San Antonio River at Ortiz, Rio Grande near Lobatos (index and delivery stations for Colorado for Rio Grande Compact purposes); Rio Chama near Chamita, Rio Grande at Otowi Bridge, Rio Grande below Cochiti Dam, Rio Grande Low Flow Conveyance Channel at San Marcial, Rio Grande Floodway at San Marcial (index and delivery stations for New Mexico for Rio Grande Compact purposes) and other stations to analyze for current river and irrigation operations upstream of Elephant Butte Reservoir.

To determine when to begin releases for irrigation on the Rio Grande Project, the total Project storage in both reservoirs at the end of February will dictate the beginning of releases. To determine whether "block releases" to meet irrigation requirements will occur during any one year, releases will be discontinued from Caballo Reservoir from mid-April to mid-May whenever total yearly release from Caballo Reservoir is anticipated to be less than 400,000 AF.

Releases out of Elephant Butte Reservoir in any one year will be based on maintaining irrigation demand downstream of Caballo Reservoir as well as maintaining key storage levels at Caballo Reservoir during the irrigation season such that evaporation differences between Elephant Butte and Caballo Reservoirs are minimized per the Court Order of 1996.

In the event of serious flooding above Elephant Butte Reservoir and when the storage level is approaching the flood reservation space, a pre-release from Elephant Butte Reservoir would be considered in coordination with upstream operations and volume of floodwaters anticipated reaching Elephant Butte Reservoir. As flood releases and pre-releases from Elephant Butte Reservoir reach Caballo Reservoir, and to the extent that storage in Caballo Reservoir approaches and enters the 100,000 AF flood control pool, the IBWC will coordinate with Reclamation and dictate the releases to be made from Caballo Reservoir to control flooding in the valleys downstream. Elephant Butte Dam flood releases will be made in coordination with the IBWC and status of flood operations at Caballo Reservoir.

To determine evaporation and other reservoir losses for each reservoir, Reclamation will utilize historical data for Elephant Butte and Caballo Reservoirs and assign monthly values based on similar reservoir levels and conditions.

After the initial plan for each year is completed, the following checks and adjustments are made:

- Check to see if the "low point" at Elephant Butte Reservoir has changed due to evaporation on SJ-C water, inflow or outflow from the total SJ-C pool, and any relinquishment of Rio

Grande Compact credit waters by Colorado or/and New Mexico. If this “low point” has changed, then adjust releases from each reservoir and re-calculate evaporation & other losses accordingly. Also, if necessary, adjust Otowi, Cochiti, and San Marcial flows in the spring runoff period if any relinquishments of Compact credits occur.

- Utilize historical precipitation data for Elephant Butte, Caballo, Las Cruces, and El Paso and determine if rainfall amounts during the summer monsoon period (July – September) would decrease irrigation demand on the Rio Grande Project. If so, adjust releases from both reservoirs accordingly, and adjust evaporation and other losses on both reservoirs as necessary.

- Check status of Colorado and New Mexico yearly deliveries for Rio Grande Compact purposes to determine if Otowi, Cochiti, and San Marcial flows need to be adjusted for present operations upstream of Elephant Butte Reservoir. If these flows are changed, then adjust reservoirs’ releases as well as evaporation and other losses accordingly.

A specific set of Rio Grande Project general operational criteria and guidelines were used to develop a projected five-year plan. To develop each year’s Rio Grande Project reservoirs operational plan, the following criteria and guidelines were utilized and applied as closely as possible.

1. Check at beginning of the year for the non-Project water in Elephant Butte Reservoir (SJ-C water) and Rio Grande Compact credit waters for either the State of Colorado or/and the State of New Mexico and the total amount is the tentative low point at Elephant Butte Reservoir for the year.

2. Insert historical monthly flows for Cochiti Dam releases and San Marcial flows for the appropriate historical year.

3. Check the “net depletions” between Cochiti Dam releases and San Marcial flows for the runoff period to determine if reasonable.

4. To determine when to begin releases from Caballo Dam for the irrigation season on the Rio Grande Project, use the following general guidelines:

   If combined Project storage at the end of February is > 500,000 AF, then begin releases the last week of February;

   If combined Project storage at the end of February is < 500,000 AF and > 400,000 AF, then begin releases the first week of March;

   If the combined Project storage at the end of February is < 400,000 AF, then begin releases mid-March or at the latest, 1 April.

5. To determine releases out of Caballo Reservoir during the Rio Grande Project irrigation season, the following criteria will modify continuous releases for the entire irrigation season:

If the total yearly release out of Caballo Reservoir is < 400,000 AF, then assume “block releases” will occur for the irrigation season where releases out of Caballo Reservoir will be 0 cfs from mid-April to mid-May, and Elephant Butte Dam releases will be modified to maintain appropriate summer levels at Caballo Reservoir.

6. To determine releases out of Elephant Butte Dam, the following general guidelines will dictate these releases:

   Caballo Reservoir storage content will not exceed 55,000 AF by mid-June; draw Caballo Reservoir down to approximately 30,000 AF by the end of August; draw Caballo Reservoir down to approximately 20,000 AF by the end of September; and, draw Caballo Reservoir down to 10,000 AF by the end of the Rio Grande Project irrigation season (during drought years only).

7. During flooding events upstream, at, or downstream of Elephant Butte and Caballo Reservoirs, the following general guidelines will be followed to the extent possible:

   If the storage level at Elephant Butte Reservoir is approaching the prudent flood reservation space and severe flooding is occurring upstream, coordination with upstream Water Operations personnel and determination of volume of flood waters to arrive at Elephant Butte Reservoir is essential, and a pre-release of storage may be warranted, such that the storage level will not exceed the top of the flood space, and provided that downstream channel conditions are able to safely pass releases without causing flooding, and space is available in Caballo Reservoir to store releases without exceeding the top of Caballo Reservoir’s flood control pool;

   If the storage level at Elephant Butte Reservoir is in the flood reservation space due to localized flooding, then flood waters are held in the flood space until it is safe to pass flood waters downstream without causing flooding, to the extent that the storage will not exceed the top of the flood space, and to the extent that storage in Caballo Reservoir will not exceed the top of the flood control pool;

   If the storage level at Caballo Reservoir is approaching or in the flood control pool, coordination with IBWC is essential as IBWC dictates how the flood control pool will be operated and how and when flood releases from Caballo Reservoir will be made, provided that the storage in Caballo Reservoir will not exceed the top of the flood control pool, and close coordination with Reclamation will be necessary to determine the appropriate releases from Elephant Butte Reservoir.

8. Determine monthly evaporation and losses amounts for each reservoir (Elephant Butte and Caballo) utilizing historical data based on similar storage contents for each reservoir.

9. After plan is initially completed, then check end of year non-Project storage (SJ-C waters) and Compact credit waters to determine if low point at Elephant Butte Reservoir needs to be modified (due to change in SJ-C water and Rio Grande Compact credit waters for both the

State of Colorado and the State of New Mexico, which would be any relinquishment by either State).

10. If relinquishment of Rio Grande Compact credit waters by either State occurs due to no. 9 above, then adjust Otowi, Cochiti, and San Marcial flows for the spring runoff period only, if necessary.

11. If low point at Elephant Butte Reservoir has changed due to no. 9 above, then adjust releases out of Caballo and Elephant Butte Reservoirs accordingly.

12. If low point at Elephant Butte Reservoir has changed due to no. 9 above, then adjust evaporation and losses to each reservoir, if necessary.

13. To determine if precipitation that has fallen during the monsoon season (July – September) on the Rio Grande Project area will affect the irrigation demand out of Caballo Reservoir, check the monthly precipitation historical data and adjust Caballo and Elephant Butte Reservoirs releases accordingly.

14. If summer monsoon precipitation on the Rio Grande Project will affect irrigation demand out of Caballo and Elephant Butte Reservoirs per no. 13 above, then adjust evaporation and losses to Elephant Butte and Caballo Reservoirs, if necessary.

15. To determine if Cochiti Dam releases and San Marcial flows reflect present operations upstream of Elephant Butte Reservoir, check end of year calculations for deliveries for the State of Colorado and the State of New Mexico for accrued Compact credits and debits. If selected flows are higher, then adjust Cochiti Dam releases and San Marcial flows accordingly.

16. If no. 15 above applies, then modify releases out of Elephant Butte and Caballo Reservoirs and evaporation & losses for both reservoirs accordingly.

The 30-year average flow at the San Marcial station is 573,000 AF (per the Natural NRCS's latest 30-year average flow from 1971 to 2000) for the spring runoff period (March – July). The data in each year's operational plan are in acre-feet on a monthly basis, and in the various losses columns, a positive number indicates a loss and a negative number indicates a gain.

2.4 Results of the Development of a Five-year Operation Plan

Detailed results of Reclamation's three five-year runs of the Rio Grande Project reservoirs operational plans appear in Appendix B. Below, Table 1 shows the results of the "dry", "average", and "wet" trends for the next five years at Elephant Butte Reservoir, by end-of-month water elevation. Each five-year run includes the beginning and end of year status of the SJ-C water and Rio Grande Compact credit waters in Elephant Butte Reservoir, movement of SJ-C water to Elephant Butte Reservoir, any relinquishments of Compact credit waters by Colorado and/or New Mexico, and any decisions made to alter releases from the Project reservoirs.

Table 1. Results of three five-year operational scenarios for Elephant Butte Reservoir.

5-YEAR RIO GRANDE PROJECT OPERATIONAL PLAN FOR ELEPHANT BUTTE RESERVOIR
END OF MONTH ELEVATIONS

		Dry Run (feet) *	Avg Run (feet) *	Wet Run (feet) *
2009	Jan	4354.43	4354.12	4354.14
	Feb	4355.19	4355.25	4354.07
	Mar	4353.78	4348.54	4348.05
	Apr	4349.10	4348.55	4342.13
	May	4342.08	4345.91	4343.08
	Jun	4333.92	4335.60	4339.12
	Jul	4321.26	4324.77	4328.46
	Aug	4311.42	4314.98	4317.34
	Sep	4306.07	4305.47	4309.96
	Oct	4300.23	4302.84	4307.44
	Nov	4299.64	4307.24	4313.06
	Dec	4301.56	4314.18	4318.50
2010	Jan	4305.60	4319.56	4323.26
	Feb	4309.83	4323.81	4328.15
	Mar	4310.51	4316.82	4325.95
	Apr	4308.36	4318.41	4330.34
	May	4308.30	4331.29	4346.08
	Jun	4308.26	4337.15	4357.69
	Jul	4308.28	4328.51	4364.48
	Aug	4308.28	4322.41	4362.67
	Sep	4308.27	4316.58	4358.90
	Oct	4310.46	4316.90	4356.29
	Nov	4311.12	4320.81	4360.58
	Dec	4313.34	4325.25	4365.10
2011	Jan	4316.31	4329.12	4367.16
	Feb	4318.78	4331.79	4367.82
	Mar	4320.25	4330.08	4364.22
	Apr	4316.40	4327.31	4363.97
	May	4316.26	4323.15	4373.39
	Jun	4314.03	4315.96	4378.94
	Jul	4313.97	4315.05	4375.28
	Aug	4313.96	4327.90	4370.98
	Sep	4314.01	4326.81	4369.04
	Oct	4315.17	4332.77	4367.12
	Nov	4315.96	4340.92	4369.65
	Dec	4318.66	4348.18	4373.06
2012	Jan	4320.17	4351.28	4374.59
	Feb	4323.12	4353.79	4374.62
	Mar	4319.78	4348.58	4370.42
	Apr	4317.48	4346.58	4366.16
	May	4314.19	4346.64	4360.62
	Jun	4301.13	4340.25	4352.42
	Jul	4287.87	4331.51	4345.48
	Aug	4287.01	4321.94	4338.97
	Sep	4285.89	4316.30	4334.99
	Oct	4286.03	4314.25	4333.57
	Nov	4286.42	4317.35	4335.92
	Dec	4287.26	4324.58	4339.03
2013	Jan	4290.38	4328.99	4341.57
	Feb	4294.38	4331.23	4342.54
	Mar	4292.25	4329.60	4338.86
	Apr	4292.24	4335.83	4339.20
	May	4292.40	4341.98	4345.05
	Jun	4301.07	4343.07	4346.80
	Jul	4317.22	4343.44	4339.30
	Aug	4332.90	4340.56	4334.85
	Sep	4336.52	4341.50	4336.34
	Oct	4340.82	4341.84	4336.02
	Nov	4347.91	4345.70	4340.65
	Dec	4351.06	4350.58	4345.19

* Rio Grande Project datum, to obtain USGS mean sea level datum, add 43.3 feet.

Conversion of storage content at Elephant Butte Reservoir to water surface elevation is based on Reclamation's April 1999 Area and Capacity Tables for Elephant Butte Reservoir. New sedimentation surveys of Elephant Butte Reservoir and Caballo Reservoir were conducted in the fall of 2007. The results of those surveys, including new area and capacity tables, will be available by the end of 2008 and Reclamation will begin using the new tables for official data at the reservoirs on 1 January 2009. Finally, all elevation data are per Rio Grande Project datum, so to obtain USGS mean sea level datum, add 43.3 feet.

Figure 4 graphs the end-of-month elevations for all three plans. Under the dry run of the five-year plan, Elephant Butte Reservoir's water surface elevation does not exceed 4355.2 ft. Under the average run, it does not exceed 4355.3 ft., and under the wet run, it does not exceed 4378.9 ft.

The influence of climate change on weather and hydrology is of considerable concern, and it is difficult to predict the changes that will occur at Elephant Butte Reservoir over the next five years. One outcome may be shorter periods of wet and dry, but each of those events may be more intense, and the variability may be more erratic. Therefore, the "average" trend five-year projections may be the closest to incorporating the effects of climate change in the short-term.

Chapter 3: Listed Species Habitat and Life History

3.1 Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Information pertaining to the habitat needs and life history of the flycatcher is incorporated by reference from the following documents which provide extensive details on these subjects:

U.S. Fish and Wildlife Service. 2002. Final Southwestern Willow Flycatcher recovery plan. U.S. Fish and Wildlife Service, Albuquerque, N. M. 210 pp. + appendices (15).

Moore, D. and D. Ahlers. 2008. 2007 Southwestern Willow Flycatcher study results: selected sites along the Rio Grande from Velarde to Elephant Butte Reservoir, New Mexico. U.S. Bureau of Reclamation, Denver, CO. 64 pp.

The proposed action is outside of designated critical habitat for the flycatcher.

3.2 Rio Grande Silvery Minnow (*Hybognathus amarus*)

Information pertaining to life history and habitat needs of the minnow is incorporated by reference from the following documents:

Dudley, R.K. and S.P. Platania. 1997. Habitat use of the Rio Grande silvery minnow. Report to the U.S. Bureau of Reclamation, Albuquerque, NM. 88 pp.

Dudley, R.K., G.C. White, S.P. Platania, and D.A. Helfrich. 2008. Rio Grande silvery minnow population estimation program results from October 2007. Draft report to the U.S. Bureau of Reclamation, Albuquerque, NM. 97 pp.

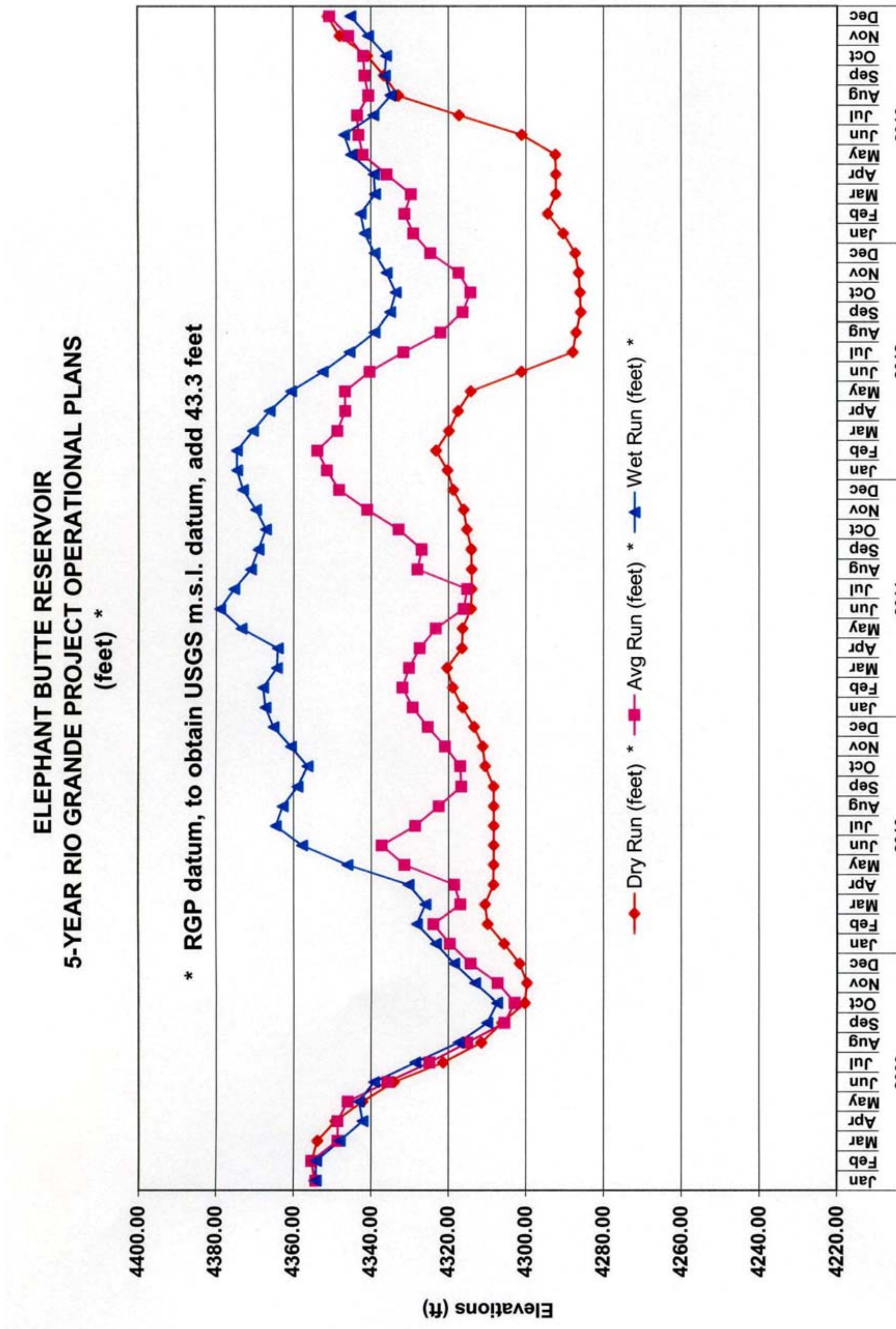


Figure 4. Plot of three scenarios of five-year projected water elevations in Elephant Butte Reservoir.

U.S. Fish and Wildlife Service. 1994. Endangered and threatened wildlife and plants; final rule to list the Rio Grande silvery minnow as an endangered species. Federal Register 59: 36988-36995.

U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; designation of critical habitat for the Rio Grande silvery minnow; final rule. Federal Register 68: 8087-8135.

U.S. Fish and Wildlife Service. 2007. Draft Revised Recovery Plan for the Rio Grande Silvery Minnow (*Hybognathus amarus*).

The proposed action is located outside of designated critical habitat for the minnow.

Chapter 4: Environmental Baseline

The USFWS has issued biological opinions, two of them quite recent, for other Reclamation activities in the Middle Rio Grande that describe the environmental baseline. The pertinent information regarding environmental baseline relevant to the endangered minnow and flycatcher in the current proposed action area is incorporated by reference from the following documents:

U.S. Fish and Wildlife Service. 2003. Biological and conference opinions of the effects of actions associated with the programmatic Biological Assessment of Bureau of Reclamation's water and river maintenance operations, Army Corps of Engineers' flood control operation, and related non-federal actions on the Middle Rio Grande, New Mexico, [variously paged].

U.S. Fish and Wildlife Service. 2007. Biological Opinion of the Effects of Actions Associated with the Biological Assessment for the Perennial Rio Grande Silvery Minnow Refugia at Drain Outfalls Project. 48 pp.

U.S. Fish and Wildlife Service. 2008. Biological Opinion on the effects of actions associated with the Elephant Butte Reservoir temporary channel maintenance project. 53 pp.

In addition, it is now known that minnows are present within the action area. Surveys for minnows, conducted by the USFWS within the existing temporary channel through the upper half of Elephant Butte Reservoir during the winter of 2005 – 2006, found between 10 - 100 minnows associated with backwater features on point bars.

Flycatcher surveys have been conducted in the proposed project area for several consecutive years. The most recent flycatcher surveys (Moore and Ahlers *in prep*.) found breeding flycatchers through the currently-dry portion of the reservoir to the southern end of the Narrows. In the summer of 2008, approximately 229 flycatcher territories were detected within the dry, vegetated portion of Elephant Butte Reservoir.

Chapter 5: Effects of the Action

5.1 Southwestern Willow Flycatcher

The SWFL is a federally-endangered subspecies of the Willow Flycatcher (*Empidonax traillii*; WIFL). The USFWS officially listed the SWFL as endangered in February 1995 (USFWS 1995). The SWFL is also listed as endangered or a species of concern by the states of Arizona, California, Colorado, New Mexico, Texas, and Utah (Sogge et. al. 1997, TPWD 2005).

In October 2005, the USFWS designated Critical Habitat for the SWFL along the Middle Rio Grande in three separate segments, separated by the Sevilleta and Bosque del Apache National Wildlife Refuges (NWR) which were excluded from the designation. The designated reaches include "from the southern boundary of the Isleta Pueblo for 44.2 miles to the northern boundary of the Sevilleta NWR. The Middle Rio Grande segment extends for 27.3 miles from the southern boundary of the Sevilleta NWR to the northern boundary of the Bosque del Apache NWR. The most southern Rio Grande segment extends for 12.5 miles from the southern boundary of the Bosque del Apache NWR to the overhead powerline near Milligan Gulch" (USFWS 2005). This designation does not include the conservation pool of Elephant Butte Reservoir.

5.1.1 Distribution and Abundance

Presence/absence surveys are conducted to determine the distribution and abundance of the endangered SWFL during the relatively brief breeding season when they become a seasonal resident of the Southwestern United States. Surveys are conducted by a wide-range of Federal, State, Local and private entities throughout the SWFL's range. All presence/absence surveys follow an established protocol developed by Sogge et al. (1997).

Reclamation personnel have conducted presence/absence surveys and nest monitoring during the May to July survey season within the Rio Grande Basin since 1995. In 1994, the New Mexico Natural Heritage Program (NMNHP 1994) conducted presence/absence surveys and nest monitoring within portions of the San Marcial reach under a contract with the COE.

5.1.1.1 Range-wide

In 1997, an estimated 300 to 500 SWFL pairs were known throughout their range (Sogge et al. 1997). More recent survey results estimate the number of breeding pairs range-wide at 1000 (USGS 2008). The sites where SWFLs are found are scattered, sometimes isolated, and range in size from only a couple of territories to more then 200. Since listing SWFL populations have shifted due to the dynamic nature of riparian habitat (Ellis et al. 2008).

The sites that currently support the largest concentrations of SWFLs include: Roosevelt Lake (AZ); lower San Pedro River and nearby Gila River (AZ); Santa Ynez River (CA); San Luis Rey River (CA); Cliff-Gila Valley (NM); and Elephant Butte Reservoir (NM), (USGS 2008). The SWFL population within Elephant Butte Reservoir is currently the largest population within New Mexico, and within the subspecies' range.

5.1.1.2 Rio Grande Basin, New Mexico

Approximately 310 to 320 SWFL territories were found within the Rio Grande Basin of New Mexico during the 2008 breeding season. Occupied sites were scattered from the Orilla Verde Recreation Area near Taos downstream to Selden Canyon and Radium Springs near Las Cruces. During the 2008 breeding season, most suitable habitat was surveyed within the mainstem of the Rio Grande in New Mexico. It is highly unlikely that any large populations of SWFLs have gone undetected, however, sites supporting a few undetected territories may exist in some isolated patches of habitat throughout the Rio Grande Basin.

2008 Estimated Territories for the Rio Grande Basin:

- Orilla Verde Recreation Area – 2 territories
- Tierra Azul – 4-5 territories
- Ohkay Owingeh and Isleta Pueblos – 20-25 territories*
- Sevilleta NWR/La Joya State Wildlife Area – 32 territories
- Bosque del Apache NWR – 5 territories
- Tiffany/San Marcial – 15 territories
- Elephant Butte Reservoir – 229 territories
- Selden Canyon/Radium Springs – 5 territories

* Based on historic data provided by respective Pueblos

Since 1993, SWFLs have been reported from 19 sites within the Rio Grande Basin, however several of these sites no longer support SWFLs. The majority of sites within the Rio Grande Basin support isolated populations of fewer than six territories. The only two reaches/sites that have shown significant population increases over the past 8-10 years are the Sevilleta NWR/La Joya State Wildlife Area reach and Elephant Butte Reservoir. The population within the Sevilleta NWR and La Joya State Wildlife Area was first detected in 1999. Formal surveys were initiated in 2000 and eight territories were detected. The population increased to 17 in 2003 and remained relatively stable until 2008 when approximately 32 territories were detected. The current Elephant Butte Reservoir population was first detected in 1995 when two SWFL territories were found. The population has steadily increased to 229 in 2008. Over 70% of the total territories found within the Rio Grande Basin during the 2008 season were within Elephant Butte Reservoir. Sites such as Tierra Azul, the Ohkay Owingeh and Isleta pueblos, and Selden Canyon/Radium Springs have been fairly consistent in territory numbers since 1993, which is indicative of somewhat stable populations within these sites. Several sites such as La Canova, La Rinconada, and Garcia Acequia within the Velarde Reach no longer support breeding SWFLs – although structurally suitable habitat still exists.

5.1.1.3 Elephant Butte Reservoir

The current SWFL population was first detected within Elephant Butte Reservoir in 1995, when a total of two territories were found. Historic records document SWFLs in the 1970s when several territories were found in the area then known as Elephant Butte Marsh (Hundertmark 1978, Hubbard 1987). The population of SWFLs within Elephant Butte Reservoir has dramatically increased from 1995 to 2008 (Figure 5) when 229 territories were documented.

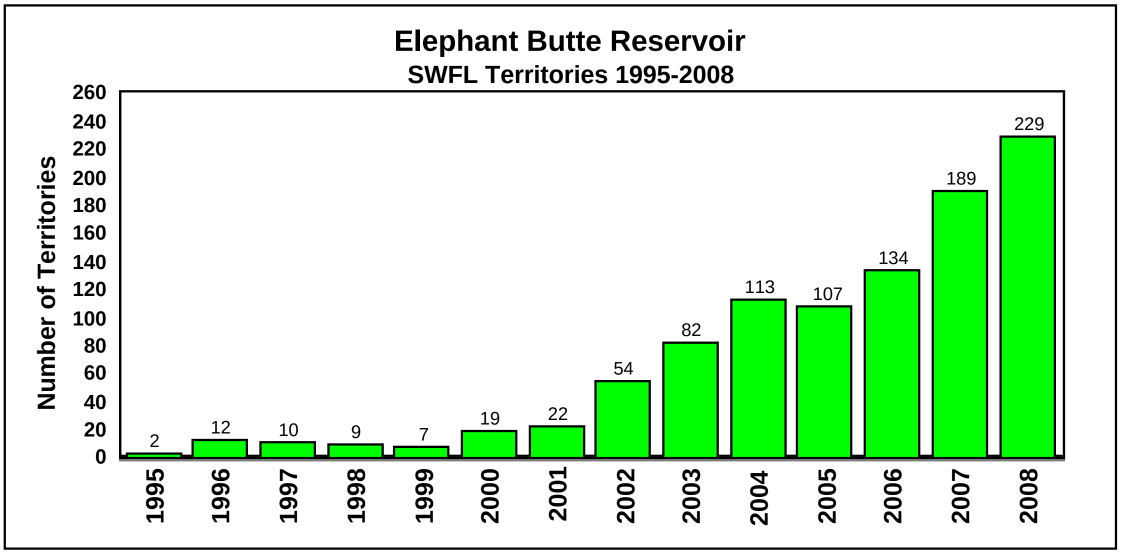


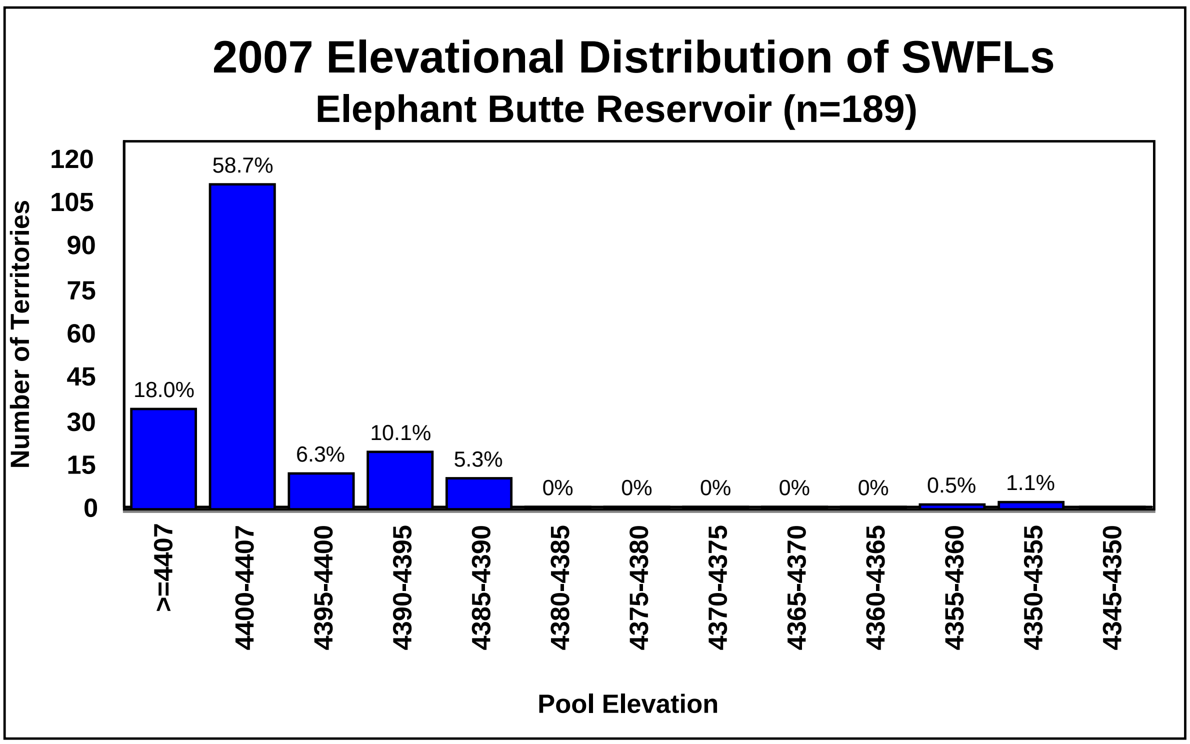
Figure 5. Southwestern Willow Flycatcher territories in Elephant Butte Reservoir, 1995 – 2008.

The distribution of territories within Elephant Butte Reservoir has shifted with the development of younger habitats at lower elevations within the conservation pool. From 1995 to 1999 all SWFL territories within Elephant Butte Reservoir were found at elevations above 4400 ft. (Elephant Butte Dam spillway elevation = 4407 ft.) The following table (Table 2) illustrates a shift further within the conservation pool from 1999 through 2008 as habitat developed and reached a stage of suitability. Although SWFLs are utilizing habitat at elevations lower within the conservation pool, the greatest densities remain in the portion above 4400 ft. where suitable habitat is supported by outflows from the Low Flow Conveyance Channel (LFCC). There is currently no suitable SWFL habitat below 4345 ft.

Figures 6 and 7 illustrate the elevation distribution of SWFLs within EB Reservoir for 2007 and 2008, respectfully. In 2007, 18% (34 territories) were found above spillway elevations of 4407; 77% (145 territories) were found above 4400 ft; and 98% (186 territories) were found above 4385 ft. in elevation. In 2007, only 2% (3 territories) of the Elephant Butte population were found below 4385 ft.

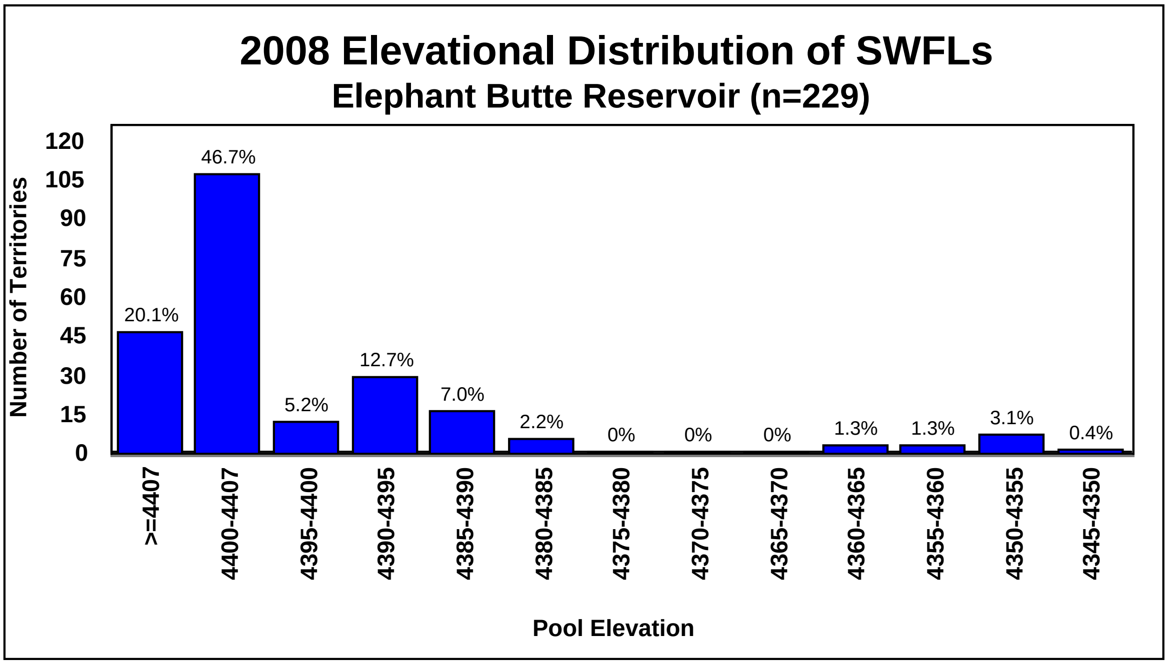
Table 2. Elevation distribution of Southwestern Willow Flycatchers in Elephant Butte Reservoir.

Elevation	**1999**	**2003**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
>=4407	0	15	19	34	28	26	21	30	34	46
4400-4407	7	4	3	17	54	79	73	83	111	107
4395-4400	0	0	0	0	0	3	5	5	12	12
4390-4395	0	0	0	0	0	0	5	9	19	29
4385-4390	0	0	0	0	0	5	3	6	10	16
4380-4385	0	0	0	0	0	0	0	0	0	5
4375-4380	0	0	0	0	0	0	0	0	0	0
4370-4375	0	0	0	0	0	0	0	0	0	0
4365-4370	0	0	0	0	0	0	0	0	0	0
4360-4365	0	0	0	0	0	0	0	0	0	3
4355-4360	0	0	0	0	0	0	0	1	1	3
4350-4355	0	0	0	0	0	0	0	0	2	7
4345-4350	0	0	0	0	0	0	0	0	0	1
Total	**7**	**19**	**22**	**51**	**82**	**113**	**107**	**134**	**189**	**229**



2007 Elevational Distribution of SWFLs

Figure 6. Distribution of Southwestern Willow Flycatcher territories, by elevation, within Elephant Butte Reservoir in 2007.



2008 Elevational Distribution of SWFLs

Figure 7. Distribution of Southwestern Willow Flycatcher territories, by elevation, within Elephant Butte Reservoir in 2008.

Based on 2008 territory distributions within Elephant Butte Reservoir, approximately 20% (46 territories) were found above spillway elevations of 4407; 67% (153 territories) were found above 4400 ft; and 92% (215 territories) were found above 4385 ft. in elevation. In 2008, 8% (19 territories) of the Elephant Butte population were found below 4385 ft. (Figure 7).

Although there was a subtle shift in the percentage of territories downstream within the pool from 2007 to 2008, territory numbers increased throughout the pool. Habitat availability has been a key component to the increasing population trend. This trend is expected to continue based on the current availability of unoccupied suitable habitat.

5.1.2 Habitat and Nest Site Conditions

Breeding site characteristics vary widely across its range. The dominant vegetation at the sites can be entirely exotic [e.g., saltcedar (*Tamarix* sp.), Russian olive (*Elaeagnus angustifolia*)], or native [Goodding's willow (*Salix gooddingi*), Geyer willow (*S. geyeriana*), coyote willow (*S. exigua*), boxelder (*Acer negundo*), cottonwood, etc.] or a combination of both. Nesting substrate can include all of the dominant vegetation species, as well as seep willow (*Baccharis salicifolia*), buttonbush (*Cephalanthus occidentalis*), and several other shrubs. Although patch size and shape vary widely, the commonality among these sites is a dense interior, often interspersed with small openings, and in close proximity to standing or slow moving water. The presence of water is likely the determining factor in the establishment, maintenance, and development of suitable breeding habitat. Ellis et al. (2008) also believe the presence of surface water can positively influence flycatcher recruitment and occupancy. This positive relationship between SWFLs and surface water has also been observed within the Middle Rio Grande (Moore and Ahlers 2007, Smith and Johnson 2008).

SWFL habitat is dynamic and temporary in nature. Proper functioning riverine systems allow for erosion and destruction of maturing habitats, while deposition of new sediments allow for the establishment and development of younger habitats. Water developments over the past 100 years have altered this natural system and reduced the availability of suitable riparian habitat for the SWFL. Reservoir pools throughout the Southwest mimic to a certain degree the destruction and establishment of riparian habitat found in a natural system. Several of the largest known SWFL populations currently exist within the conservation pool of several reservoirs throughout the Southwest (e.g. Roosevelt Lake, AZ; Elephant Butte Reservoir, NM; Lake Isabella, CA) (Ellis et. al. 2008).

Most of the suitable SWFL habitat within Elephant Butte Reservoir became established as the reservoir receded from 1996 to 2004. Stratified age classes of Goodding's willow developed in respect to drawdown levels. Drawdowns during the early spring when native seed sources were abundant, favored the establishment and development of native plant communities. Where soils and hydrology were favorable, native species (primarily Goodding's willow) outcompeted the developing exotic vegetation (Ahlers et al. 2005). Developing Goodding's willow habitat was occupied by SWFLs within 3-4 years of drawdown – particularly those areas in close proximity to previously occupied sites.

Within Elephant Butte Reservoir, most occupied sites are flooded during the breeding season and throughout the year. Water flooding the occupied sites is provided primarily by the outfall of the LFCC. Occupied sites further downstream within the pool are supported by high ground water levels and seeps from the adjacent uplands. In 2008, only three (< 2%) territories within Elephant Butte Reservoir are directly associated with the Rio Grande pilot channel.

Following a fairly significant channel degradation event in June 2005, groundwater levels in proximity to the channel decreased and the potential for overbank flooding was all but eliminated. During the summer of 2008, a sediment plug formed in the temporary river channel in the vicinity of elevation 4355-4360 ft. (approximately 8 miles within the conservation pool) which resulted in the breaching of adjacent spoil banks – flooding the areas to both the east and west of the sediment plug. Therefore, pilot channel flows have little direct affect on the riparian habitat within the upper pool, but are having a major hydrologic effect on the riparian community downstream of the sediment plug. In 2008, 11 SWFL territories were found downstream of the sediment plug, an increase from three territories in 2007.

Nest, vegetation, and hydrology data for the 2008 territories have not been processed and are not included in the following section. From 1999 to 2007, within the Middle Rio Grande, 80% of all territories (n = 997) were found within native dominated plant communities, 6% were found within exotic dominated vegetation, and 14% were within mixed communities. Typical occupied habitat within Elephant Butte Reservoir is comprised of overstory Goodding's willow, with or without a mixed understory of coyote willow and saltcedar. Cottonwoods are interspersed throughout the pool, but not relatively abundant. The following section describes the various nesting parameters that have been recorded at occupied sites from 2002 through 2007 within Elephant Butte Reservoir.

5.1.2.1 Dominant Vegetation at Occupied Territories

From 2002 through 2007 (n = 801), 90.8% of the nests were found within Goodding's willow-dominated communities; 8.9% were found in mixed willow/saltcedar plant communities; and 0.4% were found within saltcedar dominated stands. The percentage of nests found within mixed communities has steadily increased from 0% in 2002 to 17.7% in 2007. No nests were found in saltcedar dominated stands until 2007 when three were discovered. This trend also reflects observations made in the field. Several of the historically occupied patches within the pool have experienced an increasing density of saltcedar, presumably due to a lowering water table within the upper pool which favors the development of saltcedar. This trend is likely to continue into the foreseeable future if reservoir water levels remain low.

5.1.2.2 Nesting Substrate

Although 90.8% (n = 801) of the nests monitored between 2002 and 2008 were found within native dominated communities, only 66.0% of the nests were physically constructed within native willows. Of the remaining nests, 33.6% were found in saltcedar and 0.4% were found in cottonwood. Therefore, it is evident that SWFLs selectively utilize saltcedar as the nest substrate – likely due to the twig structure that saltcedar provides. As the dominate vegetation within some territories shifts from native to mixed, an increasing use of saltcedar as the nest substrate has also increased. In 2002, 29.2% (n = 65) were found in saltcedar and in 2007 43.3% (n = 215) were placed in saltcedar.

5.1.2.3 Nest Success

Nest data was collected from 774 nests with known outcomes from 2002-2007. Overall nest success was 53.9% during this period. Success rates ranged from a high of 58.2% in 2006, to a low of 47.7% in 2004. Nest success, when the nest was physically placed in native *Salix* spp. was 55.6% (n = 511). If the nest was placed in saltcedar, nest success was 50.6% (n = 261). Although nests placed in native vegetation did experience a slightly higher success rate than those found in saltcedar, the difference was not statistically significant (Chi-square test, $P = 0.21$, df = 1, $\chi^2 = 1.55$).

Nest success within territories dominated by native vegetation was 55.1% (n = 701), while those within exotic dominated territories was 100% (n = 3), and those within mixed vegetation were 40% (n = 70). The sample size of nests from exotic dominated territories is obviously very small, and the percent nest success should not be considered as indicative of the dominate vegetation. Data from nests found in exotic-dominated stands was not included in the statistical analysis. Although sample sizes between native (n = 701) and mixed (n = 70) are also somewhat skewed, a statistical comparison shows a higher nest success rate among nests found in native dominate stands (Chi-square test, P = 0.02, df = 1, χ^2 = 5.22). Nest success within native dominated stands is relatively and statistically higher then those of mixed stands. This is likely due to the hydrologic conditions that exist within the native stands that increase the structure/density of the vegetation, and subsequently the suitability of the site. It is likely that hydrology, which is a key factor in determining structure and density, plays a greater role than species composition in determining nest success.

5.1.2.4 Pair Success/Fecundity

Nest success is often the most common measure used to determine an avian population's reproductive potential. However, fecundity should also be considered, and nest success alone does not reveal the true potential of a breeding population. The SWFL is a somewhat persistent species. Within Elephant Butte Reservoir, SWFLs will often renest following a failed first nesting attempt, and at times attempt a third and on one occasion even a fourth nesting attempt. The number of nesting attempts depending primarily on when during the breeding season the nest failures occurred. Although less frequently than renesting following a failed nest attempt, some pairs will also attempt to second brood following a successful nesting attempt. We established a database to determine the fecundity of breeding pairs within Elephant Butte Reservoir to determine what percent of individual pairs are ultimately successful at fledging at least one SWFL chick over the course of the breeding season. The database contains information only from those pairs where all nest outcomes during a particular season were known. From 2002-2007, data from a total of 470 pairs was analyzed and 70.6 % of these pairs were ultimately successful at fledging young. Pair success ranged from a high of 79.1% in 2005 (n = 67), to a low of 66.1% in 2003 (n = 62). If successful nests from the pairs that successfully fledged young from one or more nests are included in the totals and divided by the total number of pairs, pair success of 86.2% was achieved during the 2002-2007 period of study.

5.1.2.5 Brood Parasitism

The Brown-headed Cowbird (*Molothrus ater*) is an obligate brood parasite known to parasitize over 200 bird species (Friedmann and Kiff 1985). Small open-cup nesting species such as the SWFL are particularly susceptible to cowbird parasitism. It is uncommon for SWFLs to successfully fledge their own young once they are parasitized, although a small percentage of SWFLs do fledge both their own young and a cowbird chick. During our study, a SWFL nest was recorded as parasitized if a cowbird egg was found in the SWFL nest at any time during the respective nesting cycle; regardless of whether the cowbird egg had a reasonable chance at developing or not. Cowbird parasitism of SWFL nests from 2002 through 2007 remained relatively constant and equaled 14.2% (n = 774), overall. Parasitism rates during this period ranged from a low of 10.6% (n = 141) in 2006, to a high of 18.1% (n = 94) in 2003.

In an effort to determine whether SWFL nests that are placed in either *Salix* spp. or saltcedar substrate were more susceptible to parasitism, a total of 772 nests were evaluated. Parasitism rates when the nest was placed in *Salix* spp. were 12.5% (n = 511), while those placed in saltcedar were 17.6% (n = 261). Although not statistically significant (Chi-square test, P = 0.07, df = 1, $\chi 2 = 3.27$), overall parasitism was higher when the nest was placed in saltcedar substrate then in *Salix* spp. substrate.

Parasitism rates among stands dominated by native, exotic and mixed vegetation were also evaluated. Again, a total of 774 nests were evaluated. Parasitism rates ranged from 13.7% (n = 701) in native stands, 0% (n = 3) in exotic stands, to 20% (n = 70) in mixed stands. Due to the small sample size of nests found within saltcedar dominated territories, statistical analysis including saltcedar was not possible. Statistical analysis between native and mixed territories was conducted and no significant difference was detected (Chi-square test, $P = 0.21$, df = 1, $\chi^2 = 1.59$). However, it appears that nests found within mixed stands do experience a slightly higher rate of brood parasitism than those found in native stands.

5.1.2.6 Depredation Rates

For this study, nest depredation was defined as when the primary cause of nest failure was due to some form of avian, reptilian or mammalian depredation resulting in complete failure. Partial nest predation did occur in some instances, but was not classified as depredation if the nest did not fail to produce at least one SWFL chick. Depredation rates ranged from a low of 22.4% in 2007, to a high of 32.6% in 2006, with an overall rate of 28.7% (n = 774) from 2002 to 2007 (STD = 3.5%). Depredation was fairly consistent from 2002 to 2006, ranging from 27.7% to 32.6%, however in 2007 the rate dropped to a low of 22.4%. The reason for the relatively dramatic decline in depredation is unknown.

5.1.2.7 Abandonment Rates

Abandonment rates from 2002 to 2007 ranged from 5.8% to 14.6%, with an overall rate of 9.7% (n = 774) (STD = 2.9%). Similar to depredation rates, abandonment was fairly consistent from 2002 to 2006, ranging from 5.8% to 10.6%. However, in 2007 abandonment rates increased to 14.6%. The reason for the increase in abandonment in 2007 is unknown.

When depredation and abandonment rates are combined over the period of study it is interesting to note that the combined rates range from a low of 36.9 to a high of 40.2 – a range of only 3.3% with a STD of 1.3%. It appears that depredation and abandonment rates can vary among years; but when combined are fairly consistent – suggesting that a certain percentage of nests are essentially doomed regardless of the cause. The reason for this is unknown.

5.1.3 Effects of Hydrology on Nesting Parameters 2004-2007

Beginning in 2004, a detailed analysis of hydrologic conditions in the immediate and general vicinity of SWFL nests was initiated. The following section therefore is based on SWFL nests from 2004 through 2007. Data were recorded upon each nest monitoring visit, and were entered into a database for analysis.

Hydrologic conditions are known to frequently change throughout the season, and even within individual nesting cycles. If multiple nesting attempts from individual pairs were documented, each nesting cycle was analyzed individually. The four categories are: Dry all cycle;

Saturated/Flooded then Dry; Saturated/Flooded all cycle; and Flooded all cycle. Flooded all cycle is therefore a subset of Saturated/Flooded all cycle. This subset was created to determine whether the physical presence of water during the entire nest cycle affected the various nesting parameters.

It is likely that hydrologic conditions within the site and immediate proximity to the nest play several roles. Hydrologic conditions obviously will affect the density and structure of the vegetation and often the species composition of the site. It also will likely play a role in insect abundance (i.e. prey base) and diversity. In addition, SWFLs appear to have a strong affinity for surface water, particularly upon territory establishment.

Analyses were conducted based on: 1) Hydrologic Conditions Immediately Under Nest; and 2) Hydrologic Conditions in Vicinity of Nest.

5.1.3.1 Analysis Based on Hydrologic Conditions Immediately Under Nest

An evaluation of nesting parameters and hydrologic conditions immediately beneath the nest was conducted. This study was initiated to determine whether an association between hydrologic conditions and nest success, depredation, parasitism, or productivity exists.

5.1.3.1.1 Nesting Success

Nest success was compared among the four hydrologic conditions found under the nest:

Dry All Cycle – From 2004 through 2007, a total of 156 nests were monitored where the nest was placed above dry ground during the entire nesting cycle. Of these, 51.3% were successful.

Saturated/Flooded then Dry – Only 12 nests during the period of study fell into this category. Under this category, the nest would have been initially constructed over saturated or flooded soils, but dried out during the nesting cycle. Of these 12 nests, 75.0% were successful. Due to the relatively small sample size, statistical analysis was not conducted.

Saturated/Flooded All Cycle – The bulk of the nests were found under these conditions, which included either saturated soils and/or flooded conditions. A total of 447 nests were placed above saturated and/or flooded soils, and 55.3% were successful.

Flooded All Cycle – In an effort to determine whether flooded conditions played a role in parasitism and depredation the nests that were placed above flooded conditions during each nesting cycle were also analyzed. This category is therefore a subset of the Saturated/Flooded All Cycle.

No statistically significant difference in nest success was found between the three hydrologic conditions (Chi-square test, $P = 0.69$, df = 2, $\chi^2 = 0.74$). However, in general, the sites that were saturated and/or flooded tended to have higher nesting success. These sites also tended to support vegetation that was denser and more structurally suitable than the drier sites (i.e. more suitable habitat). An analysis to determine whether there is a statistical difference of the vegetative characteristics within “dry” and “wet” territories was conducted. Eleven nest site parameters were evaluated based on data collected from 11.35-m radius center plots. Evaluated parameters that showed a statistically significant difference included: shrub density m^2, percent dead shrubs, nest height, and substrate height. The difference in shrub density and percent dead shrubs can easily be correlated with the drier conditions. The nest height and substrate height are likely a result of the reduced shrub layer, essentially forcing SWFLs to select trees and nest higher in an effort to increase concealment. In addition to the center plot, three additional plots (5m radius) were established at 15m centers from the nest tree. Nine nest site parameters were evaluated based on these data. Canopy and shrub data were collected from all four plots. Evaluated parameters that showed a statistically significant difference included: percent canopy cover > 6m, canopy height, and shrub density/ha. Percent canopy > 6m, and canopy height were greater at the dry sites primarily due to the lack of canopy > 6m at the wetter sites. The greater shrub density at the wetter sites is indicative of greater water availability.

Based on the nest site quantification analysis it appears that the vegetative characteristics within each territory play a role in determining nest success. Additionally, it is likely that the availability of water has a direct influence on the structure and density of vegetation. For a detailed analysis of all data associated with the Nest Site Quantification Study, see Moore (2007).

5.1.3.1.2 Parasitism Rates

Parasitism was compared among the four hydrologic conditions found under the nest:

Dry All Cycle – From 2004 through 2007, a total of 156 nests were monitored where the nests was placed above dry ground during the entire nesting cycle. Parasitism rates ranged from a high of 35.0% (n = 20) to a low of 4.5% (n = 22), over the period of study. The overall parasitism rates for “Dry all Cycle” from 2004-2007 was 16%.

Saturated/Flooded then Dry – Only 12 nests during the period of study fell into this category. Of these 12 nests, 16.7% were parasitized. Due to the relatively small sample size, statistical analysis was not conducted.

Saturated/Flooded All Cycle – A total of 447 nests were placed above saturated and/or flooded soils, and 13.0% were parasitized. Parasitism rates ranged from a high of 20.0% (n = 100) to a low of 3.0% (n = 66).

Flooded All Cycle – In an effort to determine whether flooded conditions played a role in parasitism rates the nests that were placed above flooded conditions during each nesting cycle were also analyzed. This category is therefore a subset of the Saturated/Flooded All Cycle. A total of 292 nests fell into this category. Parasitism rates ranged from a high of 25.0% (n = 48) to a low of 4.8% (n = 42), with an overall parasitism rate of 12.0% (n = 292).

Overall, parasitism rates were fairly constant among years, ranging from a high of 16.8% (n = 149) in 2004, to a low of 10.6% (n = 141) in 2006. Parasitism was more variable within years among the various hydrologic conditions. For example, in 2007 35.0% (n = 20) of the Dry All

Cycle nests were parasitized, while only 6.1% (n = 114) were parasitized that were Flooded All Cycle. Although there was not a statistical difference among the three hydrologic conditions of sufficient sample size (i.e. Dry all Cycle, Saturated/Flooded all Cycle, and Flooded All Cycle) (Chi-square test, $P = 0.48$ df = 2, $\chi^2 = 1.48$), overall parasitism rates were highest under the Dry All Cycle conditions.

5.1.3.1.3 Depredation Rates

Depredation was compared among the four hydrologic conditions found under the nest. For this study, nest depredation was defined as when the primary cause of nest failure was due to some form of avian, reptilian or mammalian depredation resulting in complete failure.

Dry All Cycle – From 2004 through 2007, a total of 156 nests were monitored where the nest was placed above dry ground during the entire nesting cycle. Depredation rates ranged from a high of 41.3% (n = 75) to a low of 23.1% (n = 39), over the period of study. Overall depredation rates for “Dry all Cycle” from 2004-2007 was 34.6% (n = 156).

Saturated/Flooded then Dry – Only 12 nests during the period of study fell into this category. Of these 12 nests, only 8.3% were predated. Due to the relatively small sample size, statistical analysis was not conducted.

Saturated/Flooded All Cycle – The bulk of the nests were found under these conditions, which included either saturated soils or flooded conditions. A total of 447 nests were placed above saturated and/or flooded soils, and 28.2% were predated. Depredation rates ranged from a high of 42.0% (n = 100) to a low of 21.9% (n = 183).

Flooded All Cycle – In an effort to determine whether flooded conditions affected depredation rates the nests that were placed above flooded conditions during each nesting cycle were also analyzed. This category is therefore a subset of the Saturated/Flooded All Cycle. A total of 292 nests fell into this category. Depredation rates ranged from a high of 45.8% (n = 48) to a low of 21.4% (n = 42), with an overall depredation rate of 30.1% (n = 292).

Depredation rates were variable between years for all hydrologic conditions, ranging from a high of 34.2% (n = 149) in 2004, to a low of 22.5% (n = 205) in 2007. Depredation was more variable within years among the various hydrologic conditions. For example, in 2006 41.3% (n = 75) of the Dry All Cycle nests were predated, while only 21.4% (n = 42) were predated that were Flooded All Cycle. Although there was not a statistical difference among the three hydrologic conditions of sufficient sample size (i.e., Dry all Cycle, Saturated/Flooded all Cycle, and Flooded All Cycle) ($P = 0.32$ df = 2, $\chi^2 = 2.29$), overall depredation rates were highest under the Dry All Cycle conditions.

5.1.3.1.4 Productivity of Successful Nests

The productivity (i.e., young fledged/nest) of successful nests was analyzed among the various hydrologic conditions in an effort to determine whether these conditions may directly, or indirectly influence productivity

Dry All Cycle – Overall productivity of successful nests from 2004-2007 under Dry All Cycle was 2.54 young/nest (n = 80), ranging from a high of 2.83 young/nest (n = 12) in 2005, to a low of 2.28 young/nest (n = 25) in 2004.

Saturated/Flooded then Dry - Overall productivity of successful nests from 2004-2007 under Saturated/Flooded then Dry was 2.67 young/nest (n = 9). Due to the small sample size within this category, no statistical analysis was conducted.

Saturated/Flooded All Cycle – A total of 247 successful nests were documented under these conditions from 2004-2007 and productivity was 2.74 young/nest. Productivity ranged from a high of 2.91 young/nest (n = 56) in 2005, to a low of 2.51 young/nest (n = 45) in 2006.

Flooded All Cycle – This subset of Saturated/Flooded All Cycle experienced the highest productivity of the various conditions, fledging 2.79 young/nest (n = 159). Productivity of successful nests that were Flooded All Cycle ranged from a high of 2.94 young/nest (n = 50) in 2005, to a low of 2.48 young/nest (n = 27) in 2006.

Overall productivity from 2004-2007 for all hydrologic conditions was 2.69 (n = 336), ranging from a high of 2.90 young/nest (n = 68) in 2005, to a low of 2.56 young/nest (n = 82) in 2006. From 2004-2007, overall productivity ranged from 2.54 young/nest (n = 80) under Dry All Cycle, compared to 2.79 young/nest (n = 159) under Flooded All Cycle. Although there was not a statistically significant difference among the three hydrologic conditions of sufficient sample size (i.e., Dry all Cycle, Saturated/Flooded all Cycle, and Flooded All Cycle) (P = 0.07, df = 2, F-ratio = 2.34), overall productivity was lowest under the Dry All Cycle conditions.

5.1.3.2 Analysis Based on Hydrologic Conditions in Vicinity of Nest

This analysis was based on the distance of the territory center to surface water. The sample size distribution of nests based on proximity to a permanent water source was not conducive to statistical analysis. From 2004-2007, 91.4% of all nests (n = 615) were found within 50 meters of a permanent water source, and 94.5% were within 100 meters of a permanent water source, a difference of only eight nests. A total of only 34 nests 5.5% of the total were found at distances greater than 100 meters of water. All nests found at distances greater than 100 meters were in 2006 – a year of reduced flows from the LFCC.

5.1.3.2.1 Nest Success

Nest Success based on distance to permanent surface water for both > or < 50m, and > or < 100m was evaluated. It is important to note that there is little difference between the 50m and 100m analysis since 91.4% of the same nests are evaluated under both distances. No significant difference in nest success was found at either the 50m or 100m distance to water, (Chi-square test, $P = 0.67$, df = 1, $\chi^2 = 0.18$) and ($P = 1.00$, df = 1, $\chi^2 = 0.00$), respectively.

With the exception of 2006 when 34 nests (24.1% of the 2006 total (n = 141) were found at distances > 100 meters from a permanent water source, 100% of all nests were < 100 meters during 2004, 2005, and 2007. The vast majority of all nests were found < 50 meters from a permanent water source.

When evaluating the nest parameters based on hydrology under the nest, and excluding the "Saturated/Flooded then Dry" category which had small sample sizes, the "Dry All Cycle" experienced the lowest nest success, the highest depredation rates, the highest parasitism rates, and the lowest productivity of all hydrologic categories. To what degree this is due to reduced structure, density, foliage height diversity, prey abundance, greater fluctuation in daily temperatures, or lower relative humidity is unknown. However, it appears evident that wet hydrologic conditions – while avoiding the destruction of habitat - are more suitable for breeding SWFLs.

Saturated or flooded soil conditions likely contribute to higher habitat suitability based on factors such as: increased prey abundance, increased foliage height diversity, and reduced daily variation in both temperature and humidity (i.e., cooler and damper). These conditions may limit access by predators reducing depredation, and may also reduce parasitism by requiring cowbirds to travel greater distances to forage and also increasing the abundance of other suitable cowbird hosts, thereby reducing parasitism rates on the SWFL.

5.1.4 Consequences of the Proposed Action

5.1.4.1 Case Study – Roosevelt Lake, Arizona

Inundation of Roosevelt Lake, AZ in 2005-2006 significantly altered the availability of existing SWFL habitat within the reservoir pool. The SWFL population at Roosevelt Lake decreased by 47% between 2004 and 2006 due to the reduced availability of suitable habitat (Ellis et. al. 2008). In addition to reduced numbers of SWFLs, fewer nesting attempts and a reduced rate of nest success were also documented. However, the Roosevelt Lake SWFL population remains to be one of the larger populations within the subspecies' range and may not suffer long-term effects if the habitat regenerates as the Lake recedes (Ellis et al. 2008).

The SWFL population at Roosevelt Lake has been monitored since 1996; nine years prior to the inundation that occurred from 2005 to 2006. During this study period the Lake rose to 56% capacity in 1998, only to recede to 10% capacity in 2002. As the lake receded, suitable habitat developed and SWFLs established territories in the developing habitat. As new habitat developed, SWFLs moved further into the conservation pool from the originally occupied sites surveyed in 1996 (Ellis et. al. 2008). Territory numbers in the upper conservation pool decreased as the lake receded, and increased further within the conservation pool as habitat developed.

During the winter and spring of 2005, Roosevelt Lake rose to 96% capacity – completely inundating or partially inundating habitat which was occupied by SWFLs during the summer of 2004. Due to the rising lake levels, SWFLs arriving in the spring of 2005 reestablished territories in the upper conservation pool, and established new territories further upstream than previously recorded (Ellis et al. 2008). Overall territory numbers at Roosevelt Lake decreased by 27% from 2004 to 2005 with the SWFL population going from 209 territories to 153 territories, respectively. From 2005 to 2006, territories decreased by additional 27 %, 153 and

111, respectively. Overall, territory numbers declined by 47% between 2004 and 2006. From 2004 to 2005, approximately 90% of the suitable SWFL habitat within Roosevelt Lake was rendered unsuitable due to the rising lake levels (Ellis et al. 2008). With the loss of habitat on this scale SWFLs established territories in perhaps less than suitable habitat, resulting in reduced nesting attempts and reduced nest success. Nest success was proportionately higher during pre-inundation (56.6% n = 680), than during inundation (45.2% n = 212) (P = 0.004, df = 1, χ^2 = 8.36) (Ellis et al. 2008). Parasitism and depredation rates pre-inundation were comparable to those during inundation. The difference in nest success pre- and during inundation was due to subtle increases in the number of infertile clutches and other causes such as dead nestlings in the nest (Ellis et al. 2008). From Ellis et al. (2008), Warner and Hendrix (1984) believed that inundation of habitat confined birds to smaller territories, thereby reducing the availability of food resources and subsequently reducing nesting attempts and nesting success. Also from Ellis et al. (2008), as reported by Van Horne (1983), Virkkala (1990), and Holmes et al. (1996) "As with other species, flycatchers may occupy less suitable habitat (i.e., disturbed) if less disturbed habitat of higher quality is unavailable, but they may be subject to additional pressures potentially resulting in reduced nest success, reduced survivorship, lower productivity, or fewer nesting attempts."

Ellis et al. (2008) conclude that the short-term impacts of rising lake levels are apparent. However, as the newly established vegetation develops and reaches a stage of suitability, SWFL populations may increase similarly to those found in the late 1990's and early 2000s as the Lake receded.

Like the Roosevelt Lake SWFL population, the population within Elephant Butte Reservoir likely serves as a source population for several sites within the Middle Rio Grande. Large source populations also play a major role in regional population dynamics and genetic diversity (Ellis et al. 2008).

Although the Roosevelt Lake case study is an excellent example of potential impacts to breeding SWFLs due to inundation by a rising reservoir pool and similarities are apparent, several fundamental differences between Elephant Butte Reservoir and Roosevelt Lake do exist:

1. Similar to Roosevelt Lake, SWFLs are establishing territories at lower elevations within the conservation pool. However the majority (47%) of SWFL territories found within Elephant Butte Reservoir remained within the upper 7 ft. of the pool in 2008. This is likely due to the relative abundance of currently suitable habitat in the upper pool that is maintained by outflows from the LFCC.

2. Occupied SWFL habitat within Elephant Butte Reservoir is dominated by Goodding's willow, which is more flood tolerant than saltcedar – which was more prevalent within the occupied stands of Roosevelt Lake.

3. Due to aggradation within the upper pool of Elephant Butte Reservoir, 20% of the SWFL territories in 2008 were found above the spillway elevation of 4407: essentially creating refugia in the event of habitat losses further within the pool. This habitat is also maintained

by outflows from the LFCC. (Elephant Butte Reservoir storage capacity has been reduced by nearly 600,000 acre feet due to sedimentation/aggradation since construction in 1916).

4. Due to the overall capacity of Elephant Butte Reservoir (Spillway elevation = 4407, Surface Area = 35,984 acres, Storage capacity = 2,023,358 AF), compared to Roosevelt Lake (Top of Conservation Pool = 2151, Surface Area = 19,199 acres, Storage capacity = 1,653,043 AF) (At Spillway elevation = 2218 ft, Surface Area = 21,493 acres, Storage capacity =2,910,200 AF) it is very unlikely that the reservoir would fill within the five-year period of analysis and SWFLs would have a greater period of time as available habitat was lost to relocate and establish territories outside of Elephant Butte Reservoir.

5. The surface area of Elephant Butte Reservoir (4407 ft. elevation) is 90% greater then the surface area of Roosevelt Lake (2151 ft. elevation). The significance of the greater surface area found at Elephant Butte Reservoir translates to reduced water depth over a larger area, thereby reducing the potential for broad-scale habitat loss.

6. Roosevelt Lake is fed by two major sources: Salt River and Tonto Creek. Elephant Butte Reservoir is supported only by flows from a single source: Rio Grande.

5.1.4.2 Vegetation Response to Reservoir Inundation

The extent of short-term and long-term impacts to existing habitat depends largely on the timing, depth, and duration of the reservoir inundation. Warner and Hendrix (1984) and Reitan and Thingstad (1999) [as reported in Ellis (et al. 2008)], found that the loss or degradation of habitat due to reservoir inundation resulted in the reduction of some bird populations, species richness, and nest success, while other avian species such as shorebirds and waterfowl benefitted by improved feeding conditions.

Some habitat in proximity to the rising pool would be enhanced by a rising water table. Habitat that is partially inundated could be enhanced by deposition of new sediments and nutrients; by flushing of accumulated salts, and by irrigating the respective site. However, prolonged and/or complete inundation would ultimately result in the total loss of riparian habitat. Also, species composition and age class will likely play a role in determining survivability.

Goodding’s willow, the primary component of occupied SWFL territories within Elephant Butte Reservoir, is a very flood-tolerant species. Saltcedar, coyote willow, and cottonwood are also components of SWFL territories within Elephant Butte Reservoir. Based on hydrologic data collected since 2004, a large portion of the upper reservoir pool remains flooded throughout the year due to the outfall of the LFCC (Moore 2005). This area is dominated by Goodding’s willow and supports a large portion of the local SWFL population. Water depth typically ranges from 0.5 ft. to 2 ft. While some stands of Goodding’s willow are beginning to show signs of stress, presumably due to prolonged flooding of several years, other stands are showing signs of maturing past a point of suitability for the SWFL. Though habitat changes are occurring, suitable habitat in this portion of the reservoir pool remains relatively abundant.

Although the specific willow species were not identified, Whitlow and Harris (1979) found 100% survival of willow species following 365 consecutive days of flooding at a depth of nearly six ft. over the root crown. Also according to Whitlow and Harris (1979), "Once established, *Salix gooddingii* is especially flood tolerant and individual plants have been observed to leaf out after 4 years of continuous flooding in over 50 ft. of water." Under greenhouse conditions, three-inch black willow (*S. nigra*) seedlings were subjected to 20 inch inundation for a period of 32 consecutive days and all (n = 3) survived (Whitlow and Harris 1979). Following the establishment of a livestock exclosure in the vicinity of Dryland Road in August 1997, Elephant Butte Reservoir elevations increased and flooded the exclosure with 3-4 ft. of water from November through May of 1998. In November 1997, Goodding's willow densities of 14.7/yd^2, with an average height of 18.5 inches and saltcedar densities of 1.6/yd^2 with an average height of 18.2 inches, were recorded (Ahlers et al. 2003). The following year in December 1998, Goodding's willow densities of 22.7/yd^2, with an average height of 35.0 inches and saltcedar densities of 0.3/yd^2 with an average height of 19.5 inches, were recorded. Based on these data, young Goodding's willow were found to be more flood tolerant than saltcedar, with Goodding's willow densities and height increasing following a period of 6 months of inundation with 18-24 inches over the terminal bud primarily during the dormant season . Our observations at Elephant Butte Reservoir are supported by those found by Ellis et al. (2008) which reported die-off of saltcedar understory and survival of the more flood tolerant Goodding's willow at Roosevelt Lake. Ellis et al. (2008) also state that most species were not able to survive more than one year of complete inundation. Since the vast majority of the SWFL territories within Elephant Butte Reservoir are dominated by Goodding's willow, the flood tolerance of this species plays a major role in the short and long-term effects of a rising pool.

Partial (10-15 ft) and temporary (< 6 months) flooding of habitat would likely cause a reduction in the overall structure of the vegetation. The shrub layer, if present, would be slow to recover; the lower limbs of the Goodding's willow, saltcedar, and cottonwoods could be killed, and the overall structure altered. The greater the degree and duration of flooding, the greater the anticipated reduction in vegetation structure. This theory is supported by Ellis et al. (2008) that reported vegetation at "nest sites following inundation was thinner with less canopy cover, more canopy gaps, a lower canopy, and lower tree density than pre-inundation."

Ultimately, it is difficult to fully predict the adverse and beneficial impacts associated with reservoir fluctuations. The habitat that currently supports the largest population of SWFLs in the Southwest was created when Elephant Butte Reservoir receded – allowing for the establishment and development of various age classes of vegetation. If the reservoir was to suddenly fill to capacity, large expanses of suitable breeding habitat would be lost. Short-term and long-term impacts are inevitable, whatever fluctuation in reservoir elevations ultimately occur. The focus of the impact assessment has been on that of a rising reservoir, although there would be potential impacts if the reservoir remains low. Associated impacts from rising reservoir levels could result in a "take" of SWFLs, while stable or receding reservoir levels would be less direct.

Timing, depth, and duration of inundation are variables that that have been simulated in the analysis, however nature often has its own process and schedule. Future SWFL distribution and abundance within Elephant Butte Reservoir have also been predicted. These estimates assume constant recruitment, constant survival and productivity, absence of fire, cottonwood leaf beetles

(*Chrysomela scripta*), any other unforeseen catastrophic events, and a constant water source from the LFCC - all of which would change the population dynamics and estimates.

The vegetative community is constantly changing within the conservation pool. Changes to this community will occur regardless of whether or not the reservoir fluctuates in elevation. A rising reservoir will ultimately inundate and destroy habitat. It will also provide a higher water table to some areas, increasing its structure and density. Inundation will also flush accumulated salts from the soils, replenish nutrients, and deposit new sediments. When the reservoir recedes, these rich exposed soils will quickly be revegetated which could develop and provide future habitat for a wide variety of species, including the SWFL. If the reservoir remains at low levels, suitable SWFL habitat will ultimately mature through natural succession past a point of suitability. The structure and density of some suitable habitat will be reduced as the water table within the pool continues to decline. Without inundation, replenishment of nutrients and flushing of the salts will not occur and the vegetation will be reduced in vigor, degrading its suitability for SWFLs.

5.1.5 Impact Assessment Model

It is important to note that the values used to develop this model and the values derived from the model output are not definitive values. A model is simply a tool to aid in the evaluation of a resource's response under different scenarios—in this case, habitat and SWFL response to various reservoir elevations. The model is also intended to help determine the “degree” of a resource's response; it is not a precise measurement of the response.

A model to evaluate the potential impacts of a rising reservoir on both habitat and on SWFL displacement was developed. Components to the model include: 1) an assessment of baseline SWFL habitat; 2) an estimation of future SWFL populations; 3) an estimation of average territory size to determine carry capacity of available SWFL habitat; 4) a projection of future reservoir elevations under three different hydrologic scenarios; 5) the development of an impact assessment flowchart to determine the degree of reservoir impacts on SWFL habitat; and 6) a compilation of formulas to determine habitat loss/gain and the physical displacement of SWFLs.

The model was developed based on: 1) the findings of SWFL response at Roosevelt Lake, AZ; 2) documentation from SWFL related studies within Elephant Butte Reservoir; and 3) existing literature.

First, a current assessment of vegetation and associated habitat was conducted. Aerial photography of Elephant Butte Reservoir was obtained during the late summer of 2007. During the spring and summer of 2008, vegetation types were delineated based on the Hink and Ohmart (1984) classification. Ground-truthing and aerial reconnaissance surveys were also conducted during the summer 2008 to verify the vegetation classification and associated habitat types. From these data, an accurate assessment of habitat distribution and abundance was obtained using a Geographic Information System (GIS). Habitat abundance was categorized within five-foot contours (Table 3) from 4345 ft. to 4407 ft. elevations (4407 ft. is Elephant Butte Dam spillway elevation).

For the purposes of the Model, habitat units were assigned to both flooded and dry suitable habitat. Suitable flooded habitat was assigned a value of 1.0/acre, while suitable dry was assigned a value of 0.75/acre. These values were assigned based on past site-specific data collected from Elephant Butte Reservoir showing that flooded suitable habitat is more populated with a slightly higher nest success, and slightly more productive than dry suitable habitat.

Table 3. Acres of suitable dry and suitable flooded habitat within Elephant Butte Reservoir at five-foot contour intervals.

	TOTAL SUITABLE DRY	TOTAL SUITABLE FLOODED	TOTAL SUITABLE
4345-4350	3.8	44.9	48.7
4350-4355	0.5	143.9	144.4
4355-4360	33.1	369.3	402.4
4360-4365	130.5	114.6	245.0
4365-4370	50.1	23.3	73.4
4370-4375	11.9	0.2	12.1
4375-4380	174.6	0.1	174.7
4380-4385	22.4	3.2	25.6
4385-4390	56.1	132.1	188.2
4390-4395	210.7	209.8	420.6
4395-4400	292.1	134.7	426.8
4400-4407	269.3	163.8	433.1
>4407	90.6	29.0	119.6
TOTALS	1345.7	1368.8	2714.5

Next, population estimates for the Elephant Butte SWFL population were determined using linear regression. Two methods were employed. For the purposes of these estimates, both methods assume the current baseline habitat conditions remain unchanged over the next five years. The first method estimated the population from 2009 to 2013 using the Elephant Butte SWFL population as a whole based on data collected from 1999-2008. Utilizing this method, the SWFL population would be expected to increase from 227 territories in 2009, to 322 in 2013. These estimates are presented in Figure 8.

The second method used to estimate the future population required the estimation of SWFL populations at each of the respective 14, five-foot contours and summing the totals. Utilizing this method, the SWFL population would be expected to increase from 257 territories in 2009, to 397 in 2013. These estimates are presented in Figure 9.

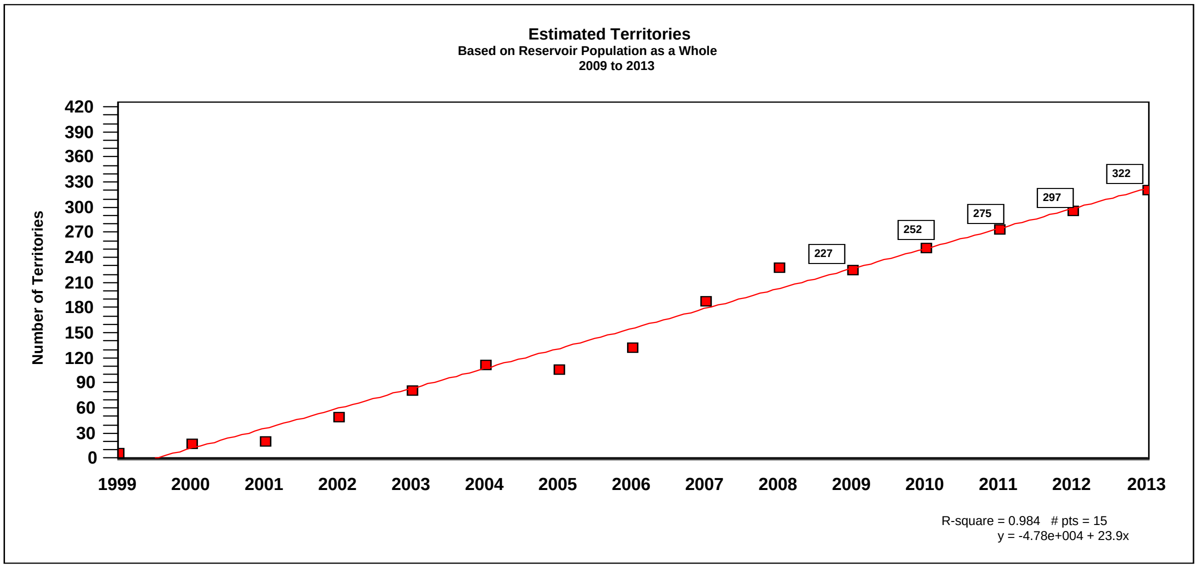


Figure 8. Southwestern Willow Flycatcher population projections at Elephant Butte Reservoir based on observations through 2008.

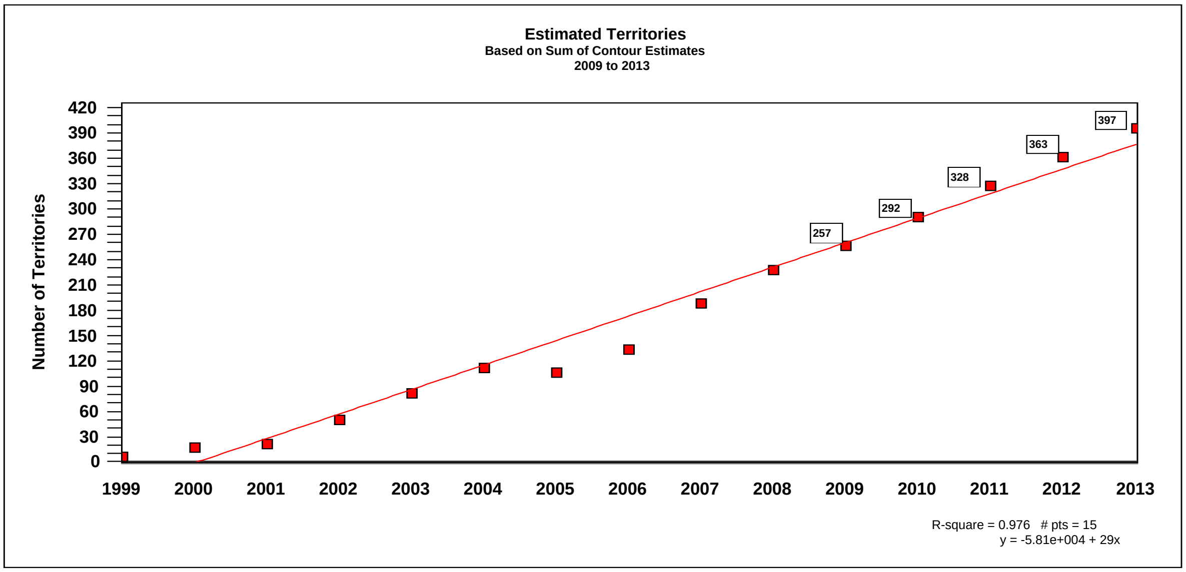


Figure 9. Southwestern Willow Flycatcher population projections at Elephant Butte Reservoir based on observed numbers in five-foot contour intervals.

Both methods fit the linear regression with a fairly high degree of confidence. Since habitat associated impacts are assessed based on projected Reservoir elevations at five-foot contours, the second population estimate will be used to assess potential displacement of SWFLs. The second method also estimates a slightly greater population over the five-year period, and in the best interest of the SWFL and its habitat these estimates also are appropriate for assessing potential impacts.

Table 4. Range of Southwestern Willow Flycatcher territory sizes in twelve clusters in Elephant Butte Reservoir.

Cluster	No. territories	Acreage	Acres Ave. density
1	12	9.7	0.81
2	9	5.4	0.60
3	10	11.5	1.15
4	10	7.5	0.75
5	29	33.3	1.15
6	8	2.9	0.36
7	10	6.2	0.62
8	4	1.1	0.28
9	4	1.9	0.48
10	8	6.2	0.78
11	5	2.6	0.52
12	26	8.3	0.32
TOTAL	135	96.6	
		Average size of territories (acres) =	0.72
		Range of territory size (acres) =	0.28 – 1.15

In an effort to determine the carrying capacity (i.e., number of territories that can be supported within various stands of suitable habitat) a total of 12 territorial "clusters" found in 2008 were evaluated using GIS. Polygons were established that encompassed each respective "cluster" of SWFL territories. The total acreage of the polygon was divided by the number of established territories and an average territory size was determined. Territorial sizes ranged from 0.28 to 1.15 acres, with an overall average territory size for the 12 territorial "clusters" of 0.72 acres (Table 4). When habitat is highly suitable, territory densities can increase to accommodate additional pairs. [Example: Site 17A within the upper pool of Elephant Butte Reservoir supported 12 SWFL territories (11 pairs, one unpaired male) in 2004. Nesting attempts averaged 1.7 attempts/pair, and nest success was 63%. In 2007, 26 SWFLs established territories (25 pairs, 1 unaired male) within this site with an average of 1.6 nest attempts/pair and nest success of 62%. Although the increase in SWFL densities from 2004 to 2007 can not be attributed to the absence or reduction of other suitable habitat, it does illustrate that densities can increase (2x) within highly suitable habitat, without a reduction in nest attempts and nest success.] The number of territories each five-foot contour could support was determined by dividing the available habitat units (i.e., 1 unit/acre flooded and 0.75 unit/acre dry) by 0.72 (average SWFL territory size).

Projected reservoir elevations during the period of 2009 through 2013 were provided by Reclamation's El Paso Field Division. Projected levels over this five-year period were determined under three different hydrologic scenarios: low, average, and high reservoir inflows. The reservoir elevations for each respective five-foot contour; for each respective year; under the three hydrologic scenarios were used to determine impacts to the associated SWFL habitat. Suitable flycatcher habitat does not currently exist below 4345 ft., therefore reservoir elevations below this level would have no direct effect on SWFL habitat.

The final component of the impact assessment model required the development of a habitat impact assessment flowchart (Figure 10). Goodding's willow has been the key habitat component of SWFL territories within Elephant Butte Reservoir for the past 14 years. Therefore, this flowchart assessment was developed to assess the potential impacts to this key component. Impact assessment was developed based on field observations, existing literature, and field data collected over the past 14 years at Elephant Butte Reservoir. The flowchart provides a determination of reservoir effects on SWFL habitat for each five-foot contour, for each respective year. Utilizing the flowchart allows determinations to whether, and to what degree, an effect to the respective habitat will occur due to rising reservoir levels. Some impacts associated with a rising reservoir could be positive, while others would result in loss or partial loss of habitat. Particular emphasis was placed on reservoir elevations during the SWFL breeding season of May through August. Although some patches of habitat may not be adversely impacted by rising reservoir levels during the May to August period – all habitat values would be assumed lost if the reservoir rose over ten feet during the peak nesting period of June to August. This assumption is based on the probability that SWFL nests would be physically inundated by reservoir levels if the elevation increase was greater than ten feet and would essentially negate any potential positive effect.

5.1.5.1 Model Output - Impacts to Suitable Habitat and Displacement of SWFLs

A summary of model output values for all three scenarios is presented in Table 5. Detailed analyses of model output, by contour intervals, are presented in Appendix D.

Drought Scenario – (Figure 11) Based on the analysis there would be no adverse effects to any SWFL habitat under this scenario. A subtle enhancement of habitat within the 4345-4350 and 4350-4355 elevation contours would occur in 2009 due to the rising reservoir levels in early-2009. Since there is an absence of suitable SWFL habitat below 4345 and the Reservoir is not expected to reach this level again until late-2013, there would be no additional positive or negative impacts to habitat under this scenario. No SWFLs would be displaced under this scenario.

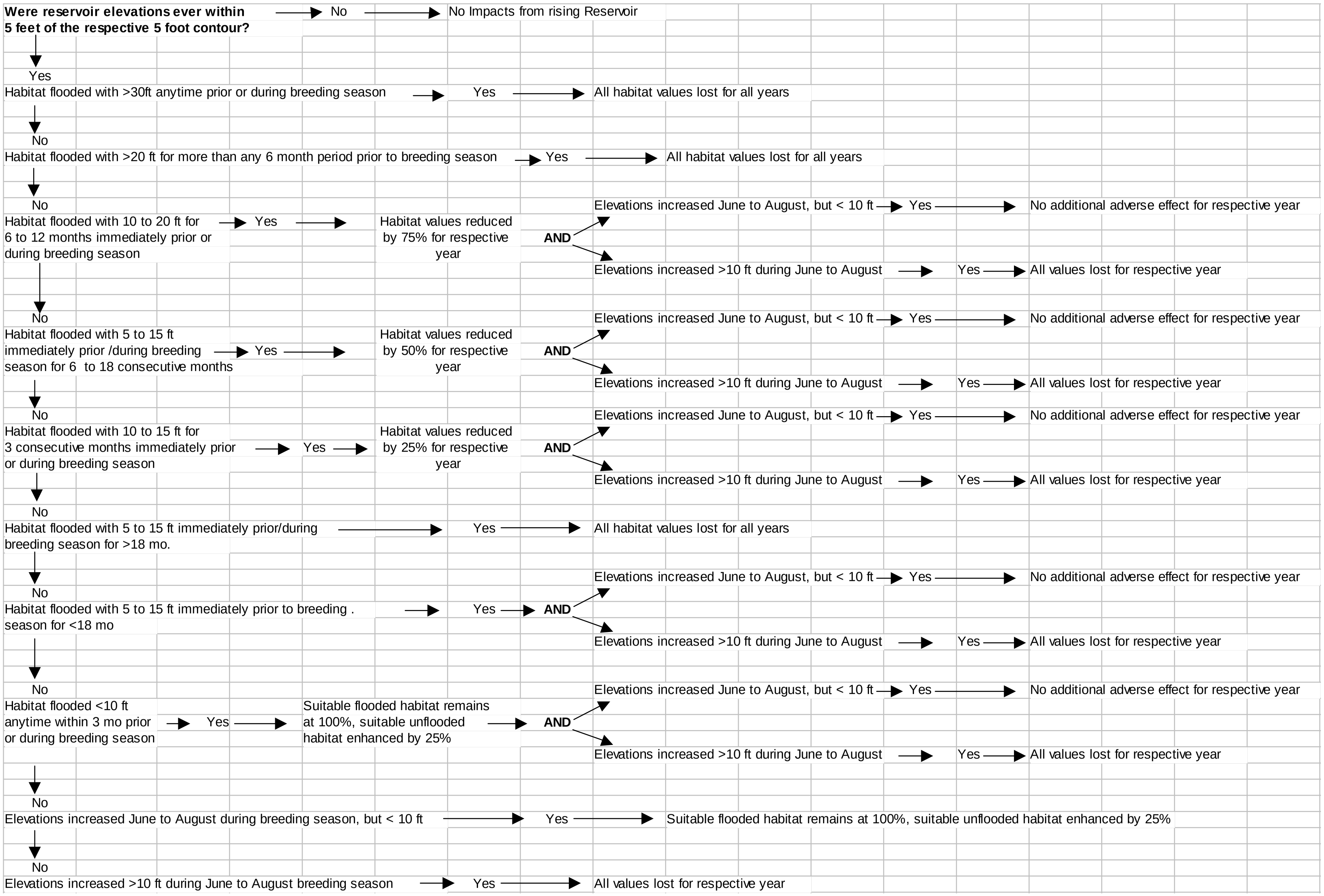


Figure 10. Habitat impact assessment scenarios based primarily on the expected flood tolerances of Goodding's willow.

DRY SCENARIO

	2009			2010			2011			2012			2013		
	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced
4345 to 4350	0.95	48.70	0	0.00	47.75	0	0.00	47.75	0	0.00	47.75	0	0.00	47.75	0
4350 to 4355	0.12	144.40	0	0.00	144.28	0	0.00	144.28	0	0.00	144.28	0	0.00	144.28	0
4355 to 4360	0.00	394.13	0	0.00	394.13	0	0.00	394.13	0	0.00	394.13	0	0.00	394.13	0
4360 to 4365	0.00	212.48	0	0.00	212.48	0	0.00	212.48	0	0.00	212.48	0	0.00	212.48	0
4365 to 4370	0.00	60.88	0	0.00	60.88	0	0.00	60.88	0	0.00	60.88	0	0.00	60.88	0
4370 to 4375	0.00	9.13	0	0.00	9.13	0	0.00	9.13	0	0.00	9.13	0	0.00	9.13	0
4375 to 4380	0.00	131.05	0	0.00	131.05	0	0.00	131.05	0	0.00	131.05	0	0.00	131.05	0
4380 to 4385	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0
4385 to 4390	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0
4390 to 4395	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0
4395 to 4400	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0
4400 to 4407	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0
>4407	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0
TOTALS	1.07	2379.25	0	0.00	2378.18	0	0.00	2378.18	0	0.00	2378.18	0	0.00	2378.18	0

AVERAGE SCENARIO

	2009			2010			2011			2012			2013		
	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced
4345 to 4350	0.95	48.70	0	0.00	47.75	0	0.00	47.75	0	0.95	48.70	0	0.00	47.75	0
4350 to 4355	0.12	144.40	0	0.00	144.28	0	0.00	144.28	0	0.12	144.40	0	0.00	144.28	0
4355 to 4360	0.00	394.13	0	0.00	394.13	0	0.00	394.13	0	0.00	394.13	0	0.00	394.13	0
4360 to 4365	0.00	212.48	0	0.00	212.48	0	0.00	212.48	0	0.00	212.48	0	0.00	212.48	0
4365 to 4370	0.00	60.88	0	0.00	60.88	0	0.00	60.88	0	0.00	60.88	0	0.00	60.88	0
4370 to 4375	0.00	9.13	0	0.00	9.13	0	0.00	9.13	0	0.00	9.13	0	0.00	9.13	0
4375 to 4380	0.00	131.05	0	0.00	131.05	0	0.00	131.05	0	0.00	131.05	0	0.00	131.05	0
4380 to 4385	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0
4385 to 4390	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0
4390 to 4395	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0
4395 to 4400	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0
4400 to 4407	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0
>4407	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0
TOTALS	1.07	2379.25	0	0.00	2378.18	0	0.00	2378.18	0	1.07	2379.25	0	0.00	2378.18	0

WET SCENARIO

	2009			2010			2011			2012			2013		
	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced	Habitat Units Lost/Gain	Habitat Units Achieved	Est. SWFL Territories Displaced
4345 to 4350	0.95	48.70	0	-47.75	0.00	-2	-47.75	0.00	-2	-47.75	0.00	-3	-47.75	0.00	-3
4350 to 4355	0.12	144.40	0	-144.28	0.00	-10	-108.21	36.07	0	-108.21	36.07	0	0.00	144.28	0
4355 to 4360	0.00	394.13	0	8.27	402.39	0	-197.06	197.06	0	-295.59	98.53	0	0.00	394.13	0
4360 to 4365	0.00	212.48	0	32.59	245.07	0	-53.12	159.36	0	-106.24	106.24	0	0.00	212.48	0
4365 to 4370	0.00	60.88	0	0.00	60.88	0	0.00	60.88	0	12.51	73.39	0	0.00	60.88	0
4370 to 4375	0.00	9.13	0	0.00	9.13	0	2.97	12.10	0	2.97	12.10	0	0.00	9.13	0
4375 to 4380	0.00	131.05	0	0.00	131.05	0	43.61	174.66	0	0.00	131.05	0	0.00	131.05	0
4380 to 4385	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0	0.00	20.00	0
4385 to 4390	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0	0.00	174.18	0
4390 to 4395	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0	0.00	367.83	0
4395 to 4400	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0	0.00	353.78	0
4400 to 4407	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0	0.00	365.78	0
>4407	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0	0.00	96.95	0
TOTALS	1.07	2379.25	0	-151.17	2227.01	-12	-359.56	2018.62	-2	-542.30	1835.87	-3	-47.75	2330.43	-3

Table 5. Impact summary tables for determining effects to Southwestern Willow Flycatcher territories.

Average Scenario – (Figure 12) No adverse effects to SWFL habitat would result under this scenario. Like the Drought Scenario, there would be a subtle enhancement of habitat within the 4345-4350 and 4350-4355 elevation contours in 2009. A subtle enhancement of habitat within these same elevation contours would be expected in 2012 when the reservoir again peaks at 4354 in early-2012 before receding. No SWFLs would be displaced under this scenario.

Wet Scenario – (Figure 13) Under this scenario a potential 23% loss of the total SWFL habitat units could occur in 2012, and the potential displacement of 12 SWFLs (4% of the total) in 2010 could occur. Similar to both the Drought Scenario and Average Scenario, there would be a subtle enhancement of habitat within the 4345-4350 and 4350-4355 elevation contours in 2009 and no SWFLs would be displaced. However, from 2010 to 2013 habitat loss and SWFL displacement could be expected. An abundance of habitat units would be available at higher elevations within the pool to accommodate the displaced SWFLs.

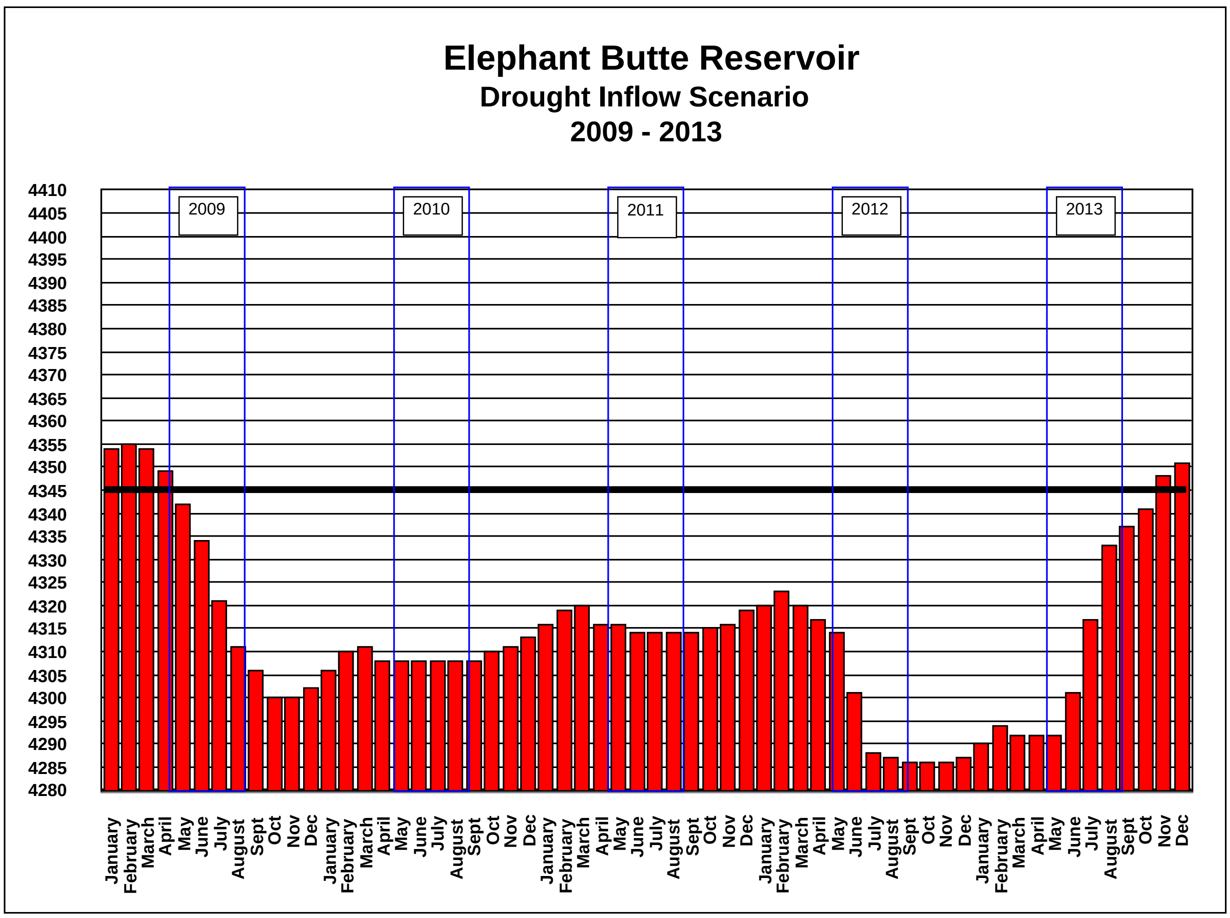


Figure 11. Predicted rise of Elephant Butte Reservoir over a five-year period (2009 – 2013) based on a drought inflow scenario. Black line depicts the lowest elevation at which Southwestern Willow Flycatchers occurred in 2008.

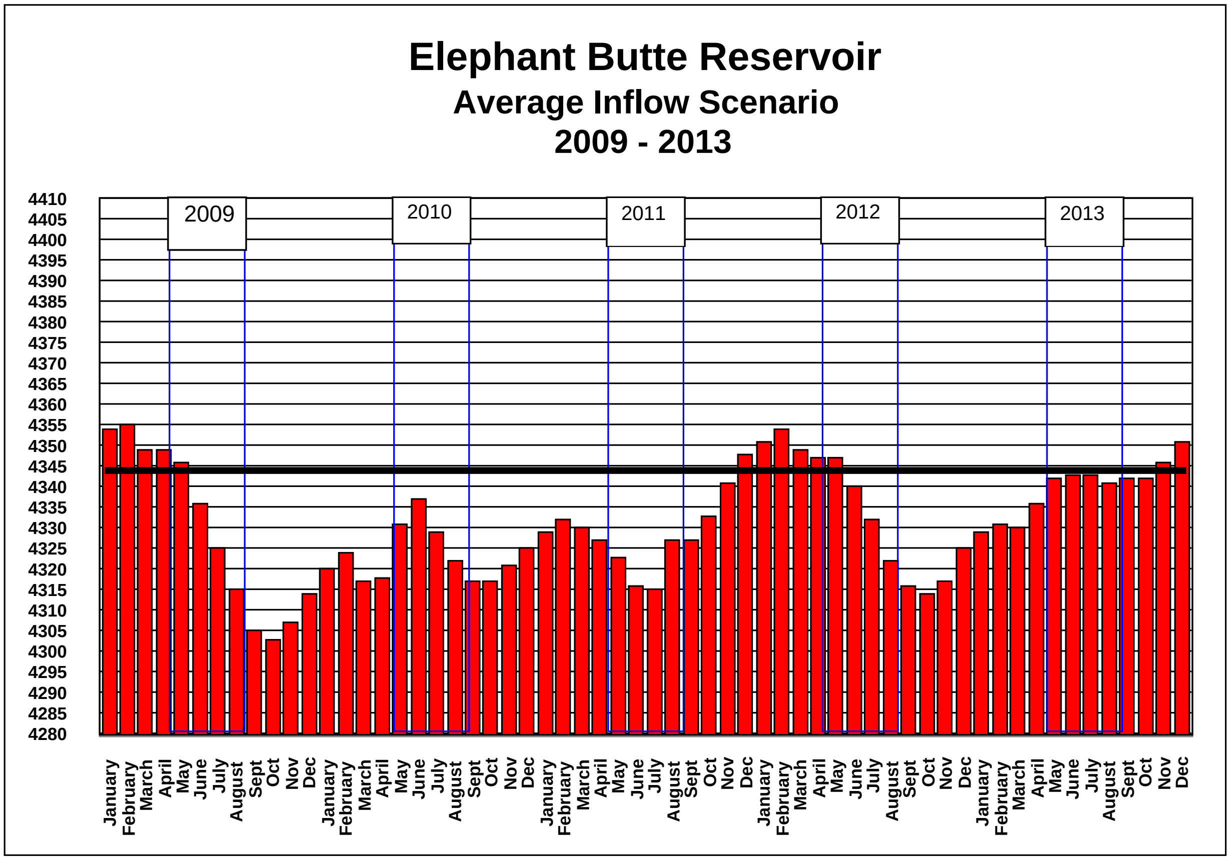


Figure 12. Predicted rise of Elephant Butte Reservoir over a five-year period (2009 – 2013) based on an average inflow scenario. Black line depicts the lowest elevation at which Southwestern Willow Flycatchers occurred in 2008.

In 2010, an increase of 17 feet in reservoir elevations during the breeding season would be very detrimental to any nesting SWFLs within the 4345-4350 and 4350-4355 elevation contours. It is possible that nests could be inundated and lost. Rising reservoir levels greater than ten feet during any breeding season is a worst case scenario for any SWFLs within that zone. Although the habitat itself would not be lost, that season's SWFL reproductive potential would be gone and the estimated 12 SWFLs would likely be displaced. An estimated 192 habitat units would be lost at the 4345-4350 and 4350-4355 elevation contours. However, approximately 41 habitat units would be gained within the 4355-4360 and 4360-4365 elevation contours. Therefore, an overall loss of 151 habitat units could occur in 2010 at the lower elevations and 12 SWFLs (4% of the total 292 territories) could be displaced. Suitable habitat would be available above 4355 ft. for the displaced SWFLs.

In 2011, rising reservoir elevations that began in 2010 would result in additional losses of habitat. All suitable SWFL habitat (48 habitat units) within the 4345-4350 contour would be rendered unsuitable due to reservoir elevations and two SWFLs could be displaced. Although habitat availability within the 4350-4355, 4355-4360, and 4360-4365 contours would be reduced by a total of 359 habitat units, no SWFLs would be displaced due to a remaining 392 habitat units. A gain of approximately 47 habitat units would be realized within the 4370-4375 and

4375-4380 elevation contours due to the rising reservoir. A loss of 360 habitat units could occur in 2011, and two SWFLs could be displaced from the 4345-4350 contour. Suitable habitat would be available above 4350 ft. for the displaced SWFLs.

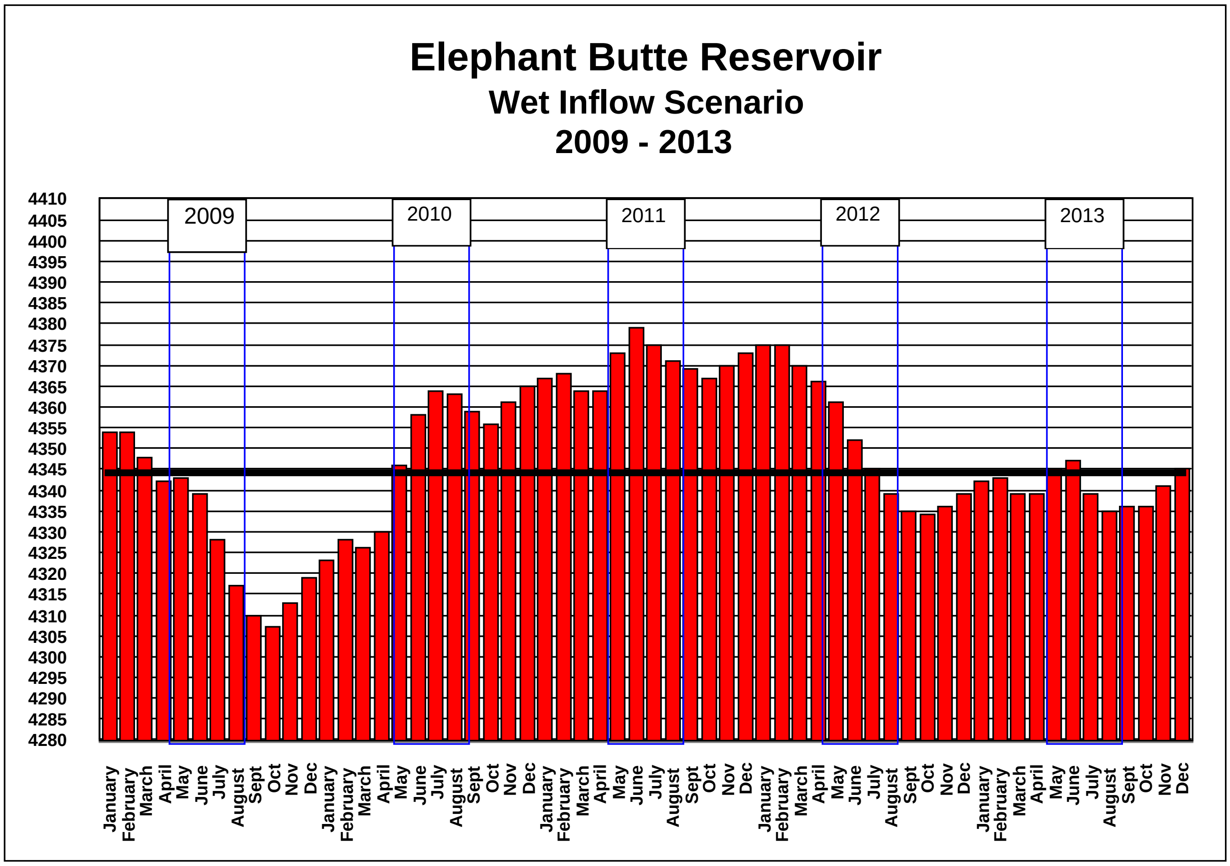


Figure 13. Predicted rise of Elephant Butte Reservoir over a five-year period (2009 – 2013) based on a wet inflow scenario. Black line depicts the lowest elevation at which Southwestern Willow Flycatchers occurred in 2008.

Although reservoir levels are expected to begin declining in early 2012, impacts from the rising reservoir during 2010 and 2011 would persist into the breeding season of 2012. Habitat losses within the 4345-4350, 4350-4355, 4355-4360, and 4360-4365 elevation contours would be expected. A total loss of 48 habitat units would occur with the 4345-4350 range, and a partial loss of habitat (510 habitat units) would be expected between 4350ft. and 4365. An estimated 3 SWFLs would be displaced from the 4345-4350 ft. zone. A total enhancement of 15 habitat units could be expected within the 4365-4370 and 4370-4375 elevation contours. A loss of 542 habitat units (23% of the total), could occur in 2012 and three SWFLs could be displaced. Suitable habitat would be available above 4350 ft. for the displaced SWFLs.

Based on the Reservoir elevation projections under this scenario; levels continue to decline through 2012, and remained somewhat stable through 2013. The adverse impacts to habitat from the higher levels realized in 2011 within the 4345-4350 elevation zone would continue into 2013. All habitat (48 units) within the 4345-4350 range would still be lost, and an estimated 3 SWFLs would be displaced from this zone. All other habitat previously impacted is expected to have recovered, and no additional habitat losses or SWFL displacement would be expected. Suitable habitat would be available above 4350 ft. for the displaced SWFLs.

5.2 Rio Grande Silvery Minnow

The Rio Grande silvery minnow currently occupies a 170-mile reach of the Rio Grande in New Mexico—between Cochiti Dam and the headwaters of Elephant Butte Reservoir (USFWS 1994). Rio Grande silvery minnows are known to be present within the action area, specifically within the temporary river channel that was dug and is being maintained through the dry portion of Elephant Butte Reservoir. Surveys for minnows, conducted by the USFWS within the temporary channel during the winter of 2005 – 2006, found over 100 minnows associated with backwater features on point bars (USFWS 2008). This sampling also found young-of-the-year indicating that egg/larval Rio Grande silvery minnow habitat conditions exist above the Elephant Butte Reservoir pool.

Based on the mobility of the Rio Grande silvery minnow and the slow rise and fall that is predicted for Elephant Butte Reservoir in the next five years (under three scenarios) it is anticipated that this species will have the ability to remain in the lotic ecosystem of the Rio Grande temporary channel and thus avoid the lentic ecosystem of a rising reservoir. Therefore, the projected fluctuations of Elephant Butte Reservoir over the next five years are anticipated to have no effect on the Rio Grande silvery minnow.

Chapter 6: Determination of Effects of the Proposed Action

6.1 Southwestern Willow Flycatcher

The SWFL population is expected to increase within Elephant Butte Reservoir pool over the next five years (short-term) and habitat availability would not be a limiting factor regardless of the reservoir level scenario. Some SWFL habitat could be temporarily lost and a small number of SWFLs could be displaced from their immediate area, dependent on the reservoir level scenario. An abundance of suitable habitat at higher elevations within the pool would be available to accommodate any displaced SWFLs. Under the wet scenario, a small number of SWFL nests could be inundated, depending on the location of the nesting birds, the placement of the nest, and the timing of the reservoir rise, though this is extremely difficult to predict. Though the Elephant Butte SWFL population is expected to increase, there also is a possibility that small numbers of SWFLs could be displaced and/or SWFL nests could be inundated. Therefore, Reclamation has determined that the proposed action may affect, and is likely to adversely affect Southwestern Willow Flycatchers in Elephant Butte Reservoir. Because some individual SWFLs may be displaced and a few nests may be inundated by a rising reservoir, incidental take is requested.

6.2 Rio Grande Silvery Minnow

No effects are anticipated.

Chapter 7: Conservation Measures

Concurrent with the five-year operational plan for the Rio Grande Project reservoirs, the following conservations measures will be implemented:

1. Continue to monitor SWFL habitat and population dynamics within the Middle Rio Grande Valley, with an emphasis on Elephant Butte Reservoir.

2. Explore opportunities to reestablish younger age classes of native vegetation, predominately Goodding's willow, in the upper seven feet of the Elephant Butte Reservoir conservation pool and above the spillway elevation of 4407 ft. in areas that are supported by outflows from the LFCC.

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Appendix A: Rio Grande Project Reservoirs General Operating Criteria and Restrictions

Both Rio Grande Project reservoirs, Elephant Butte and Caballo, are used to store Rio Grande (native) water for irrigation within the Rio Grande Project. Rio Grande water, defined as credit water for the States of Colorado and New Mexico under the terms of the 1938 Rio Grande Compact, and San Juan-Chama (SJ-C) contract water for the authorized minimum recreation pool, and the City of Albuquerque pool, is also stored in Elephant Butte Reservoir.

Under the terms of the 1906 and 1933 Treaty Conventions with Mexico, the United States is obligated to deliver to Mexico's Acequia Madre headworks up to 60,000 acre/feet (AF) annually from the Rio Grande Project, unless otherwise specified by such Treaties.

Elephant Butte Dam and Reservoir

Elephant Butte Dam and Reservoir were authorized by Congress on 25 February 1905 for irrigation and flood control.

The 1974 Congressionally-authorized minimum recreational pool contains an available space of 50,000 AF to be filled only with SJ-C water. Annually releases from Heron Reservoir to offset evaporation on this recreational pool were allowed for 10 years, at which time the releases from Heron Reservoir expired. The minimum recreational pool space still exists, and legally, a SJ-C contractor could still move its water to the pool.

On 26 January 1983, a contract was implemented between Reclamation and the City of Albuquerque allowing an additional 50,000 AF pool to exist in Elephant Butte Reservoir to be filled with SJ-C water for agriculture and incidental domestic purposes. Presently, the City of Albuquerque uses this water to offset depletions from the winegrowers around Elephant Butte Reservoir and domestic uses for the State Park at Elephant Butte Reservoir.

A prudent flood space is reserved at the top of the reservoir which allows Reclamation to control flooding downstream of the dam up to a safe river channel capacity of 5,000 cubic feet per second (cfs). 50,000 AF of flood space (below the spillway crest) is reserved for the summer months and 25,000 AF (below the spillway crest) for the winter months.

Elephant Butte Reservoir General Storage Criteria and Restrictions

The general plan for filling Elephant Butte Reservoir is to retain in storage all inflows in excess of: downstream irrigation demand; re-regulation of the Rio Grande Project storage to manage Caballo Reservoir per Court Order CIV-90-95 HB/WWD dated 17 October 1996 and Caballo Reservoir's authorized flood control pool; and the safe river channel capacity below Elephant Butte Dam of 5,000 cfs.

Of the total conservation storage pool amount, 50,000 AF (elev. 4407.0 ft. to 4405.6 ft.) is reserved for prudent flood control space from 1 April to 30 September (summer months), and 25,000 AF (elev. 4407.0 ft. to 4406.3 ft.) from 1 October to 31 March (winter months) each year. Prudent flood space is utilized and managed such that the flow in the river channel downstream of the dam through the New Mexico cities of Truth or Consequences and Williamsburg does not exceed 5,000 cfs (the safe channel capacity) and to minimize local flooding.

A 50,000 AF minimum pool space was authorized by the U.S. Congress for recreational purposes. Presently, there is no SJ-C water stored in it. However, legally, any SJ-C contractor could move its waters into the recreational space even though releases from Heron Reservoir for offsetting evaporation in the pool have expired. The U.S. Congress and the Rio Grande Compact Commission define SJ-C water in Elephant Butte Reservoir as non-Project Storage. Therefore, it is the first waters to be spilled in a year of a spill from Project Storage (actual spill).

An additional 50,000 AF minimum pool space in Elephant Butte Reservoir was contracted for between the City of Albuquerque and Reclamation to store SJ-C water that would be used to offset depletions from water users utilizing that water for agriculture and incidental domestic purposes. The contract is in effect for a period of 25 years, and is set to expire at the end of 2008. The City of Albuquerque and Reclamation are currently in negotiations to renew and extend this contract.

Each year on 1 December or 1 January, prior to the start of the irrigation season on the Rio Grande Project, Reclamation evaluates the existing total storage in both Elephant Butte and Caballo Reservoirs. After excluding non-Project storage (SJ-C waters) and Compact credit waters for Colorado and/or New Mexico, Reclamation allocates the remaining Rio Grande (native) storage in both reservoirs (with adjustments for the efficiency of delivering water from Caballo Dam to the Project canal headings) to the three major water users of the Rio Grande Project (EBID, EP #1, and Mexico) according to historic patterns of the Project water delivered to the United States farm lands on the Project and to Mexico's Acequia Madre heading per the International Treaties of 1906 and 1933. Each month during the irrigation season on the Rio Grande Project, Reclamation updates the Project allocation based on the previous end of month total Project storage less non-Project waters and Compact credit waters, and releases made out of Caballo Reservoir since the beginning of the irrigation season, and then adjusts for the current efficiency of delivering water from Caballo Dam to the Project canal headings.

All Elephant Butte Reservoir data (elevation, storage, and evaporation) is monitored, collected, analyzed, and finalized as official Rio Grande Project data records by Reclamation's El Paso Field Division. The official records of data are transmitted yearly to the USGS for publication, and are also transmitted monthly to the Rio Grande Compact Commission for their accounting procedures.

The following Rio Grande Compact provisions exist concerning the regulation and storage of native Rio Grande water and any non-Project water in Elephant Butte Reservoir.

- The Rio Grande Project represents the "Texas portion" of the Rio Grande Compact. Under the Compact provisions, New Mexico makes its deliveries to Elephant Butte Reservoir. Also, the 1938 Rio Grande Compact (Compact) and its appurtenant rules and regulations defines "Project Storage" (Article I), for Compact accounting purposes, as the total amount of storage in Elephant Butte and Caballo reservoirs (excluding non-Project storage, such as SJ-C water in the authorized recreation and City pools in Elephant Butte Reservoir – Articles

I, IV, and X). Under Compact rules and regulations, the States of Colorado and New Mexico are allowed to store in "Project Storage space" overdeliveries by either or both States as a function of delivery schedules per index stations in the Compact (Articles III and IV). These overdeliveries by Colorado and/or New Mexico are defined as "credit waters" per Compact rules and regulations. Any underdeliveries by Colorado and/or New Mexico are defined as "debit waters", and Colorado and/or New Mexico must store such debit waters in post-1929 reservoirs upstream of Elephant Butte Reservoir (Article VI).

- In a year when Elephant Butte and Caballo reservoirs' total conservation storage pools are full and inflow exceeds outflow from "Project storage", as soon as all non-Project storage (SJ-C water in the recreation and/or City pools of Elephant Butte Reservoir) is spilled, and then all "Credit Waters" are spilled; then as long as inflow continues to exceed outflow or flood waters are stored in upstream reservoirs' flood control pools, the Rio Grande Compact Commission will declare an actual spill of Project Storage. All debits and credits for that year are cancelled, and any accrued debits for Colorado and/or New Mexico are cancelled (Article VI).

- In a year when Elephant Butte and Caballo reservoirs' total conservation storage pools are not full, but if debit accrued departures from a normal yearly release from Caballo Reservoir of 790,000 AF per year are sufficient that when added to the total Project Storage (excluding any non-Project storage and Credit Waters) would have produced a spill from Project Storage, then the Rio Grande Compact Commission will declare a hypothetical spill (Articles I and VI). All debits and credits for that year are cancelled, and any accrued debits for Colorado and/or New Mexico are cancelled. Credit Waters for Colorado and/or New Mexico are not cancelled.

- In any year when total "Project Storage" (excluding non-Project Storage and Credit Waters) is less than 400,000 AF – defined as usable water in Project storage, then any Rio Grande (native) water flowing into post-1929 reservoirs upstream of Elephant Butte Reservoir shall be passed downstream and not captured for storage (Article VII). Colorado and/or New Mexico may relinquish their respective "Credit Waters" within Project Storage instead, and will be allowed to store waters within their respective post-1929 reservoirs up to the amount relinquished from the Credit Waters (Article VII). The credit waters relinquished in Elephant Butte Reservoir revert to native Rio Grande water which is available for allocation to the Rio Grande Project water users.

- In January of any year, the Texas Commissioner may demand that debit waters held in post-1929 reservoirs upstream of Elephant Butte Reservoir be released to the extent of the accrued debits of Colorado and/or New Mexico such that Project Storage will contain 600,000 AF by 1 March, and maintain this quantity until 30 April, and further allow a normal release from Caballo Reservoir of 790,000 AF for that year (Article VIII).

- For Rio Grande Compact accounting purposes, any SJ-C water existing in the recreational and/or City pools is considered "non-Project Water" (Articles I, IV, and X), and it is excluded from the calculation of "Project Storage". Any SJ-C water in Project storage, suffers evaporation losses in the same proportion as the total storage in Elephant Butte

Reservoir. In a year when the Rio Grande Compact Commission declares an actual spill, the spill is not officially declared until: 1) all non-Project Storage (SJ-C water stored in Elephant Butte Reservoir) is spilled first; and 2) all the Credit Waters for Colorado and/or New Mexico are spilled secondly (Article VI). In a year when the Rio Grande Compact Commission declares a hypothetical spill, all non-Project Storage (SJ-C Water) and Credit Waters are excluded from the calculation of usable Project Storage in both Elephant Butte & Caballo Reservoirs (Article I).

Elephant Butte Dam Releases General Operating Criteria and Restrictions

Whenever possible, Reclamation's Elephant Butte Field Division schedules releases through the hydroelectric facility (power plant). These scheduled releases are also coordinated with the Western Area Power Administration (WAPA) or its designated contractor for distribution of power generated at the power plant. This allows Reclamation to generate hydroelectric power to fulfill its secondary purpose of power generation. Normally, the power plant maximum discharge is all that is needed to meet downstream irrigation demand below Caballo Dam, even during the peak irrigation demand period of mid-June through early August (provided storage in Caballo Reservoir is utilized). If one generator is taken off-line or is unavailable, then the following appurtenant facilities or structures are used to release additional flow: 1) if the Elephant Butte Reservoir elevation is above 4396.0 ft., then additional releases can be made through the spillway drum gates and spillway channel; and 2) if the Elephant Butte Reservoir elevation is below 4396.0 ft., then additional releases can be made through the outlet works (balanced valves).

Since the only authorized purposes for the Rio Grande Project are irrigation and flood control, and all Rio Grande Project storage is contracted for or obligated under International Treaties, Elephant Butte Dam's releases are shut completely off at the end of the irrigation season on the Rio Grande Project (typically mid-October). Releases are typically started from Elephant Butte Dam when the first orders for irrigation use are received (this can be as early as the middle of January). Sometimes, releases begin from Elephant Butte Dam seven to ten days prior to the start of the irrigation season to begin raising Caballo Reservoir to its summer operating range per the 1996 Court Order for Caballo Reservoir.

Flood control releases from Elephant Butte Dam are required when the reservoir level is within the prudent flood space. However, in coordination with the COE in Albuquerque, if it is anticipated that a large flood event or high releases will reach Elephant Butte Reservoir and raise the reservoir level into or fill the prudent flood space, a pre-release of storage water may be made dependent upon safe channel conditions downstream and if the storage level in Caballo Reservoir is not approaching or in its exclusive flood control pool. The safe channel capacity downstream of Elephant Butte Dam is 5,000 cfs. This includes the Rio Grande reach through the New Mexico cities of Truth or Consequences and Williamsburg. Reclamation, in its discretionary responsibility to utilize the prudent flood pool space, may temporarily store waters in the prudent flood space by reducing releases from Elephant Butte Dam if: 1) flash flooding is occurring on the intervening drainages between Elephant Butte Dam and the head end of Caballo Reservoir, and the safe channel capacity (5,000 cfs) is being exceeded; or 2) flooding is occurring below Caballo Dam and the Caballo Reservoir level is in its exclusive flood control pool. Waters within the prudent flood space will be evacuated as soon as practicable dependent upon safe, downstream channel conditions to convey such discharges, or in coordination with the IBWC, when it is safe to transport water to Caballo Reservoir.

Flood control releases from Elephant Butte Dam are accomplished by a combination of hydroelectric facility (power plant) releases, outlet works (balanced valves) releases, and possibly spillway drum gates releases. If waters within the prudent flood space continue to rise above the top of the prudent flood space, then uncontrolled releases over the spillway weir crest will occur.

Other Elephant Butte Dam Operating Criteria and Restrictions

U.S. Congress' Flood Control Act of 1948 gives Reclamation the authority to maintain the Rio Grande channel between Elephant Butte Dam and the head-end of Caballo Reservoir for flood control purposes such that 5,000 cfs can pass safely. To fulfill this obligation, Reclamation evaluates the river channel each fall and identifies areas of sediment deposition within the channel that need to be removed during the winter, non-irrigation season. In order to ensure that the channel can safely pass 5,000 cfs, Reclamation will periodically (every 2 to 5 years roughly) increase the discharge at Elephant Butte Dam up to 5,000 cfs for a short period of time. Reclamation monitors the river to observe whether it is capable of passing 5,000 cfs without causing localized flooding. This special operation is conducted during the irrigation season, and it is conducted over a 2 to 3 day period typically.

Even though power generation at Elephant Butte Dam is secondary in purpose to the primary purpose of irrigation, there are two situations where increased power generation is warranted:

1. If WAPA or its designated contractor urgently needs peaking power from the power plant, Elephant Butte Dam can accommodate this request. However, this increased power generation is subject to: the restrictions of maintaining Caballo Reservoir at acceptable storage levels that would not increase evaporation differences between Elephant Butte and Caballo reservoirs, the constraints of the 1996 Court Order for Caballo Reservoir, and increased releases are within the irrigation season.

2. Elephant Butte Dam power plant has been designated as a Black Start facility in the event of a national emergency involving a widespread power outage or other power system interruption. If such an emergency occurred during the winter months (basically the non-irrigation season – October through January), then Elephant Butte Dam power plant has the ability to start power generation and transfer power locally to other regional plants (Lordsburg, NM) to allow them to start-up and provide power to the Federal transmission grid.

To accommodate bathhouse owners downstream of Elephant Butte Dam within the City of Truth or Consequences during the non-irrigation or winter season, Reclamation will generally install a temporary dike across the Rio Grande near the old State Veterans Hospital seven days after releases from Elephant Butte Dam are shut off. Once the dike is installed, the maximum safe discharge capacity over the dike is limited to approximately 600 cfs.

Caballo Dam and Reservoir

By the Treaty between the U.S. and Mexico dated 1 February 1933, the United States was obligated to construct a flood retention structure downstream of Elephant Butte Dam to alleviate flooding in the El Paso/Juarez area of the Rio Grande. This structure became known as the Caballo Dam and Reservoir. Congress authorized the facility as a unit within the Rio Grande Canalization Project on 29 August 1935. The dam's construction was completed in 1938. The Bureau of Reclamation owns, operates, and maintains Caballo Dam and Reservoir. The primary purposes of the facility are irrigation and flood control.

A minimum fishery pool of 25,000 AF is recognized in Caballo Reservoir per a 1991 USFWS Biological Opinion. This fishery pool was established to provide winter habitat for the Bald Eagle (*Haliaeetus leucocephalus*). Since the issuance of this Biological Opinion, the Bald Eagle has been de-listed. During drought years, Caballo Reservoir is typically drawn down much lower at the end of an irrigation season. The primary reason is to maintain minimum evaporation differences between Elephant Butte and Caballo reservoirs, per the Court Order of 1996, due to the fact that Elephant Butte Reservoir is at a much lower storage level.

On 17 October 1996, Court Order CIV-90-95 HB/WWD directed Reclamation to operate Caballo Reservoir such that the storage level would not exceed 50,000 AF during the winter months (1 October through 31 January). During the summer months (1 February – 30 September), Caballo Reservoir's storage level is coordinated with EBID and EP #1 in conjunction with Reclamation's Rio Grande Project reservoirs operational plan such that evaporation differences between Elephant Butte and Caballo Reservoirs are minimized.

An exclusive flood control space (100,000 AF) is reserved at the top of the reservoir, above the authorized conservation storage pool. IBWC, in coordination with Reclamation, controls, manages, and directs the operation of the flood pool to control flooding downstream of Caballo Dam.

Caballo Reservoir General Storage Criteria and Restrictions

The general plan for filling Caballo is to retain in storage all inflows in excess of: downstream irrigation demand; and the safe river channel capacity below Caballo Dam of 5,000 cfs; or per the IBWC's direction to control flooding in the Rio Grande downstream to American Diversion Dam (up to 11,000 cfs).

The exclusive flood control pool amount is 100,000 AF (from elevation 4172.4 ft. to 4182.0 ft). Elevation 4182.0 ft. is 1.5 ft. below the top of the radial gates, which control discharge through the spillway. Flood control operations are dictated and directed by the IBWC, in conjunction and coordination with Reclamation per the 1 June 1998 IBWC Flood Operations Criteria document (updated in September 2003). Generally, IBWC dictates that the flood pool will be completely evacuated from 1 June to 31 October each year.

During the irrigation season on the Rio Grande Project (typically mid-February to mid-October), Reclamation maintains at least 50,000 AF to 55,000 AF of storage (elevation 4146.1 ft. to 4147.3 ft.) in Caballo Reservoir at the peak irrigation period (typically mid-June to early August) so that in the event of an emergency where Elephant Butte Dam was unable to deliver any water, there would be enough “emergency storage” in Caballo Reservoir to continue making irrigation deliveries out of Caballo Dam for 5 days. Also, this peak storage level minimizes evaporation between the two reservoirs per the Court Order of 1996.

Generally, Reclamation operates Caballo Reservoir (per the Court Order of 1996) by drawing down the storage level sufficiently below 50,000 AF by the end of the irrigation season (typically mid-October) to leave enough space to allow for winter accretions into Caballo Reservoir, and still maintain the storage level below 50,000 AF (elevation 4145.0 ft.) from 1 October to 31 January (winter months) each year, provided that Elephant Butte Reservoir has space available to store Rio Grande Project storage. This also allows for any rainfall runoff that may occur during the winter months into Caballo Reservoir. From 1 February to 30 September, Reclamation (in consultation with the Rio Grande Project irrigation districts) operates Caballo Reservoir within a flexible storage pool between 30,000 AF and 55,000 AF (elevation 4140.2 ft. to elevation 4147.3 ft.). This minimizes the evaporation differences between Elephant Butte and Caballo Reservoirs (during drought years when Elephant Butte Reservoir is much lower in storage) and allows an amount of storage to meet peak irrigation demand downstream of Caballo Dam if all releases were discontinued for a five day period from Elephant Butte Dam. This flexible storage pool also allows Reclamation to peak power generation at Elephant Butte Dam power plant, if necessary, and allows for rainfall runoff into Caballo Reservoir during the irrigation season.

Each year on 1 December or 1 January, prior to the start of the irrigation season on the Rio Grande Project, Reclamation evaluates the existing total storage in both Elephant Butte and Caballo Reservoirs. After excluding non-Project Storage (SJ-C waters) in Elephant Butte Reservoir, and Compact credit waters for Colorado and/or New Mexico, Reclamation allocates the remaining Rio Grande (native) storage in both reservoirs to the three major water users of the Rio Grande Project (EBID, EB #1, and Mexico) according to historic patterns of the Project water delivered to the United States farm lands on the Project and to Mexico’s Acequia Madre heading per the International Treaties of 1906 and 1933. Adjustments are made to the allocation with respect to the current year’s gross efficiency of delivering storage waters from Caballo Dam to the Project’s designated canal headings on the Rio Grande.

All Caballo Reservoir data (elevation, storage, and evaporation) is monitored, collected, analyzed, and finalized as official Rio Grande Project data records by Reclamation’s El Paso Field Division. The official records of data are transmitted yearly to the USGS for publication, and are also transmitted monthly to the Rio Grande Compact Commission for their accounting procedures.

The following Rio Grande Compact provisions exist concerning the regulation and storage of native Rio Grande water in Caballo Reservoir.

- The Rio Grande Project represents the “Texas portion” of the Rio Grande Compact. Under the Compact provisions, New Mexico makes its deliveries to Elephant Butte Reservoir.

Also, the 1938 Rio Grande Compact (Compact) and its appurtenant rules and regulations defines “Project Storage” (Article I), for Compact accounting purposes, as the total amount of storage in Elephant Butte and Caballo reservoirs (excluding non-Project storage, such as SJ-C water in the authorized recreation and City pools in Elephant Butte Reservoir – Articles I, IV, and X). Under Compact rules and regulations, the States of Colorado and New Mexico are allowed to store in “Project Storage space” overdeliveries by either or both States as a function of delivery schedules per index stations in the Compact (Articles III and IV). These overdeliveries by Colorado and/or New Mexico are defined as “credit waters” per Compact rules and regulations. Any underdeliveries by Colorado and/or New Mexico are defined as “debit waters”, and Colorado and/or New Mexico must store such debit waters in post-1929 reservoirs upstream of Elephant Butte Reservoir (Article VI).

- In a year when Elephant Butte and Caballo Reservoirs total conservation storage pools are full and inflow exceeds outflow from “Project storage”, as soon as all non-Project storage (SJ-C water in the recreation and/or City pools of Elephant Butte Reservoir) is spilled, and then all “Credit Waters” are spilled; then as long as inflow continues to exceed outflow or flood waters are stored in upstream reservoirs’ flood control pools, the Rio Grande Compact Commission will declare an actual spill of Project Storage. All debits and credits for that year are canceled, and any accrued debits for Colorado and/or New Mexico are canceled (Article VI).

- In a year when Elephant Butte and Caballo Reservoirs’ total conservation storage pools are not full, but if debit accrued departures from a normal yearly release from Caballo Reservoir of 790,000 AF per year are sufficient that when added to the total Project Storage (excluding any non-Project storage and Credit Waters) would have produced a spill from Project Storage, then the Rio Grande Compact Commission will declare a hypothetical spill (Articles I and VI). All debits and credits for that year are canceled, and any accrued debits for Colorado and/or New Mexico are canceled. Credit Waters for Colorado and/or New Mexico are not canceled.

- In any year when total “Project Storage” (excluding non-Project Storage and Credit Waters) is less than 400,000 AF – defined as usable water in Project storage, then any Rio Grande (native) water flowing into post-1929 reservoirs upstream of Elephant Butte Reservoir shall be passed downstream and not captured for storage (Article VII). Colorado and/or New Mexico may relinquish their respective “Credit Waters” within Project Storage instead, and will be allowed to store waters within their respective post-1929 reservoirs up to the amount relinquished from the Credit Waters (Article VII). The credit waters relinquished in Elephant Butte Reservoir revert to native Rio Grande water which is available for allocation to the Rio Grande Project water users.

- In January of any year, the Texas Commissioner may demand that debit waters held in post-1929 reservoirs upstream of Elephant Butte Reservoir be released to the extent of the accrued debits of Colorado and/or New Mexico such that Project Storage will contain 600,000 AF by March 1st, and maintain this quantity until April 30th, and further allow a normal release from Caballo Reservoir of 790,000 AF for that year (Article VIII).

- For Rio Grande Compact accounting purposes, any SJ-C water existing in the recreational and/or City pools in Elephant Butte Reservoir is considered "non-Project Water" (Articles I, IV and X), and it is excluded from the calculation of "Project Storage". Any SJ-C water in Project storage, suffers evaporation losses in the same proportion as the total storage in Elephant Butte Reservoir. In a year when the Rio Grande Compact Commission declares an actual spill, the spill is not officially declared until: 1). all non-Project Storage (SJ-C water stored in Elephant Butte Reservoir) is spilled first; and 2). all the Credit Waters for Colorado and/or New Mexico are spilled secondly. In a year when the Rio Grande Compact Commission declares a hypothetical spill, all non-Project Storage (SJ-C Water) and Credit Waters are excluded from the calculation of usable Project Storage in both Elephant Butte & Caballo Reservoirs (Article I).

- For Rio Grande Compact accounting purposes, a normal yearly release from "Project Storage" (from Caballo Dam) for the "Texas portion" of the Rio Grande Compact (Rio Grande Project) is an average of 790,000 AF since the last Compact-declared spill from Project storage. In some years the irrigation demand will exceed the normal release, and in some years the irrigation demand will be less than the normal release. However, any yearly release in excess of the normal release is considered a debit departure from normal release in the Compact accounting procedures. Likewise, any yearly release that is less than the normal release is considered a credit departure from normal release. From year to year, these departures from normal release are accrued. They can affect the Project Storage calculation and force a hypothetical spill. Whether a hypothetical or actual spill is declared by the Rio Grande Compact Commission, accrued departures from normal release are canceled and departures from normal release for that spill year are canceled. New departures from normal release are calculated again starting in the year after a spill year.

Caballo Dam General Release Criteria and Restrictions

Releases from Caballo Dam can occur from either the outlet works (high pressure slide gates) or the spillway (radial gates) or both.

Releases from Caballo Dam are made to satisfy the irrigation demand for the Rio Grande Project, including Mexico's schedule for irrigation per the 1906 and 1933 International Treaties. Elephant Butte Dam releases generally coincide with Caballo Dam releases, and simultaneously assist in managing Caballo Reservoir's storage levels for its summer and winter operating ranges (per the Court Order CIV-90-95 HB/WWD dated 17 October 1996 for Caballo Reservoir) and satisfying irrigation demand on the Rio Grande Project.

Irrigation orders are received from the three water users of the Rio Grande Project (EBID, EP #1, and Mexico) frequently during the irrigation season (sometimes as much as three or four times a week). Reclamation's El Paso Field Division analyzes the river conditions downstream of Caballo Dam, the Rio Grande Project drain flow to the Rio Grande, and any rainfall into the mainstem of the Rio Grande, and calculates the total release from Caballo Dam to meet the irrigation orders at the respective diversion headings on the Rio Grande. The total release from Caballo Dam is monitored at Reclamation's gauging station downstream of Caballo Dam, and the flow is frequently measured at the station to ensure that the proper shift is applied to the rating table and ensure that the Rio Grande Project storage release will meet the total irrigation orders. The gauging station record of daily flows from Caballo Dam is monitored, collected, analyzed, and finalized as official Rio Grande Project data records by Reclamation's El Paso Field Division. The official records of data are transmitted yearly to the USGS for publication, and are also transmitted monthly to the Rio Grande Compact Commission for their accounting procedures.

Since the only authorized purposes for the Rio Grande Project are irrigation and flood control, and all Rio Grande Project storage is contracted for or obligated under International Treaties, Caballo Dam's releases are shut completely off at the end of the irrigation season on the Rio Grande Project (typically mid-October). Releases are typically started from Caballo Dam when the first orders for irrigation use are received (this can be as early as the middle of January). During the irrigation season, when storage levels in both reservoirs are low and a low spring runoff is anticipated, "block releases" from Caballo Dam for irrigation delivery is accomplished. Releases from Caballo Dam are completely shut off from mid-April to mid-May when irrigation demand is typically much lower during drought years.

Flood control releases from Caballo Dam are required when the reservoir level is within the exclusive flood control space. IBWC directs the flood operations of the flood control pool in coordination with Reclamation. IBWC's 1 June 1998 Flood Operations Criteria document (updated in September 2003) for Caballo Reservoir is the official document for the operation of the flood pool. Flood control releases from Elephant Butte Reservoir, flooding immediately upstream of Caballo Reservoir, or flooding downstream of Caballo Dam will initiate flood control operations, as long as Caballo Reservoir's level is within the flood pool. Reclamation, IBWC, and the COE in Albuquerque coordinate operations closely in conjunction with the operations of Caballo Reservoir's flood control pool. The safe river channel capacity downstream of Caballo Dam is generally 5,000 cfs, except for a few isolated spots north of Las Cruces. However, due to the stipulations of the 1933 Treaty with Mexico and the 1935 U. S. Congressional authorization of the Rio Grande Rectification and Canalization Projects (which include a system of levees the IBWC maintains from Percha Diversion Dam downstream to American Diversion Dam), IBWC operates and directs the operation of Caballo Reservoir's flood control pool such that the river channel shall not exceed 11,000 cfs at American Diversion Dam.

Flood control releases from Caballo Dam are accomplished by operating a combination of outlet works (high pressure slide gates) releases and spillway radial gates.

Other Caballo Dam Operating Criteria and Restrictions

The Caballo State Park is located along the west bank of the Rio Grande just downstream of Caballo Dam. Because of the attendance and usage along the river at the park for day-use, camping, and fishing, there unfortunately is an occasional drowning in the river. When Reclamation is alerted to such a tragedy, we make every effort to cooperate with local law enforcement and rescue operations by reducing or shutting off the releases completely at Caballo Dam for a period of time. Coordination with the Project's water users (EBID, EP #1, IBWC, and Mexico) is necessary prior to reduction or shut down of the releases from Caballo Dam.

If localized flooding is occurring downstream of Caballo Dam due to rainfall runoff, Reclamation will coordinate with Rio Grande Project water users to reduce or shut down releases from Caballo Dam to alleviate flooding on the Rio Grande downstream of the dam.

With its headworks in the Caballo Dam blockhouse, the Bonita Lateral pipeline terminates at a small blockhouse at the downstream foot of the Caballo Dam embankment. This allows the Bonita Lateral Community Ditch to deliver water to their canal when needed for irrigation purposes. The community ditch and its diversion on the Rio Grande existed prior to Caballo Dam and Reservoir being built. Reclamation built the pipeline to continue delivering water to the prior water right when Caballo Dam and Reservoir was being constructed. Reclamation monitors and collects the flow data for the pipeline usage (by the Bonita Lateral Community Ditch) once a month, and we develop the water record which is reported annually to the USGS and the Rio Grande Compact Commission.

Appendix B: Detailed Results of Three Five-Year Runs of the Rio Grande Project Reservoirs Operational Plans

Results of the "Dry" scenario:

YEAR	COCHITI RELEASE	NET LOSSES	SAN MARCIAL	<==== ELEPHANT BUTTE LOSSES	EVAP	CONTENT	RELEASE ====>	<=== EVAP	CABALLO LOSSES	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2008														2008
* JAN	45300	-3100	48400	-1400	3000	455370	870	620	-1900	200	0	200	25964	JAN *
* FEB	57500	3800	53700	-3600	5040	482230	25400	1100	3000	6700	0	6700	40564	FEB *
* MAR	135300	52050	83250	-32000	7950	495040	94490	1990	6900	88600	0	88600	37564	MAR *
* APR	209490	73690	135800	-34400	12070	535710	117460	2800	6300	94700	0	94700	51224	APR *
* MAY	260000	62300	197700	800	14000	614510	104100	3000	3300	102700	0	102700	46324	MAY *
* JUN	237800	65100	172700	4700	16300	625510	140700	3800	2400	124500	0	124500	56324	JUN *
* JUL	81600	-11400	93000	16000	8700	626110	67700	3000	-19400	77100	0	77100	63324	JUL *
* AUG	60600	3400	57200	8000	16300	573210	85800	3000	-500	88300	0	88300	58324	AUG *
* SEP	53200	31500	21700	-12000	12200	590210	4700	800	-17800	54000	0	54000	26120	SEP *
OCT	47000	26600	20400	-5800	10200	571010	35200	1400	400	48200	0	48200	11320	OCT
NOV	52000	600	51400	1000	5000	616210	200	800	-1800	240	0	240	12280	NOV
DEC	57480	-7120	64600	2000	3000	675610	200	600	-2700	240	0	240	14340	DEC
TOTAL	1297270	297420	999850	-56700	113760		676820	22910	-21800	685480	0	685480		TOTAL
AVG			Total Mar-Jul			571728							36973	AVG
	924190	241740	682450	119%										

2008

End of Year (EOY):
SJ-C 32,032 AF
RG Compact (RGC) Credits 65,500 AF

DRY RUN 1953 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT BUTTE LOSS	EVAP	CONTENT	RELEASE ====>	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2009						675610							14340	2009
JAN	41750	2755	38995	-1400	3000	712135	870	1200	-3000	200	0	200	16810	JAN
FEB	46989	4117	42873	-3600	5040	724568	29000	1200	-2000	6700	0	6700	39910	FEB
MAR	67102	21516	45586	-32000	7950	701704	92500	2000	2000	88600	0	88600	39810	MAR
APR	73254	58017	15237	-34400	10800	630541	110000	3000	2000	94700	0	94700	50110	APR
MAY	82101	57206	24895	2800	12000	532136	108500	3800	2000	102700	0	102700	50110	MAY
JUN	114706	68134	46572	4700	14300	428708	131000	4000	2000	124500	0	124500	50610	JUN
JUL	37191	19158	18034	16000	12700	292041	126000	2800	-1000	124000	0	124000	50810	JUL
AUG	35625	19535	16090	8000	10300	205631	84200	2000	-3000	106000	0	106000	30010	AUG
SEP	22376	21093	1283	-12000	8200	166715	44000	1000	-1000	54000	0	54000	20010	SEP
OCT	26125	25643	482	-5800	6200	128797	38000	800	-1800	48200	0	48200	10810	OCT
NOV	30371	28738	1632	1000	4000	125229	200	800	-1800	240	0	240	11770	NOV
DEC	32724	16726	15999	2000	2000	137028	200	600	-2800	240	0	240	13930	DEC
TOTAL	610315	342638	267678	-54700	96490		764470	23200	-8400	750080	0	750080		TOTAL
AVG			Total Mar-Jul			398769							32058	AVG
	374355	224031	150324	26%										

2009

Beginning of Year (BOY):
SJ-C 32,032 AF
RG Compact (RGC) Credits 91,200 AF

Moved 5,000 AF of Santa FE SJ-C water to EB

RED = San Marcial flows adjusted for present irrigation practices & trends

EOY:
SJ-C 31,076 AF
RGC Credits 91,200 AF

DRY RUN 1954 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT BUTTE LOSS	EVAP	CONTENT	RELEASE ====>	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2010						137028							13930	2010
JAN	30306	4991	25315	-4000	2000	163473	870	1200	-3000	200	0	200	16400	JAN
FEB	37911	6854	31057	-3000	3000	193580	950	1200	-2000	200	0	200	17950	FEB
MAR	45024	29980	15045	4000	5000	198675	950	1200	2000	200	0	200	15500	MAR
APR	66951	52767	14184	11000	6000	182858	13000	1600	2000	12000	0	12000	12900	APR
MAY	111066	74994	36071	-8000	10500	182430	34000	2000	2000	9000	0	9000	33900	MAY
JUN	41464	38172	3293	-9800	10400	182122	3000	2400	2000	12500	0	12500	20000	JUN
JUL	48328	40184	8144	-17000	8000	182267	17000	2400	-1000	15600	0	15600	20000	JUL
AUG	27582	5674	21907	-10400	4400	182274	27900	1800	-2000	38100	0	38100	10000	AUG
SEP	37637	12264	25373	-4000	3000	182247	26400	600	-1000	34800	0	34800	2000	SEP
OCT	27747	12149	15598	-1700	1000	198345	200	500	-1800	400	0	400	3100	OCT
NOV	21927	17726	4201	-2000	1000	203346	200	500	-1800	200	0	200	4400	NOV
DEC	24344	8885	15459	-3500	1200	220905	200	400	-2800	200	0	200	6800	DEC
TOTAL	520288	304641	215647	-48400	55500		124670	15800	-7400	123400	0	123400		TOTAL
AVG			Total Mar-Jul			189377							13579	AVG
	312834	236097	76737	13%										

2010

BOY:
SJ-C 31,076 AF
RGC Credits 151,268 AF

CO relinquishes 900 AF

Moved 5,000 AF of Santa FE SJ-C water to EB

EOY:
SJ-C 31,279 AF
RGC Credits 150,368 AF

DRY RUN 1955 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT BUTTE LOSS	EVAP	CONTENT	RELEASE ====>	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2011						220905							6800	2011
JAN	28138	922	27215	-1853	3100	246003	870	600	-1500	200	0	200	8370	JAN
FEB	27026	509	26517	-795	4000	268365	950	600	-1100	200	0	200	9620	FEB
MAR	42045	26836	15209	-6147	6500	282271	950	1000	-900	200	0	200	10270	MAR
APR	33407	29495	3911	-4538	9800	246821	34100	1600	-300	12900	0	12900	30170	APR
MAY	104429	83174	21255	296	11800	245579	10400	2400	-400	8500	0	8500	30070	MAY
JUN	52006	40615	11391	-8012	10700	226583	27700	2800	2000	13400	0	13400	39570	JUN
JUL	42580	25425	17155	-3893	10200	226031	11400	2400	3000	26000	0	26000	19570	JUL
AUG	65718	-19500	85218	-5772	6200	226020	84800	2000	-700	83500	0	83500	19570	AUG
SEP	47516	32777	14739	-5424	4800	226384	15000	600	-500	32000	0	32000	2470	SEP
OCT	25048	16259	8789	-4980	3800	236152	200	500	-1600	400	0	400	3370	OCT
NOV	24317	16907	7410	-2230	2600	242993	200	500	-1050	200	0	200	3920	NOV
DEC	29840	4442	25398	-951	1900	267242	200	400	-1200	200	0	200	4720	DEC
TOTAL	522071	257863	264208	-44299	75400		186770	15400	-4250	177700	0	177700		TOTAL
AVG			Total Mar-Jul			245037							15141	AVG
	274468	205546	68922	12%										

2011

BOY:
SJ-C 31,279 AF
RGC Credits 201,216 AF

CO relinquishes 900 AF

RED = above average rainfall in July adjusts Caballo releases

EOY:
SJ-C 25,371 AF
RGC Credits 200,316 AF

DRY RUN 1956 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT BUTTE LOSS	EVAP	CONTENT	RELEASE ====>	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2012						267242							4720	2012
JAN	33241	-873	34114	17545	1500	281441	870	600	-1460	300	0	300	6150	JAN
FEB	30408	-2841	33249	800	2500	310440	950	600	-1100	200	0	200	7400	FEB
MAR	50253	28857	21396	-6428	4000	277763	56500	1000	-900	21400	0	21400	42400	MAR
APR	74742	55363	19379	-4552	9800	256394	35500	1600	-279	36500	0	36500	40079	APR
MAY	77762	61420	16342	-5334	11500	227870	38700	2500	-376	46500	0	46500	30155	MAY
JUN	41325	38925	2400	-6328	9300	134298	93000	2800	2000	88000	0	88000	30355	JUN
JUL	29920	29555	365	-5739	8700	67702	64000	2400	3000	59200	0	59200	29755	JUL
AUG	27358	21701	5657	-6712	5300	64470	10300	2000	-756	30000	0	30000	8811	AUG
SEP	26194	25869	325	-2957	3000	60453	4300	1000	-564	10600	0	10600	2075	SEP
OCT	18931	18647	284	-2997	2400	60933	400	500	-1567	140	0	140	3402	OCT
NOV	19454	19065	389	-3207	2000	62329	200	500	-1043	100	0	100	4045	NOV
DEC	23170	20788	2382	-2697	1800	65408	200	400	-1213	100	0	100	4958	DEC
TOTAL	452757	316477	136280	-28606	61800		304920	15900	-4258	293040	0	293040		TOTAL
AVG			Total Mar-Jul			155792							17465	AVG
	274002	214121	59881	10%										

2012

BOY:
SJ-C 25,371 AF
RGC Credits 273,326 AF

CO relinquishes 900 AF
NM relinquishes 230,000 AF

RED = Otowi/Cochiti flows adjusted for present irrigation practices and trends

EOY:
SJ-C 17,934 AF
RGC Credits 42,426 AF

DRY RUN 1957 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT BUTTE LOSS	EVAP	CONTENT	RELEASE ====>	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2013													4958	2013
JAN	24373	10600	13773	-1519	2000	77831	870	600	-1460	300	0	300	6388	JAN
FEB	30243	9397	20846	-1573	3000	96300	950	600	-1100	200	0	200	7638	FEB
MAR	38417	22774	15644	-4626	5000	86069	25500	1990	6900	200	0	200	24048	MAR
APR	81034	62895	18139	359	6000	86049	11800	2800	6300	16500	0	16500	10248	APR
MAY	233228	107033	126194	10968	10500	86776	104000	3000	3300	67500	0	67500	40448	MAY
JUN	304891	97995	206896	10732	12000	133940	137000	3800	2400	131000	0	131000	40248	JUN
JUL	278080	44248	233831	7154	10000	254117	96500	3000	-19400	113000	0	113000	40148	JUL
AUG	214193	-19183	233375	-3787	8000	416679	66600	3000	-500	74000	0	74000	30248	AUG
SEP	116416	15910	100506	-94	6000	460280	51000	800	-17800	78000	0	78000	20248	SEP
OCT	66616	-25412	92027	4914	4000	515393	28000	1400	400	35300	0	35300	11148	OCT
NOV	101805	-14632	116438	15463	3000	613167	200	800	-1800	100	0	100	12248	NOV
DEC	59293	-2873	62166	13522	2000	659611	200	600	-2700	100	0	100	14448	DEC
TOTAL	1548588	308752	1239836	51513	71500		522620	22390	-25460	516200	0	516200		TOTAL
AVG			Total Mar-Jul			290518							21459	AVG
	935650	334946	600704	105%										

2013

BOY:
SJ-C 17,934 AF
RGC Credits 68,361 AF

CO relinquishes 900 AF

RED = above average precipitation in July and August, adjusted Caballo and EB releases, adjusted EB evaporation

EOY:
SJ-C 12,595 AF
RGC Credits 67,461 AF

Results of the "Average" scenario:

	YEAR	COCHITI RELEASE	NET LOSSES	SAN MARCIAL	<==== ELEPHANT LOSSES	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSSES	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT		
	2008														2008	
*	JAN	45300	-3100	48400	-1400	3000	455370	870	620	-1900	200	0	200	25964	JAN	*
*	FEB	57500	3800	53700	-3600	5040	482230	25400	1100	3000	6700	0	6700	40564	FEB	*
*	MAR	135300	52050	83250	-32000	7950	495040	94490	1990	6900	88600	0	88600	37564	MAR	*
*	APR	209490	73690	135800	-34400	12070	535710	117460	2800	6300	94700	0	94700	51224	APR	*
*	MAY	260000	62300	197700	800	14000	614510	104100	3000	3300	102700	0	102700	46324	MAY	*
*	JUN	237800	65100	172700	4700	16300	625510	140700	3800	2400	124500	0	124500	56324	JUN	*
*	JUL	81600	-11400	93000	16000	8700	626110	67700	3000	-19400	77100	0	77100	63324	JUL	*
*	AUG	60600	3400	57200	8000	16300	573210	85800	3000	-500	88300	0	88300	58324	AUG	*
*	SEP	53200	31500	21700	-12000	12200	590210	4700	800	-17800	54000	0	54000	26120	SEP	*
	OCT	47000	26600	20400	-5800	10200	571010	35200	1400	400	48200	0	48200	11320	OCT	
	NOV	52000	600	51400	1000	5000	616210	200	800	-1800	240	0	240	12280	NOV	
	DEC	57480	-7120	64600	2000	3000	675610	200	600	-2700	240	0	240	14340	DEC	
	TOTAL	1297270	297420	999850	-56700	113760		676820	22910	-21800	685480	0	685480		TOTAL	
	AVG			Total Mar-Jul			571728							36972.7	AVG	
		924190	241740	682450	1.19101											

2008

End of Year (EOY):
SJ-C 32,032 AF
RG Compact (RGC) Credits 65,500 AF

AVERAGE RUN 2004 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2009						675610							14340	2009
JAN	30196	-1710	31906	-4000	3500	707146	870	1000	-1470	200	0	200	15480	JAN
FEB	27636	-2801	30436	-2900	5500	725482	9500	1000	-1600	200	0	200	25380	FEB
MAR	59252	20458	38795	4000	8000	622277	130000	1800	-5400	118550	0	118550	40430	MAR
APR	78129	-23068	101197	10000	12000	622474	79000	2000	-2000	79000	0	79000	40430	APR
MAY	144179	70947	73232	-8000	13000	584706	106000	2600	3400	90000	0	90000	50430	MAY
JUN	52342	39326	13016	-9800	15000	449021	143500	3800	4000	131000	0	131000	55130	JUN
JUL	40824	26384	14440	-17000	8700	327261	144500	4000	7400	133000	0	133000	55230	JUL
AUG	32146	20315	11831	-10400	14000	234492	101000	3000	-1800	125000	0	125000	30030	AUG
SEP	29609	27102	2507	-4000	12000	162599	66400	1000	-2800	78000	0	78000	20230	SEP
OCT	20606	7575	13031	-1700	9000	145131	23200	900	-3400	35000	0	35000	10930	OCT
NOV	39626	7658	31968	-2000	4000	174898	200	800	-3000	240	0	240	13090	NOV
DEC	52675	1085	51590	-3500	2000	227788	200	400	-1500	240	0	240	14150	DEC
TOTAL	607220	193271.3	413948	-49300	106700		804370	22300	-8170	790430	0	790430		TOTAL
AVG			Total Mar-Jul			415273							30911.7	AVG
	374725	134046.9	240678	0.42										

2009

Beginning of Year (BOY):
SJ-C 32,032 AF
RG Compact (RGC) Credits 91,200 AF

Moved 5,000 AF of Santa FE SJ-C water to EB

EOY:
SJ-C 31,341 AF
RGC Credits 91,200 AF

AVERAGE RUN 2005 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2010						227788							14150	2010
JAN	46489	-2545	49033	-2200	2500	275652	870	1000	-4100	200	0	200	17920	JAN
FEB	54867	1595	53272	-5000	5000	317424	11500	1000	-6800	200	0	200	35020	FEB
MAR	58358	-4028	62386	-4700	7000	250510	127000	1800	1600	118550	0	118550	40070	MAR
APR	178606	61309	117297	10500	9000	264907	83400	2000	2400	79000	0	79000	40070	APR
MAY	324417	52891	271525	15600	12000	398032	110800	2600	8000	90000	0	90000	50270	MAY
JUN	300337	51794	248543	20000	14000	468175	144400	3800	4800	131000	0	131000	55070	JUN
JUL	66327	27983	38344	-21500	13000	367019	148000	4400	10800	133000	0	133000	54870	JUL
AUG	45098	29909	15189	-23600	12000	303408	90400	3300	7000	105000	0	105000	29970	AUG
SEP	39096	28065	11031	-19000	11000	248440	74000	1000	15000	67800	0	67800	20170	SEP
OCT	32469	4437	28032	-10000	10000	251272	25200	900	-1700	35000	0	35000	11170	OCT
NOV	43460	10259	33201	-7400	4000	287673	200	800	-2000	240	0	240	12330	NOV
DEC	42789	1519	41270	-5500	2000	332243	200	400	-1900	240	0	240	13790	DEC
TOTAL	1232313	263187.7	969125	-52800	101500		815970	23000	33100	760230	0	760230		TOTAL
AVG			Total Mar-Jul			313730							31727	AVG
	928044	189949	738095	1.2881										

2010

BOY:
SJ-C 31,341 AF
RGC Credits 127,139 AF

CO relinquishes 900 AF

Moved 5,000 AF of Santa FE SJ-C water to EB

RED = Above normal rainfall in Aug & Sep adjusts Caballo & EB releases

EOY:
SJ-C 30,157 AF
RGC Credits 126,239 AF

AVERAGE RUN 2006 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2011						332243							13790	2011
JAN	38229	-7240	45469	100	3000	373742	870	1000	-1800	100	0	100	15360	JAN
FEB	32836	-1549	34385	-1600	5000	403827	900	1000	-1900	100	0	100	17060	FEB
MAR	34739	11626	23113	-10500	7000	384440	46000	1800	9000	12000	0	12000	40260	MAR
APR	47879	37777	10102	-22500	8000	354042	55000	2000	7900	40000	0	40000	45360	APR
MAY	54956	46937	8019	-18700	11000	310761	59000	2600	11400	40000	0	40000	50360	MAY
JUN	63523	56690	6833	-16400	13000	242994	78000	3800	11400	65000	0	65000	48160	JUN
JUL	42795	-2450	45245	-23500	13000	235139	63600	3800	10600	61600	0	61600	35760	JUL
AUG	44922	-136766	181688	-29000	11000	360427	74400	3000	-20800	98000	0	98000	29960	AUG
SEP	32930	5649	27281	8000	9000	348708	22000	1000	-16200	56500	0	56500	10660	SEP
OCT	47704	-20186	67890	-7000	8000	415198	400	800	-6000	240	0	240	16020	OCT
NOV	63439	-16378	79817	-25900	4000	516715	200	700	-2400	100	0	100	17820	NOV
DEC	47540	-20340	67880	-34700	2000	617095	200	400	-3200	100	0	100	20720	DEC
TOTAL	551492	-46229.8	597722	-181700	94000		400570	21900	-2000	373740	0	373740		TOTAL
AVG			Total Mar-Jul			380258							28958	AVG
	243892	150580	93312	0.1628										

2011

BOY:
SJ-C 30,157 AF
RGC Credits 209,459 AF

CO relinquishes 900 AF

RED = Above average rainfall in Jul, Aug, & Sep adjusts Caballo and EB releases

EOY:
SJ-C 26,139 AF
RGC Credits 208,559 AF

AVERAGE RUN 2007 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2012						617095							20720	2012
JAN	37406	-17758	55164	5000	3500	662889	870	1000	-3000	200	0	200	23390	JAN
FEB	39517	-4700	44217	-1000	5500	701856	750	1000	-1800	200	0	200	24740	FEB
MAR	84232	29470	54762	-14300	8000	622918	140000	1800	3800	118550	0	118550	40590	MAR
APR	71861	12071	59790	-15000	12000	594208	91500	2000	5500	79000	0	79000	45590	APR
MAY	160497	33914	126583	4300	13000	594991	108500	2600	6000	90000	0	90000	55490	MAY
JUN	85924	40505	45419	-10500	15000	507910	128000	3800	-6700	131000	0	131000	55390	JUN
JUL	52699	37020	15679	-13300	8700	400589	127600	4000	500	133000	0	133000	45490	JUL
AUG	47772	33420	14352	-15400	14000	298741	117600	3000	4200	125000	0	125000	30890	AUG
SEP	35262	19063	16199	-12000	12000	245940	69000	1200	200	78000	0	78000	20490	SEP
OCT	28223	18006	10217	-5200	9000	228357	24000	800	-2200	35000	0	35000	10890	OCT
NOV	33600	6411	27189	-3900	4000	255246	200	600	-2300	240	0	240	12550	NOV
DEC	56095	11154	44941	-27400	2000	325387	200	400	-2500	240	0	240	14610	DEC
TOTAL	733087	218574.9	514512	-108700	106700		808220	22200	1700	790430	0	790430		TOTAL
AVG			Total Mar-Jul			453253							31676	AVG
	455213	152980	302233	0.5275										

2012

BOY:
SJ-C 26,139 AF
RGC Credits 323,450 AF

CO relinquishes 900 AF
NM relinquishes 270,000 AF

EOY:
SJ-C 22,497 AF
RGC Credits 52,550 AF

AVERAGE RUN 2008 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2013						325387							14610	2013
JAN	45306	-3094	48400	-1400	2000	372317	870	1000	-1900	200	0	200	16180	JAN
FEB	57070	3370	53700	-3600	4000	397417	28200	1000	3000	200	0	200	40180	FEB
MAR	135267	52017	83250	-32000	6000	379067	127600	1800	6900	118550	0	118550	40530	MAR
APR	209494	73694	135800	-34400	10000	451867	87400	2000	6300	79000	0	79000	40630	APR
MAY	252397	54697	197700	800	13000	530767	105000	2600	2300	90000	0	90000	50730	MAY
JUN	235140	62440	172700	4700	16300	545467	137000	3800	2400	131000	0	131000	50530	JUN
JUL	81600	-11400	93000	16000	14000	550467	58000	4000	-19400	73000	0	73000	50930	JUL
AUG	60600	3400	57200	13300	15000	511867	67500	3000	-400	85000	0	85000	30830	AUG
SEP	52692	14139	38553	-12000	12200	524420	25800	1000	-17800	53000	0	53000	20430	SEP
OCT	47038	17362	29676	-9000	9500	528896	24700	800	-2000	35000	0	35000	11330	OCT
NOV	52066	-7017	59083	1000	5000	581779	200	600	-1800	240	0	240	12490	NOV
DEC	67755	-8104	75859	2000	3000	652438	200	400	-2700	240	0	240	14750	DEC
TOTAL	1296426	251505	1044921	-54600	110000		662470	22000	-25100	665430	0	665430		TOTAL
AVG			Total Mar-Jul			502231							31628	AVG
	913898	231448	682450	1.191										

2013

BOY:
SJ-C 22,497 AF
RGC Credits 162,690 AF

CO relinquishes 900 AF

RED = Above average rainfall in Jul, Aug, & Sep adjusts Caballo and EB releases

EOY:
SJ-C 20,212 AF
RGC Credits 161,790 AF

Results of the "Wet" scenario:

YEAR	COCHITI RELEASE	NET LOSSES	SAN MARCIAL	<==== ELEPHANT LOSSES	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSSES	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2008														2008
* JAN	45300	-3100	48400	-1400	3000	455370	870	620	-1900	200	0	200	25964	JAN *
* FEB	57500	3800	53700	-3600	5040	482230	25400	1100	3000	6700	0	6700	40564	FEB *
* MAR	135300	52050	83250	-32000	7950	495040	94490	1990	6900	88600	0	88600	37564	MAR *
* APR	209490	73690	135800	-34400	12070	535710	117460	2800	6300	94700	0	94700	51224	APR *
* MAY	260000	62300	197700	800	14000	614510	104100	3000	3300	102700	0	102700	46324	MAY *
* JUN	237800	65100	172700	4700	16300	625510	140700	3800	2400	124500	0	124500	56324	JUN *
* JUL	81600	-11400	93000	16000	8700	626110	67700	3000	-19400	77100	0	77100	63324	JUL *
* AUG	60600	3400	57200	8000	16300	573210	85800	3000	-500	88300	0	88300	58324	AUG *
* SEP	53200	31500	21700	-12000	12200	590210	4700	800	-17800	54000	0	54000	26120	SEP *
OCT	47000	26600	20400	-5800	10200	571010	35200	1400	400	48200	0	48200	11320	OCT
NOV	52000	600	51400	1000	5000	616210	200	800	-1800	240	0	240	12280	NOV
DEC	57480	-7120	64600	2000	3000	675610	200	600	-2700	240	0	240	14340	DEC
TOTAL	1297270	297420	999850	-56700	113760		676820	22910	-21800	685480	0	685480		TOTAL
AVG			Total Mar-Jul			571728							36972.7	AVG
	924190	241740	682450	1.19101										

2008

End of Year (EOY):
SJ-C 32,032 AF
RG Compact (RGC) Credits 65,500 AF

WET RUN 1978 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2009						675610							14340	2009
JAN	27509	-8220	35728	-1000	4000	707468	870	1000	-1000	200	0	200	15010	JAN
FEB	27388	-8102	35490	0	6500	706459	30000	1000	-3000	6700	0	6700	40310	FEB
MAR	34969	-2770	37739	-2000	8500	615298	122400	1800	2000	118550	0	118550	40360	MAR
APR	35270	24767	10503	-3000	12000	532801	84000	2000	-2000	79000	0	79000	45360	APR
MAY	156633	19988	136645	9000	13000	545646	101800	2600	-1000	90000	0	90000	55560	MAY
JUN	132575	38349	94226	-2000	14000	493172	134700	3800	0	131000	0	131000	55460	JUN
JUL	45261	23935	21326	-5000	12000	366498	141000	4000	4000	133000	0	133000	55460	JUL
AUG	27760	27119	641	-6000	10000	255139	108000	3000	5000	125000	0	125000	30460	AUG
SEP	19031	18599	432	-3000	6000	194571	58000	1000	-1000	68000	0	68000	20460	SEP
OCT	14430	12495	1935	-1000	5000	176306	16200	900	-3000	28000	0	28000	10760	OCT
NOV	39979	-4532	44511	-1000	3000	218617	200	800	-9000	240	0	240	18920	NOV
DEC	38097	-12263	50360	1000	2000	265777	200	400	-15000	240	0	240	33480	DEC
TOTAL	598901	129364	469537	-14000	96000		797370	22300	-24000	779930	0	779930		TOTAL
AVG			Total Mar-Jul			423146							35133	AVG
	404707	104268	300439	0.5243										

2009

Beginning of Year (BOY):
SJ-C 32,032 AF
RG Compact (RGC) Credits 91,200 AF

Moved 5,000 AF of Santa FE SJ-C water to EB

RED = San Marcial flows adjusted for present irrigation practices & trends
RED = Above average rainfall in Sep. adjusts Caballo & EB releases

EOY:
SJ-C 32,881 AF
RGC Credits 91,200 AF

WET RUN 1979 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2010						265777							33480	2010
JAN	30434	-16550	46984	-2000	2000	311892	870	1000	-3000	200	0	200	36150	JAN
FEB	34366	-17488	51854	-3000	3000	363146	600	1000	-5000	200	0	200	40550	FEB
MAR	86618	1284	85334	7000	7500	339580	94400	1800	5000	88600	0	88600	39550	MAR
APR	211557	54335	157222	16000	9500	387302	84000	2000	-2000	79000	0	79000	44550	APR
MAY	347663	31883	315780	-5000	14000	587082	107000	2600	4300	90000	0	90000	54650	MAY
JUN	359802	32560	327242	-7000	17000	766324	138000	3800	3000	131000	0	131000	54850	JUN
JUL	346988	52113	294875	16000	16000	889199	140000	4000	3000	133000	0	133000	54850	JUL
AUG	59123	-1732	60856	-4000	16000	855054	83000	3000	-6000	110000	0	110000	30850	AUG
SEP	30208	8550	21658	1000	14500	787213	74000	1000	400	83000	0	83000	20450	SEP
OCT	35766	17367	18399	13000	12000	742612	38000	900	-3000	50000	0	50000	10550	OCT
NOV	88383	-7063	95447	15000	6000	816859	200	800	-3000	240	0	240	12710	NOV
DEC	86783	-23598	110381	22000	4000	901039	200	400	-3000	240	0	240	15270	DEC
TOTAL	1717692	131660	1586032	69000	121500		760270	22300	-9300	765480	0	765480		TOTAL
AVG			Total Mar-Jul			645608							34582	AVG
	1352628	172175	1180453	2.0601										

2010

BOY:
SJ-C 32,881 AF
RGC Credits 191,713 AF

CO relinquishes 900 AF
Moved 5,000 AF of Santa FE SJ-C water to EB

RED = San Marcial flows adjusted for present irrig. Practices & trends
RED = Above average rainfall in Aug. adjusts Caballo & EB releases

EOY:
SJ-C 33,614 AF
RGC Credits 190,813 AF

WET RUN 1980 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2011						901039							15270	2011
JAN	42242	-19245	61487	16000	4000	941656	870	1000	400	200	0	200	14540	JAN
FEB	51757	-12546	64303	8000	6000	954959	37000	1000	4000	6700	0	6700	39840	FEB
MAR	51812	-1391	53204	3000	11000	884162	110000	1800	-4000	112000	0	112000	40040	MAR
APR	131056	41841	89215	-2000	15000	879377	81000	2000	-5000	79000	0	79000	45040	APR
MAY	371425	20865	350560	31000	20000	1072337	106600	2600	4000	90000	0	90000	55040	MAY
JUN	348476	55156	293320	4000	25000	1199857	136800	3800	2000	131000	0	131000	55040	JUN
JUL	107750	32154	75596	1000	22000	1114653	137800	4000	1000	133000	0	133000	54840	JUL
AUG	34245	5250	28994	10000	18000	1020247	95400	3000	-8000	125000	0	125000	30240	AUG
SEP	20404	-16050	36454	-3000	15000	979701	65000	1000	-4000	78000	0	78000	20240	SEP
OCT	18252	9237	9015	13000	11000	940716	24000	900	-3000	35000	0	35000	11340	OCT
NOV	72171	6288	65882	7000	7000	992398	200	800	-9000	240	0	240	19500	NOV
DEC	82215	-4579	86794	9000	5000	1064993	200	400	-5000	240	0	240	24060	DEC
TOTAL	1331804	116980	1214823	97000	159000		794870	22300	-26600	790380	0	790380		TOTAL
AVG			Total Mar-Jul			1003755							34147	AVG
	1010519	148625	861894	1.5042										

2011

BOY:
SJ-C 33,614 AF
RGC Credits 221,649 AF

EOY:
SJ-C 30,080 AF
RGC Credits 221,649 AF

WET RUN 1981 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2012						1064993							24060	2012
JAN	44882	-12009	56891	18000	4000	1099014	870	1000	2000	200	0	200	21730	JAN
FEB	32081	-9445	41526	2000	6000	1099540	33000	1000	7000	6700	0	6700	40030	FEB
MAR	29641	-4218	33859	1000	11000	1008399	113000	1800	-1000	112000	0	112000	40230	MAR
APR	29187	22842	6345	-14000	15000	921744	92000	2000	6000	79000	0	79000	45230	APR
MAY	39011	32844	6167	-14000	17000	817511	107400	2600	5000	90000	0	90000	55030	MAY
JUN	43989	43108	881	-13000	20000	680392	131000	3800	-4000	131000	0	131000	55230	JUN
JUL	33152	24835	8317	-15000	17000	578709	108000	4000	-4000	108000	0	108000	55230	JUL
AUG	27471	20959	6512	-8000	15000	491221	87000	3000	-1000	110000	0	110000	30230	AUG
SEP	14154	-5262	19416	-6000	11000	441637	64000	1000	-5000	78000	0	78000	20230	SEP
OCT	22758	10854	11904	-1000	7000	424541	23000	800	-3000	35000	0	35000	10430	OCT
NOV	42204	4587	37617	5000	4000	452958	200	700	-4000	240	0	240	13690	NOV
DEC	35199	1996	33203	-9000	3000	491961	200	300	-3000	240	0	240	16350	DEC
TOTAL	393729	131091	262638	-54000	130000		759670	22000	-5000	750380	0	750380		TOTAL
AVG			Total Mar-Jul			708968							33637	AVG
	174980	119411	55569	0.097										

2012

BOY:
SJ-C 30,080 AF
RGC Credits 329,944 AF

RED = Above average rainfall in Jul. and Aug. adjusts Caballo & EB releases

EOY:
SJ-C 26,881 AF
RGC Credits 329,944 AF

WET RUN 1982 HISTORICAL FLOWS

YEAR	COCHITI RELEASE	TRANSP. LOSSES	SAN MARCIAL	<==== ELEPHANT LOSS	EVAP	BUTTE====> CONTENT	RELEASE	<=== EVAP	CABALLO LOSS	IRRIG. DEMAND	EXCESS RELEASE	TOTAL RELEASE	CABALLO CONTENT	
2013						491961							16350	2013
JAN	35925	782	35143	-3000	4000	525234	870	800	300	200	0	200	15920	JAN
FEB	36365	754	35611	-6000	6500	538345	22000	1000	2000	200	0	200	34720	FEB
MAR	52336	12364	39972	-6000	8500	489817	86000	1800	400	78600	0	78600	39920	MAR
APR	110213	18815	91398	8000	12000	494215	67000	2000	1000	59000	0	59000	44920	APR
MAY	240119	24656	215463	16000	13000	572678	108000	2600	5000	90000	0	90000	55320	MAY
JUN	227901	56795	171106	-2000	14000	597284	134500	3800	-1200	132000	0	132000	55220	JUN
JUL	74172	28997	45175	-1000	12000	495459	136000	4000	-1100	133000	0	133000	55320	JUL
AUG	61079	18702	42377	-20000	10000	439836	108000	3000	-3200	133000	0	133000	30520	AUG
SEP	79581	-268	79849	-17000	8000	458085	70600	1000	-10000	90000	0	90000	20120	SEP
OCT	52015	9458	42557	6000	6000	454142	34500	800	-2000	45000	0	45000	10820	OCT
NOV	57086	-15055	72141	9000	4000	513083	200	700	-4000	240	0	240	14080	NOV
DEC	54226	-10506	64732	1000	2000	574615	200	400	-3000	240	0	240	16640	DEC
TOTAL	1081018	145494	935524	-15000	100000		767870	21900	-15800	761480	0	761480		TOTAL
AVG			Total Mar-Jul			512732							32793	AVG
	704741	141627	563114	0.9827										

2013

BOY:
SJ-C 26,881 AF
RGC Credits 383,577 AF

CO relinquishes 900 AF

RED = San Marcial flows adjusted for present irrigation practices and trends

EOY:
SJ-C 24,372 AF
RGC Credits 382,677 AF

Appendix C: Assessment of Effects to Candidate and De-listed Species

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

During the past 80 years, the population of Yellow-billed Cuckoos (YBCU) has declined dramatically due to habitat loss and modification as well as a reduction of food resources due to pesticides (Gaines and Laymon 1984). It has been debated whether the Western YBCU (*C. a. occidentalis*) is a true subspecies of the YBCU. In 2001, the USFWS determined that the western population is a Distinct Population Segment (DPS) from the eastern population (*C. a. americanus*) with the division being the continental divide from Montana to central Colorado, the eastern boundary of the Rio Grande drainage from central Colorado to Texas, and the mountain ranges that form a southeastern extension of the Rocky Mountains to the Big Bend area in west Texas (USFWS 2004). It also concluded that the listing of the Western YBCU as endangered was "warranted, but precluded by higher priority listing actions" (USFWS 2001). In 2005, the USFWS revised the listing priority of the Western DPS YBCU from 6 to a higher priority of 3 to better reflect the fact that threats are imminent to this DPS (USFWS 2005). Currently, the YBCU is considered a candidate for listing under the federal Endangered Species Act and is listed as either threatened, endangered, or sensitive by the states of California, Arizona, New Mexico, Colorado, and Utah.

Life Requisites

The Western Yellow-billed Cuckoo is a Neotropical-Nearctic migrant that feeds primarily on large insects. In the Southwestern United States, YBCUs nest in large, dense patches of riparian vegetation, particularly with a cottonwood (*Populus deltoides*)/Goodding's willow (*Salix gooddingii*) overstory (Ehrlich et. al. 1988). Territory sizes are quite large, ranging from 4 to 40 hectares and are usually in close proximity to water (Halterman 2001). Nest heights range from 1.3 to 13 meters and the breeding cycle at each nest is very rapid, from egg laying to fledging takes 17 days (Halterman 2001). The YBCU typically arrives to its breeding grounds by late-May and initiates migration to wintering grounds in Central and South America by mid-August (Halterman et al. 2000).

Typical YBCU habitat within Elephant Butte Reservoir consists primarily of monotypic Goodding's willow. Upstream of Elephant Butte Reservoir, suitable YBCU habitat consists of cottonwood-dominated galleries; areas with mixed canopy consisting of cottonwood and Goodding's willow; or areas with monotypic Goodding's willow.

YBCUs are loosely territorial, with pair home ranges often overlapping one another- making accurate population estimates difficult. Based on telemetry data collected during the summer of 2007, YBCU home ranges within Elephant Butte Reservoir ranged from 10 to 153 acres (n = 3) (Sechrist et al. 2007). YBCU densities are most likely to be determined by available food supplies. Veit and Peterson (1993), as reported by Wiggins (2005), found that YBCU populations may be regulated by periodic irruptions of insect populations. Field observations of YBCUs feeding on both cicadas and tent caterpillars within the Middle Rio Grande would support this theory.

Range-wide Distribution and Abundance

YBCU population trends in the western United States over the past 50 years are difficult to quantify (USFWS 2001). However, sufficient historic and recent data indicate a significant reduction in the distribution and abundance of the western YBCU. Historically, the species was widespread and locally common in California and Arizona, and locally common within a few river reaches of New Mexico (USFWS 2001). YBCUs were also locally common in parts of Oregon and Washington, western Colorado, western Wyoming, Idaho, Nevada, and Utah. The species range has significantly been reduced, with the largest likely remaining populations found in Arizona. In 1999, 168 YBCU pairs and 80 single YBCUs were recorded in Arizona (USFWS 2001).

Distribution and Abundance in the Rio Grande Basin, New Mexico

The Rio Grande is considered one of the important strongholds for the YBCU, and historically cuckoos were “fairly common” along sections of the river (Howe 1986).

Reclamation initiated formal presence/absence surveys in 2006 to determine the distribution and abundance of the YBCU along a 35-mile reach of the Middle Rio Grande from the south boundary of the Bosque del Apache National Wildlife Refuge to Elephant Butte Reservoir. In 2007, Reclamation increased the survey effort to include a 45-mile reach of the Middle Rio Grande from Highway 380 (San Antonio, NM) to Elephant Butte Reservoir. In 2008, formal surveys were repeated within the same 45-mile reach as those conducted in 2007. However, at the time of this writing, processing of the 2008 data have been completed for the entire reach and only 2008 detections within Elephant Butte Reservoir are discussed in this analysis.

During presence/absence surveys conducted from 15 June through 15 August 2007, surveyors documented a total of 261 YBCU detections. After processing the data with a GIS (ArcGIS 9.2, geoprocessing wizard buffer extension), a total of 105 territories were delineated with a 300m radius, 71 territories with a 500m radius, and 51 territories with a 750m radius (Table A1). Based on detection clumping patterns, habitat characteristics, comments documented on survey forms, and telemetry results (see Sechrist et al. 2008) the 500m distance is believed to be the most accurate determination of probable territories.

Table A1. 2007 Summary, by river reach, of YBCU detections and territories on the Rio Grande in Socorro and Sierra counties, New Mexico.

Reach	Total Detections	Total Territories		
		300m	500m	750m
Escondida	3	2	2	1
Bosque del Apache	22	15	13	11
San Marcial	236	88	56	39
Totals	261	105	71	51

Distribution and Abundance at Elephant Butte Reservoir

Based on available data and personal communications (Halterman 2007), the population of YBCUs within Elephant Butte Reservoir is likely one of the largest remaining populations throughout its western range.

Distribution of YBCU detections was fairly consistent from 2007 to 2008, with approximately 30% of all YBCU detections found within 4355-4360 ft. elevation (Figures A1 and A2). Less then 8% of all YBCU detections were found above spillway elevation—4407 feet.

A total of 39 YBCU territories were found within Elephant Butte Reservoir during the 2007 survey period of 15 June through 15 August 2007 (Figure A1). The majority of YBCUs (27 territories) were found downstream of Dryland Road (elevation 4395 ft). GIS analysis of the 2008 YBCU "territories" have not been processed as of this writing and are not included in this assessment. However, an analysis of 2007 and 2008 YBCU detections based on elevation has been included. The greatest densities of YBCU detections were found within the portion of Elephant Butte Reservoir referred to as the "Narrows". In contrast with SWFL elevation distribution, the majority of YBCUs were found at lower elevations within the pool. In 2008, 92% of the SWFL territories were found above 4385 ft., but only 30% of the YBCU detections were found in this same area (Figure A3). Approximately 70% of the YBCU detections were found below 4385 ft.

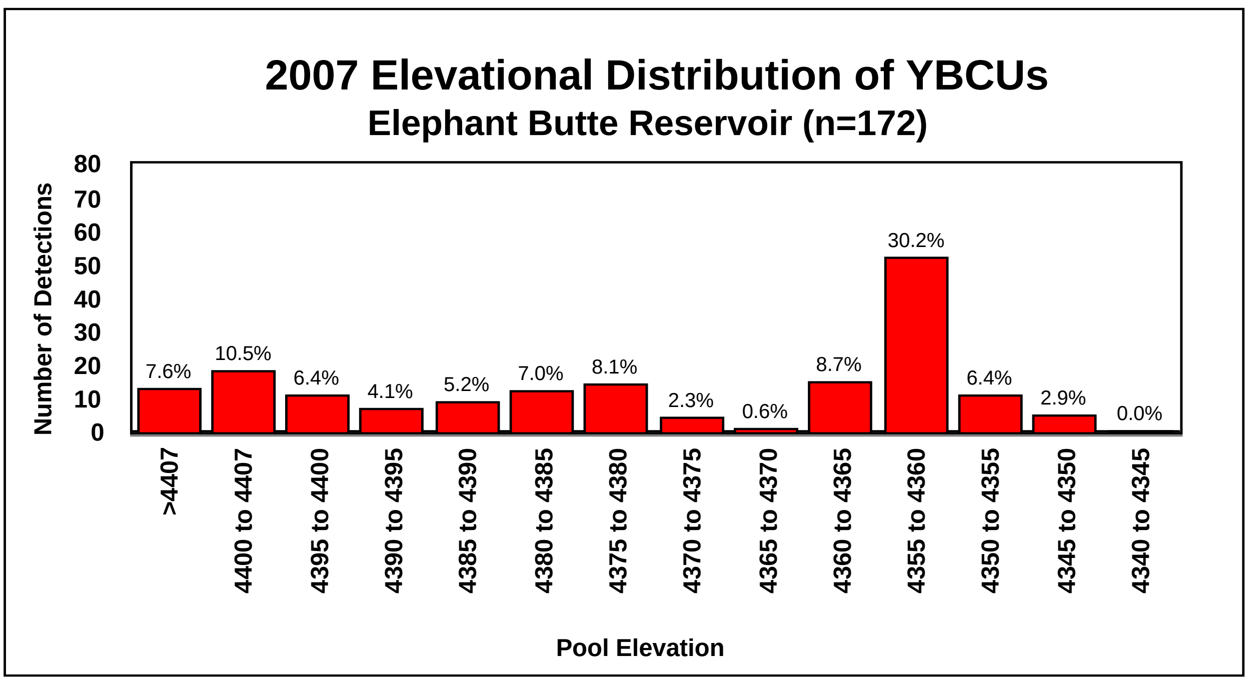


Figure A1. Elevation distribution of Yellow-billed Cuckoos at Elephant Butte Reservoir in 2007.

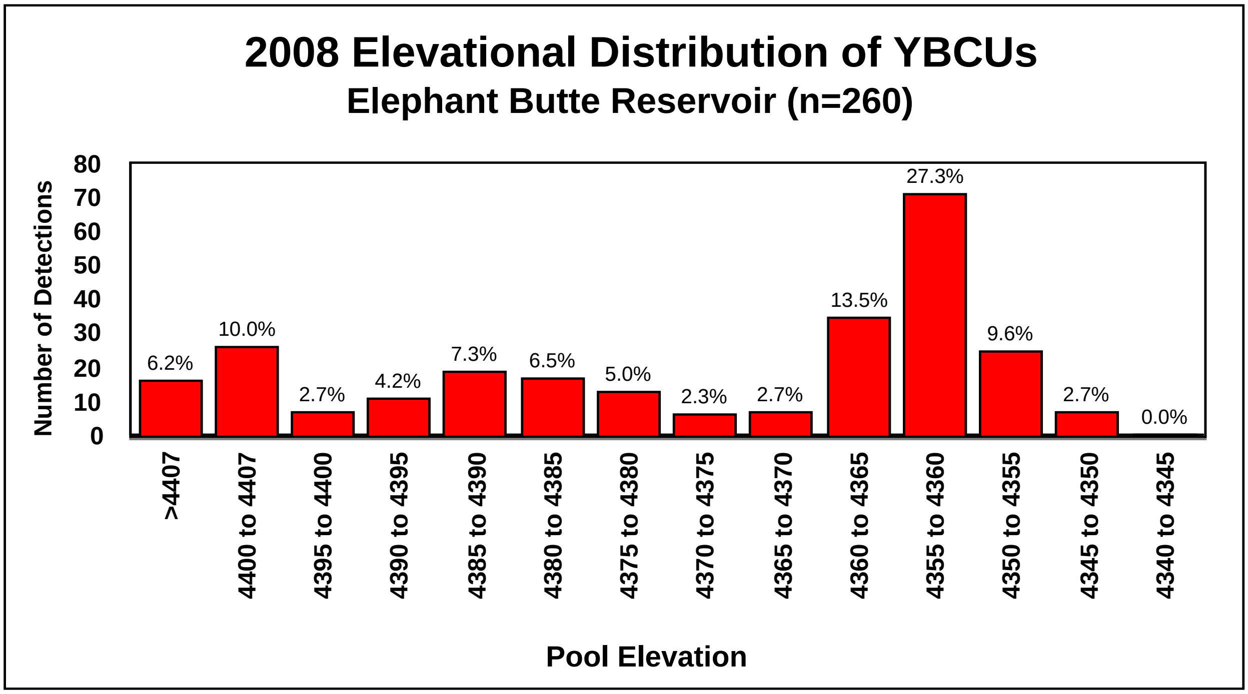


Figure A2. Elevatioinal distribution of Yellow-billed Cuckoos at Elephant Butte Reservoir in 2008.

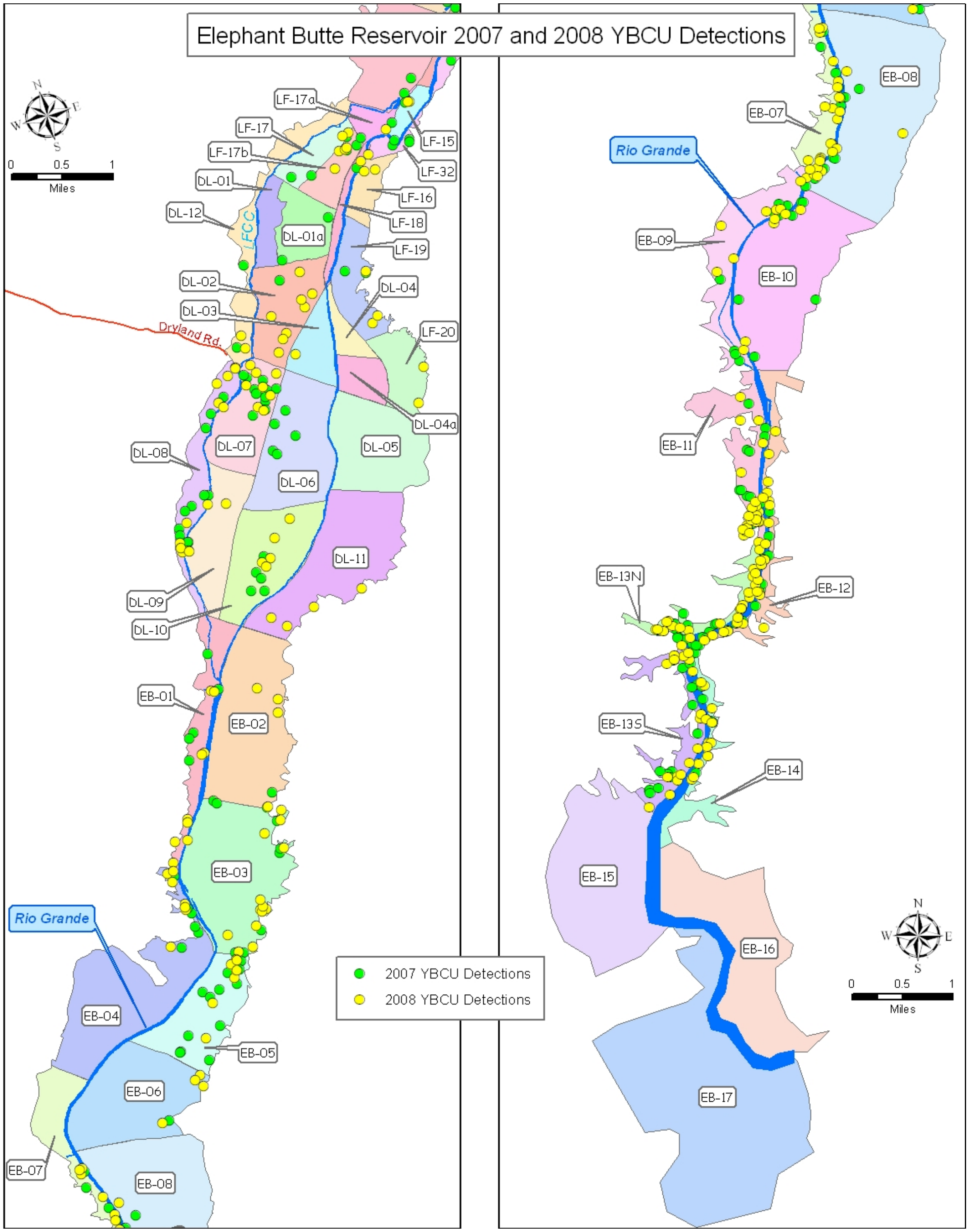


Figure A3. Locations of detections of Yellow-billed Cuckoos in Elephant Butte Reservoir in 2007 and 2008.

Effects

Adverse short-term impacts to YBCUs and their habitat would likely occur under the Wet Scenario, particularly in 2011. No other significant adverse or positive impacts would be anticipated under any scenario. Based on telemetry and survey data collected during the 2007 and 2008 YBCU breeding season, and the apparent availability of YBCU habitat at elevations above those impacted during the 2011 breeding season, the Elephant Butte YBCU population should not experience any significant long-term impacts.

Conservation Measures

1. Continue to conduct formal YBCU surveys within the Middle Rio Grande Valley, with an emphasis on Elephant Butte Reservoir, when funding and resources permit.

2. Initiate the development of a YBCU Habitat Model to determine the extent and availability of suitable YBCU habitat within the Middle Rio Grande, when funding and resources permit.

Bald Eagle (*Haliaeetus leucocephalus*)

The Bald Eagle was initially listed in 1967 under the Endangered Species Preservation Act, and again in 1978 under the ESA as either threatened or endangered within the lower 48 States (USFWS 2007). In July 2007, the USFWS de-listed the species due to the recovery of the species and the reduction or elimination of its potential threats. Although the species has officially been delisted by the USFWS, we believe in the spirit of this Biological Assessment, any potential impacts to the Bald Eagle associated with the proposed action should be evaluated.

Life Requisites

Wintering Bald Eagles are associated with unfrozen lake, river, and wetland habitats. Distribution is dependent on prey densities, suitable perch and roost sites, weather conditions, and freedom from human disturbance (Ohmart and Sell 1980).

Most wintering Bald Eagles depend primarily on fish, however other prey is also taken including jack rabbits, waterfowl, and carrion (Spencer 1976). The construction of dams has resulted in a redistribution of wintering Bald Eagles by concentrating populations to available food sources. The presence of a fishery does not necessarily ensure its attractiveness to Bald Eagles. Eagles often depend on fish that are dead, dying or otherwise vulnerable (Steenhof 1978).

Communal roosting is prevalent in wintering Bald Eagles with protection from the wind being a primary consideration (Steenhof 1978). The night roost is almost invariably a tree protruding above the forest canopy which permits an unobstructed approach and takeoff. The absence of small branches on the snag or dying tree, increases the likelihood of use (Spencer 1976). In the late 1990’s and early 2000’s, the area in the vicinity of Dryland Road within Elephant Butte Reservoir was heavily utilized as a communal roost.

Diurnal hunting and loafing perch sites are usually trees with large horizontal branches, bordering open areas, especially on the edges of rivers and lakes. Proximity to a food source and visibility are key factors influencing perch selection by eagles (Steenhof 1978). Eagles often select the tallest trees available with branches overlooking a food source. Specific trees and even branches are habitually used. During the period when Elephant Butte Reservoir was receding, Bald Eagles were often observed perched on newly exposed saltcedar and cottonwood snags, surrounded by open water. Eagles were also frequently observed perched on rock outcrops adjacent the shoreline and on exposed islands within Elephant Butte Reservoir.

Bald Eagles can be sensitive to human activities, and may abandon favorable sites if disturbed. Hunting and chainsaw activity have been known to displace eagles from wintering roost sites (Steenhof 1978).

The Bald Eagle was initially listed in 1967 under the Endangered Species Preservation Act (ESA), and again in 1978 under the ESA as either threatened or endangered within the lower 48 States (USFWS 2007). In July 2007, the USFWS delisted the species due to the recovery of the species and the reduction or elimination of potential threats to the species. Although the species has officially been delisted by the USFWS, we believe in the spirit of this Biological Assessment, any potential impacts to the Bald Eagle associated with the proposed action should be evaluated.

Range-wide Distribution and Abundance

The population of bald eagles within the lower 48 States has increased from approximately 487 breeding pairs in 1963, to an estimated 9,789 in 2007 (USFWS 2007). Breeding Bald Eagle pairs are found within all the lower 48 States. The greatest numbers of breeding pairs reside in Minnesota (1,312), Florida (1,133), and Washington (848). Despite this great population increase, only four breeding pairs have been reported in New Mexico (USFWS 2007).

Distribution and Abundance in the Rio Grande Basin, New Mexico

The majority of Bald Eagles reported in New Mexico are over-wintering. Breeding has been confirmed at only a few locations, none of which are within the Middle Rio Grande. A single reported nesting attempt was documented several miles upstream of an adjacent canyon to Caballo Reservoir in the early 1990s. Breeding was not confirmed, although a nest was constructed. Several of the reservoirs within the Middle Rio Grande support over-wintering populations, including Cochiti Reservoir and Elephant Butte Reservoir. From 1988 through 1996, the COE conducted wintering Bald Eagle surveys on the Rio Grande from Albuquerque to the confluence with the Rio Chama, and on the Rio Chama (Reclamation 2007). The number of wintering Bald Eagles ranged from a low of 39 in 1990, to a high of 88 in 1993.

Reclamation has conducted wintering Bald Eagle surveys within the San Marcial to Caballo Reservoir Reach of the Rio Grande since 1997, except for 2000 (Table A2). Detections ranged from a low of three individuals (two adults and one immature) in 2007, to a high of 94 (56 adults and 38 juveniles) in 2001.

Table A2. Summary of January Bald Eagle morning distribution surveys on the Rio Grande from San Marcial to Caballo Dam (1997 – 2008).

River Reach	1/23/97	1/27/98	1/27/99	1/9-10/01	2/1/02	1/16/03	1/28/04	1/25/05	1/11/06	1/30/07	1/24/08
San Marcial (active floodplain)	2 (2/0)	0	0	1 (1/0)	0	0	0	0	0	0	0
San Marcial (west side groundwater wetlands)	1 (1/0)	1 (1/0)	0	2 (2/0)	0	2(2/0)	1(1/0)	0	1(1/0)	2(1/1)	2(2/0)
Elephant Butte Reservoir (east side) North of Dryland Road	0	4 (2/2)	6(3/3)	0	0	0	0	0	0	0	0
Elephant Butte Reservoir (west side) wetlands north of Dryland Road	1 (0/1)	5 (3/2)	3(2/1)	1 (1/0)	2(2/0)	0	0	0	0	0	0
Elephant Butte Reservoir (east side) Dryland Road to Nogal Canyon	9 (6/3)	4 (2/2)	8(5/3) *3(3/0)**	4 (1/3)	5(2/3)	1(1/0)	0	0	0	0	0
Elephant Butte Reservoir (west side) Dryland Road to Nogal Canyon	12 (8/4) *45(30/15)**	17 (9/8)	18(11/7) *28(16/12)**	12 (7/5)	8(6/2)	8(2/6)	2(2/0)	0	0	0	0
Elephant Butte Reservoir (east side) Nogal Canyon to Narrows	6 (1/5)	0	2(1/1) *12(6/6)**	13 (8/5)	11(8/3)	6(4/2)	0	0	0	0	0
Elephant Butte Reservoir (west side) Nogal Canyon to Narrows	5 (3/2)	9 (6/3)	3(2/1)	8 (4/4)	7(5/2)	14(9/5)	3(2/1)	0	2(2/0)	0	0
Subtotal Upstream from Narrows	**36 (21/15)**	**40 (23/17)**	**40 (24/16)**	**41 (24/17)**	**33 (23/10)**	**31 (18/13)**	**6 (5/1)**	**0**	**3 (3/0)**	**2 (1/1)**	**2 (2/0)**

Table A2. Continued.

River Reach	1/23/97	1/27/98	1/27/99	1/9-10/01	2/1/02	1/16/03	1/28/04	1/25/05	1/11/06	1/30/07	1/24/08
Elephant Butte Reservoir (east side) Narrows to Dam	NS	NS	5(3/2) *3(3/0)**	16 (10/6)	25(14/11)	15(12/3)	18(13/5)	7(4/3)	4(3/1)	0	3(3/0)
Elephant Butte Reservoir (west side) Narrows to Dam	NS	NS	9(8/1)	12 (7/5)	12(9/3)	15(11/4)	7(6/1)	4(4/0)	3(3/0)	1(1/0)	1(1/0)
Subtotal Downstream from Narrows	**NS**	**NS**	**14 (11/3)**	**28 (17/11)**	**37 (23/14)**	**30 (23/7)**	**25 (19/6)**	**11 (8/3)**	**7 (6/1)**	**1 (1/0)**	**4 (4/0)**
ELEPHANT BUTTE RESERVOIR TOTAL	**NS**	**NS**	**54 (35/19)**	**69 (41/28)**	**70 (46/24)**	**61 (41/20)**	**31 (24/7)**	**11 (8/3)**	**10 (9/1)**	**3 (2/1)**	**6 (6/0)**
Rio Grande EB Dam to Caballo Delta	NS	NS	1(1/0) *1(1/0)**	1 (1/0)	0	0	1(1/0	1(1/0)	0	NS	2(1/1)
Caballo Reservoir (east side)	NS	NS	5(3/2) *6(3/3)**	16 (9/7)**	7(4/3)	3(3/0)	4(4/0)	3(3/0)	3(2/1)	NS	3(3/0)
Caballo Reservoir (west side)	NS	NS	5(1/4) *2(2/0)**	8 (5/3)	1(1/0)	2(2/0)	0	0	0	NS	0
CABALLO RESERVOIR TOTAL	**NS**	**NS**	**11 (5/6)**	**25 (15/10)**	**8 (5/3)**	**5 (5/0)**	**5 (5/0)**	**4 (4/0)**	**3 (2/1)**	**NS**	**5 (4/1)**
GRAND TOTAL	**36 (21/15)**	**40 (23/17)**	**65 40/25)**	**94 56/38)**	**78 (51/27)**	**66 (46/20)**	**36 29/7)**	**15 12/3)**	**13 (11/2)**	**3 (2/1)**	**11 (10/1)**

Numbers in parentheses (# adult/# immature)
* observed during evening roost surveys
** includes eagles on east side of Rio Grande within Caballo Reservoir delta = 4 adults/1 immature
NS = Not Surveyed

Distribution and Abundance at Elephant Butte Reservoir

Based on detections made by Reclamation from 1997 through 2008 (with exception of 2000 when surveys were not conducted), the number of wintering Bald Eagles found annually within Elephant Butte Reservoir has varied significantly (Table A3). Only three individuals were found in 2007 while 70 were observed in 2002. Overall, the over wintering population decreased as reservoir elevations receded. Presumably this is in response to reduced shoreline and foraging areas.

Table A3. Summary of January Bald Eagle morning distribution surveys in Elephant Butte Reservoir, 1997-2008.

	1997	1998	1999	2001	2002	2003	2004	2005	2006	2007	2008
Upstream of Narrows	33 (18/15)	39 (22/17)	40 (24/16)	38 (21/17)	33 (23/10)	29 (16/13)	5 (4/1)	0	2 (2/0)	0	0
Downstream of Narrows	NS	NS	14 (11/3)	28 (17/11)	37 (23/14)	30 (23/7)	25 (19/6)	11 (8/3)	10 (9/1)	3 (2/1)	6 (6/0)
TOTAL	**33 (18/15)**	**39 (22/17)**	**54 (35/19)**	**66 (38/28)**	**70 (46/24)**	**59 (39/20)**	**30 (23/7)**	**11 (8/3)**	**12 (11/1)**	**3 (2/1)**	**6 (6/0)**

Effects

Fluctuating reservoir elevations have occurred since the construction of Elephant Butte Dam. Wintering Bald Eagle numbers have also fluctuated annually, presumably due primarily on the availability of shoreline and backwater foraging areas. However, it is likely that the severity of winter climate conditions in more northern latitudes also affected overwintering populations at Elephant Butte Reservoir.

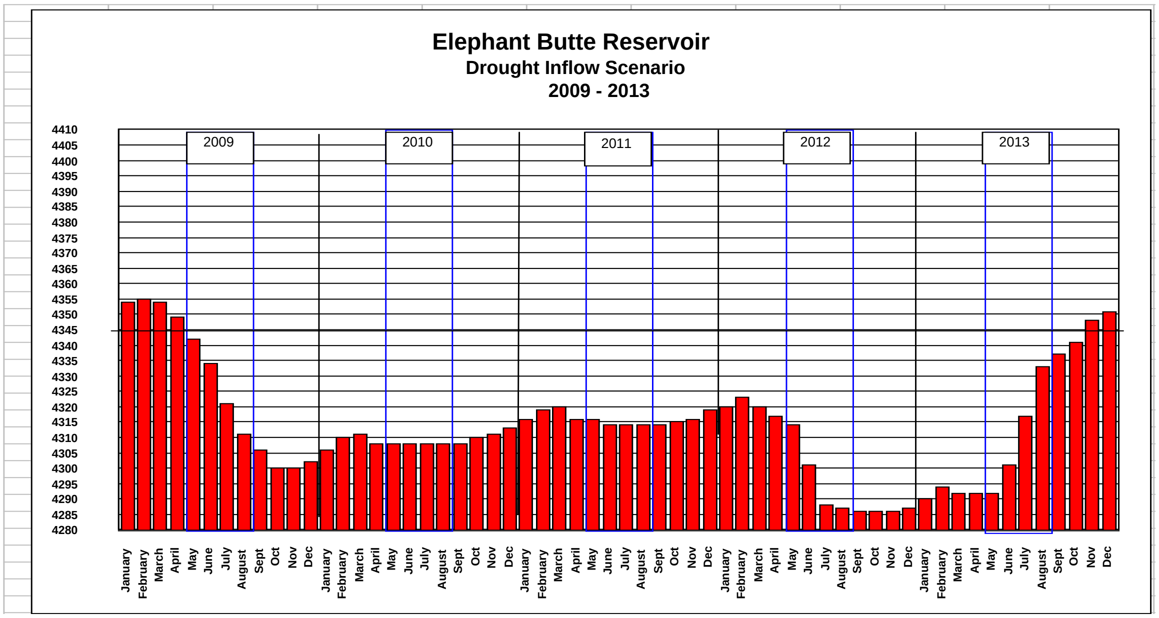
Based on previous survey results, it is likely that an increase in Elephant Butte Reservoir elevations could result in an increased number of over-wintering Bald Eagles. A rising reservoir would be expected to increase shoreline availability; increase the abundance of backwater foraging areas; increase the number of perch and roost sites by isolating snags and large trees from disturbance; and increase the overall prey base for wintering Bald Eagles.

Conservation Measures

1. Continue to conduct annual mid-winter Bald Eagle surveys of the San Marcial to Caballo Reservoir reach to document the abundance and distribution of wintering eagles in response to reservoir elevations.

Appendix D. Detailed Analysis of Impact to Southwestern Willow Flycatchers by Three Reservoir Inflow Scenarios

Detailed Analysis of Drought Scenario by Five-foot Contours:



4345-4350 – 318.9 total acres: 44.90 flooded suitable acres and 3.80 unflooded suitable acres. Total current habitat values = 47.75; maximum potential habitat values = 48.70. SWFL population estimates: 2009-1 territory; 2010-2 territories; 2011-2 territories; 2012-3 territories; 2013-3 territories.

2009 – Enhancement of 3.80 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (Jan. –April 2009), enhancement value of 0.95 habitat units. Suitable flooded acres (44.9) remained at full value, 100%

2010-2013 – Reservoir levels would not again reach this elevation through 2013. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 47.74 habitat units would be achieved each year.

4350-4355 – 310.1 total acres: 143.9 flooded suitable acres and 0.5 unflooded suitable acres. Total current habitat values = 144.28; maximum potential habitat values = 144.40. SWFL population estimates: 2009-8 territories; 2010-10 territories; 2011-12 territories; 2012-14 territories; 2013-17 territories.

2009 – Enhancement of 0.5 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (Jan. –March 2009), enhancement value of 0.12 habitat units. Suitable flooded acres (44.9) remained at full value, 100%

2010-2013 – Reservoir levels would not again reach this elevation through 2013. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 144.28 habitat units would be achieved each year.

4355-4360 – 943.20 total acres: 369.30 flooded suitable acres and 33.10 unflooded suitable acres. Total current habitat values = 394.13; maximum potential habitat values = 402.40. SWFL population estimates: 2009-3 territories; 2010-4 territories; 2011- 5 territories; 2012- 5 territories; 2013- 6 territories.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 394.13 habitat units would be achieved each year.

4360-4365 – 1179.70 total acres: 114.60 flooded suitable acres and 130.50 unflooded suitable acres. Total current habitat values = 212.48; maximum potential habitat values = 245.10. SWFL population estimates: 2009-4 territories; 2010-6 territories; 2011- 7 territories; 2012- 9 territories; 2013- 10 territories.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 212.48 habitat units would be achieved each year.

4365-4370 – 855.40 total acres: 23.30 flooded suitable acres and 50.10 unflooded suitable acres. Total current habitat values = 60.88; maximum potential habitat values = 73.39. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 60.88 habitat units would be achieved each year.

4370-4375 – 741.80 total acres: 0.20 flooded suitable acres and 11.90 unflooded suitable acres. Total current habitat values = 9.13; maximum potential habitat values = 12.10. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 9.13 habitat units would be achieved each year.

4375-4380 – 1170.50 total acres: 0.10 flooded suitable acres and 174.60 unflooded suitable acres. Total current habitat values = 131.05; maximum potential habitat values = 174.66. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 131.05 habitat units would be achieved each year.

4380-4385 – 852.00 total acres: 3.20 flooded suitable acres and 22.40 unflooded suitable acres. Total current habitat values = 20.00; maximum potential habitat values = 25.60. SWFL population estimates: 2009-7 territories; 2010-9 territories; 2011- 12 territories; 2012- 14 territories; 2013- 17 territories. Although SWFLs do currently occupy a portion of this area – habitat availability is limited, but is not expected to be a limiting factor over the next five years. This area could support approximately 28 SWFL territories. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 20.00 habitat units would be achieved each year.

4385-4390 – 985.10 total acres: 132.10 flooded suitable acres and 56.10 unflooded suitable acres. Total current habitat values = 174.18; maximum potential habitat values = 188.20. SWFL population estimates: 2009-16 territories; 2010-18 territories; 2011-21 territories; 2012-23 territories; 2013-25 territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 174.18 habitat units would be achieved each year.

4390-4395 – 4355.40 total acres: 209.80 flooded suitable acres and 210.70 unflooded suitable acres. Total current habitat values = 367.83; maximum potential habitat values = 420.50. SWFL population estimates: 2009-31 territories; 2010-37 territories; 2011-43 territories; 2012-49 territories; 2013-54 territories. This elevation range currently supports a significant number (29) of SWFL territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 367.83 habitat units would be achieved each year.

4395-4400 – 1300.90 total acres: 134.70 flooded suitable acres and 292.10 unflooded suitable acres. Total current habitat values = 353.78; maximum potential habitat values = 426.80. SWFL population estimates: 2009-14 territories; 2010-16 territories; 2011-19 territories; 2012-21 territories; 2013-23 territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 353.78 habitat units would be achieved each year.

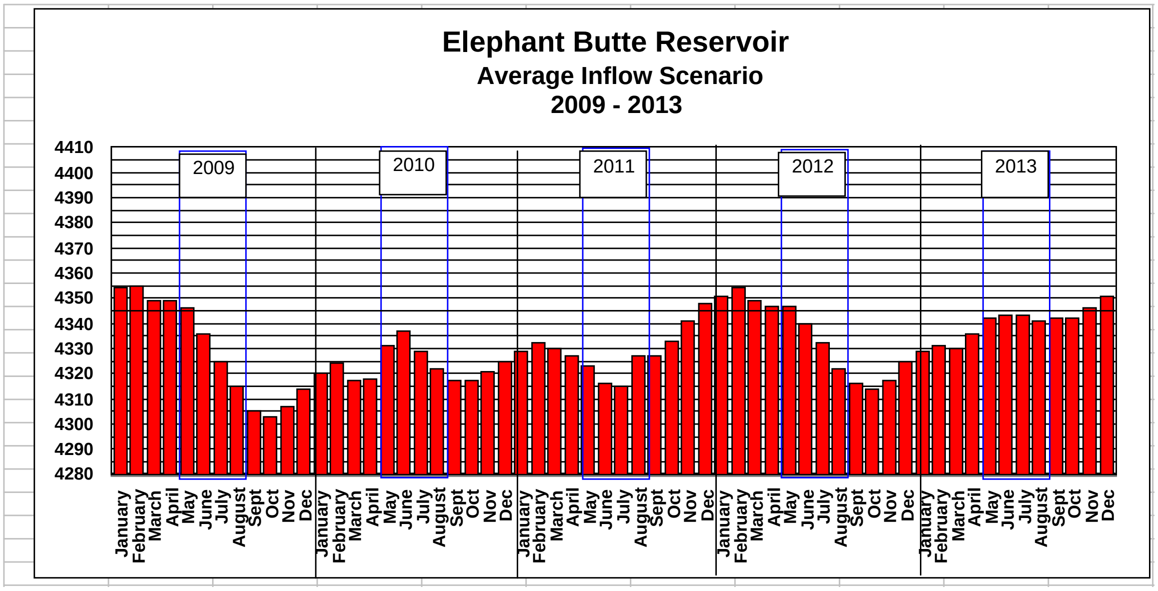
4400-4407 – 2143.70 total acres: 163.80 flooded suitable acres and 269.30 unflooded suitable acres. Total current habitat values = 365.78; maximum potential habitat values = 433.10. SWFL population estimates: 2009-129 territories; 2010-143 territories; 2011-156 territories; 2012-171 territories; 2013-184 territories. Currently, this elevation range supports nearly 50% of the total SWFL territories found in Elephant Butte Reservoir. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 365.78 habitat units would be achieved each year.

>4407 – 973.40 total acres: 29.00 flooded suitable acres and 90.60 unflooded suitable acres. Total current habitat values = 96.95; maximum potential habitat values = 119.60. SWFL population estimates: 2009-44 territories; 2010-47 territories; 2011-51 territories; 2012-54 territories; 2013-58 territories. Currently, this elevation range supports nearly 20% of the total SWFL territories found in Elephant Butte Reservoir. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. This portion of Elephant Butte Reservoir has aggraded above the spillway elevation and will not be directly impacted by rising reservoir levels, but was historically part of the pool.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 96.95 habitat units would be achieved each year.

Detailed Analysis of Average Scenario by Five-foot Contours:



4345-4350 – 318.9 total acres: 44.90 flooded suitable acres and 3.80 unflooded suitable acres. Total current habitat values = 47.75; maximum potential habitat values = 48.70. SWFL population estimates: 2009-1 territory; 2010-2 territories; 2011-2 territories; 2012-3 territories; 2013-3 territories.

2009 – Enhancement of 3.80 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (March-May 2009), enhancement value of 0.95 habitat units. Suitable flooded acres (44.9) remained at full value, 100%. A total of 48.70 habitat units would be achieved.

2010-2011 – Reservoir levels would not reach this elevation again until Dec 2011. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 47.74 habitat units would be achieved each year.

2012 – Enhancement of 3.80 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (March-May 20012), enhancement value of 0.95 habitat units. Suitable flooded acres (44.9) remained at full value, 100%. A total of 48.70 habitat units would be achieved.

2013 – Reservoir levels would not reach this elevation again until Nov 2013. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 47.74 habitat units would be achieved.

4350-4355 – 310.1 total acres: 143.9 flooded suitable acres and 0.5 unflooded suitable acres. Total current habitat values = 144.28; maximum potential habitat values = 144.40. SWFL population estimates: 2009-8 territories; 2010-10 territories; 2011-12 territories; 2012-14 territories; 2013-17 territories.

2009 – Enhancement of 0.5 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (Jan. –Feb 2009), enhancement value of 0.12 habitat units. Suitable flooded acres (44.9) remained at full value, 100%. A total of 144.40 habitat units would be achieved.

2010-2011 – Reservoir levels would not again reach this elevation again until Jan. 2012. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 144.28 habitat units would be achieved each year.

2012 – Enhancement of 0.5 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (Jan. –Feb 2012), enhancement value of 0.12 habitat units. Suitable flooded acres (44.9) remained at full value, 100%. A total of 144.40 habitat units would be achieved.

2013 – Reservoir levels would not reach this elevation again until Dec. 2013. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 47.74 habitat units would be achieved.

4355-4360 – 943.20 total acres: 369.30 flooded suitable acres and 33.10 unflooded suitable acres. Total current habitat values = 394.13; maximum potential habitat values = 402.40. SWFL population estimates: 2009-3 territories; 2010-4 territories; 2011- 5 territories; 2012- 5 territories; 2013- 6 territories.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 394.13 habitat units would be achieved each year.

4360-4365 – 1179.70 total acres: 114.60 flooded suitable acres and 130.50 unflooded suitable acres. Total current habitat values = 212.48; maximum potential habitat values = 245.10. SWFL population estimates: 2009-4 territories; 2010-6 territories; 2011- 7 territories; 2012- 9 territories; 2013- 10 territories.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 212.48 habitat units would be achieved each year.

4365-4370 – 855.40 total acres: 23.30 flooded suitable acres and 50.10 unflooded suitable acres. Total current habitat values = 60.88; maximum potential habitat values = 73.39. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 60.88 habitat units would be achieved each year.

4370-4375 – 741.80 total acres: 0.20 flooded suitable acres and 11.90 unflooded suitable acres. Total current habitat values = 9.13; maximum potential habitat values = 12.10. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 9.13 habitat units would be achieved each year.

4375-4380 – 1170.50 total acres: 0.10 flooded suitable acres and 174.60 unflooded suitable acres. Total current habitat values = 131.05; maximum potential habitat values = 174.66. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 131.05 habitat units would be achieved each year.

4380-4385 – 852.00 total acres: 3.20 flooded suitable acres and 22.40 unflooded suitable acres. Total current habitat values = 20.00; maximum potential habitat values = 25.60. SWFL population estimates: 2009-7 territories; 2010-9 territories; 2011- 12 territories; 2012- 14 territories; 2013- 17 territories. Although SWFLs do currently occupy a portion of this area – habitat availability is limited, but is not expected to be a limiting factor over the next five years. This area could support approximately 28 SWFL territories. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 20.00 habitat units would be achieved each year.

4385-4390 – 985.10 total acres: 132.10 flooded suitable acres and 56.10 unflooded suitable acres. Total current habitat values = 174.18; maximum potential habitat values = 188.20. SWFL population estimates: 2009-16 territories; 2010-18 territories; 2011-21 territories; 2012-23 territories; 2013-25 territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 174.18 habitat units would be achieved each year.

4390-4395 – 4355.40 total acres: 209.80 flooded suitable acres and 210.70 unflooded suitable acres. Total current habitat values = 367.83; maximum potential habitat values = 420.50. SWFL population estimates: 2009-31 territories; 2010-37 territories; 2011-43 territories; 2012-49 territories; 2013-54 territories. This elevation range currently supports a significant number (29) of SWFL territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 367.83 habitat units would be achieved each year.

4395-4400 – 1300.90 total acres: 134.70 flooded suitable acres and 292.10 unflooded suitable acres. Total current habitat values = 353.78; maximum potential habitat values = 426.80. SWFL population estimates: 2009-14 territories; 2010-16 territories; 2011-19 territories; 2012-21 territories; 2013-23 territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 353.78 habitat units would be achieved each year.

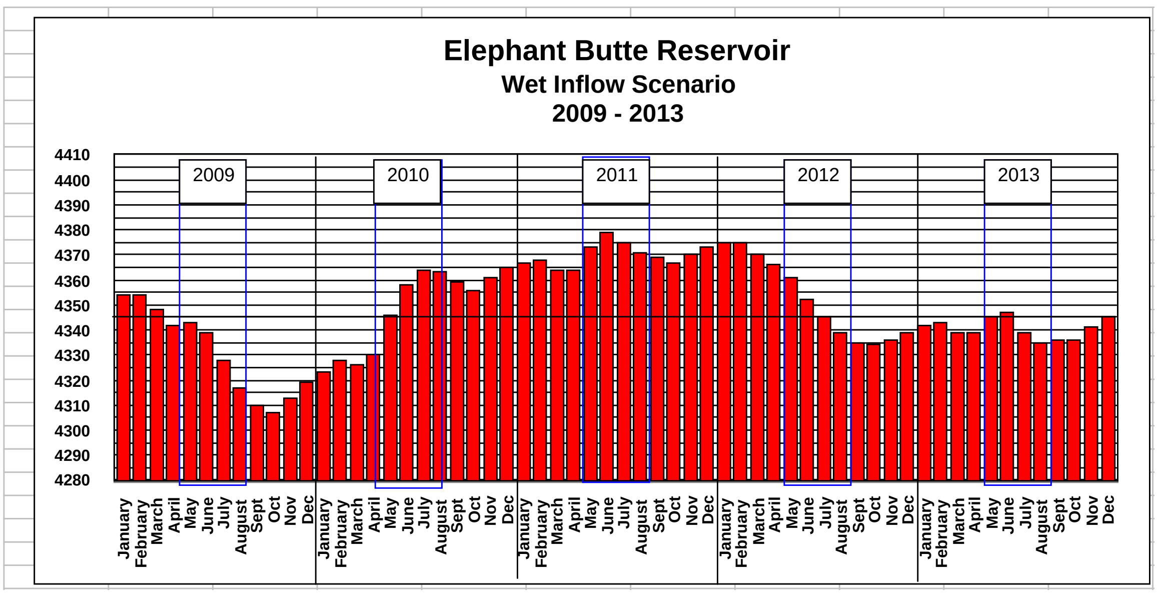
4400-4407 – 2143.70 total acres: 163.80 flooded suitable acres and 269.30 unflooded suitable acres. Total current habitat values = 365.78; maximum potential habitat values = 433.10. SWFL population estimates: 2009-129 territories; 2010-143 territories; 2011-156 territories; 2012-171 territories; 2013-184 territories. Currently, this elevation range supports nearly 50% of the total SWFL territories found in Elephant Butte Reservoir. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 365.78 habitat units would be achieved each year.

>4407 – 973.40 total acres: 29.00 flooded suitable acres and 90.60 unflooded suitable acres. Total current habitat values = 96.95; maximum potential habitat values = 119.60. SWFL population estimates: 2009-44 territories; 2010-47 territories; 2011-51 territories; 2012-54 territories; 2013-58 territories. Currently, this elevation range supports nearly 20% of the total SWFL territories found in Elephant Butte Reservoir. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. This portion of Elephant Butte Reservoir has aggraded above the spillway elevation and will not be directly impacted by rising reservoir levels, but was historically part of the pool.

2009-2013 – Reservoir levels would never reach this elevation. Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 96.95 habitat units would be achieved each year.

Detailed Analysis of Wet Scenario by Five-foot Contours:



4345-4350 – 318.9 total acres: 44.90 flooded suitable acres and 3.80 unflooded suitable acres. Total current habitat values = 47.75; maximum potential habitat values = 48.70. SWFL population estimates: 2009-1 territory; 2010-2 territories; 2011-2 territories; 2012-3 territories; 2013-3 territories.

2009 – Enhancement of 3.80 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (Jan. –March 2009), enhancement value of 0.95 habitat units. Suitable flooded acres (44.9) remained at full value, 100%

2010 – All values (47.75) lost for respective year due to reservoir increasing >10 ft during breeding season. [Assumption: SWFLs would have constructed nests, and nests would have been inundated and lost.] Since all values would have been lost, displacement of two SWFLs would have also occurred. (Two SWFLs were determined based on linear regression population estimates.)

2011 – All values (47.75) lost due to reservoir levels exceeding 30 ft. Since all values would have been lost, displacement of two SWFLs would have also occurred. (Two SWFLs were determined based on linear regression population estimates.)

2012 - All values (47.75) lost due to reservoir levels exceeding 30 ft. in June 2011 [Assumption: habitat would likely be slow to recover due to depth – although Goodding's willow would have likely survived.] Since all values would have been lost, displacement of three SWFLs would have also occurred. (Three SWFLs were determined based on linear regression population estimates.)

2013 - All values (47.75) lost due to reservoir levels exceeding 30 ft. in June 2011 [Assumption: habitat would likely be slow to recover due to depth – although Goodding's willow would have likely survived.] Since all values would have been lost, displacement of three SWFLs would have also occurred. (Three SWFLs were determined based on linear regression population estimates.)

4350-4355 – 310.1 total acres: 143.9 flooded suitable acres and 0.5 unflooded suitable acres. Total current habitat values = 144.28; maximum potential habitat values = 144.40. SWFL population estimates: 2009-8 territories; 2010-10 territories; 2011-12 territories; 2012-14 territories; 2013-17 territories.

2009 – Enhancement of 0.5 suitable unflooded acres (25%) due to reservoir levels flooding this area with < 10 ft within 3 months prior/during breeding season (Jan. –Feb. 2009), enhancement value of 0.12 habitat units. Suitable flooded acres (143.9) remained at full value, 100%

2010 – All values lost for respective year due to reservoir increasing >10 ft during breeding season. [Assumption: SWFLs would have constructed nests, and nests would have been inundated and lost.] Since all values would have been lost, displacement of ten SWFLs would have also occurred. (Ten SWFLs were determined based on linear regression population estimates.)

2011 – Habitat values reduced by 75% due to reservoir levels 10-20 ft for 6-12 months immediately prior or during breeding season. Although habitat was significantly reduced (-108.21 units), sufficient habitat units (36.07 units) remained to support the estimated 12 territories, so no SWFLs were displaced.

2012 - Habitat values reduced by 75% due to reservoir levels 10-20 ft for 6-12 months immediately prior or during breeding season. Although habitat was significantly reduced (-108.21 units), sufficient habitat units (36.07 units) remained to support the estimated 14 territories, so no SWFLs were displaced.

2013 - All habitat values (144.28 units) would be achieved since any adverse effects from previous reservoir levels would have been mitigated due to low reservoir levels over the past year. This area would not have been flooded since June 2012. Abundant habitat would be available for the estimated 17 SWFL territories.

4355-4360 – 943.20 total acres: 369.30 flooded suitable acres and 33.10 unflooded suitable acres. Total current habitat values = 394.13; maximum potential habitat values = 402.40. SWFL population estimates: 2009-3 territories; 2010-4 territories; 2011- 5 territories; 2012- 5 territories; 2013- 6 territories.

2009 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 394.13 units would have been achieved. Abundant habitat would be available for the estimated 3 SWFL territories.

2010 – Suitable flooded acres would retain their value (369.30), and unflooded acres (33.10) would be enhanced since reservoir levels increased <10 ft during the breeding season. A total of 402.40 habitat units would have been achieved. Abundant habitat would be available for the estimated 4 SWFL territories.

2011 – Habitat values reduced by 50% due to reservoir levels 5-15 ft for 6-18 consecutive months immediately prior or during breeding season. Although habitat was significantly reduced (-197.06 units), sufficient habitat units (197.06 units) remained to support the estimated 5 territories, so no SWFLs were displaced.

2012 - Habitat values reduced by 75% due to reservoir levels 10-20 ft for 6-12 months immediately prior or during breeding season. Although habitat was significantly reduced (-295.59 units), sufficient habitat units (98.53 units) remained to support the estimated 5 territories, so no SWFLs were displaced.

2013 - All habitat values (394.13 units) would be achieved since any adverse effects from previous reservoir levels would have been mitigated due to low reservoir levels over the past year. This area would not have been flooded since May 2012. Abundant habitat would be available for the estimated 6 SWFL territories.

4360-4365 – 1179.70 total acres: 114.60 flooded suitable acres and 130.50 unflooded suitable acres. Total current habitat values = 212.48; maximum potential habitat values = 245.10. SWFL population estimates: 2009-4 territories; 2010-6 territories; 2011- 7 territories; 2012- 9 territories; 2013- 10 territories.

2009 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 212.48 units would have been achieved. Abundant habitat would be available for the estimated 4 SWFL territories.

2010 – Suitable flooded acres would retain their value (114.60), and unflooded acres (130.50) would be enhanced since reservoir levels increased <10 ft during the breeding season. A total of 245.10 habitat units would have been achieved. Abundant habitat would be available for the estimated 6 SWFL territories.

2011 – Habitat values reduced by 25% due to reservoir levels 10-15 ft for 3 consecutive months immediately prior or during breeding season. Although habitat was reduced (-53.12 units), sufficient habitat units (159.36 units) remained to support the estimated 7 territories, so no SWFLs were displaced.

2012 - Habitat values reduced by 50% due to reservoir levels 5-15 ft for 6-18 consecutive months immediately prior or during breeding season. Although habitat was reduced (-106.24 units), sufficient habitat units (106.24 units) remained to support the estimated 9 territories, so no SWFLs were displaced.

2013 - All habitat values (212.48 units) would be achieved since any adverse effects from previous reservoir levels would have been mitigated due to low reservoir levels over the past year. This area would not have been flooded since May 2012. Abundant habitat would be available for the estimated 10 SWFL territories.

4365-4370 – 855.40 total acres: 23.30 flooded suitable acres and 50.10 unflooded suitable acres. Total current habitat values = 60.88; maximum potential habitat values = 73.39. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 60.88 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2010 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 60.88 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2011 – Habitat values were retained during this period since habitat was flooded with 5-15 months immediately prior/during the breeding season. [Assumption: water depths did not enhance, nor reduce the habitat values.] A total of 60.88 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2012 – Suitable flooded acres would retain their value (23.30), and unflooded acres (50.10) would be enhanced since reservoir levels increased <10 ft prior/during the breeding season. A total of 73.39 habitat units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2013 - Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 60.88 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

4370-4375 – 741.80 total acres: 0.20 flooded suitable acres and 11.90 unflooded suitable acres. Total current habitat values = 9.13; maximum potential habitat values = 12.10. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 9.13 units would have been achieved. Suitable habitat would be available in this area for a small number of SWFLs in the future.

2010 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 9.13 units would have been achieved. Suitable habitat would be available in this area for a small number of SWFLs in the future.

2011 – Suitable flooded acres would retain their value (0.20), and unflooded acres (11.90) would be enhanced since reservoir levels increased <10 ft prior/during the breeding season. A total of 12.10 habitat units would have been achieved. Suitable habitat would be available in this area for a small number of SWFLs in the future.

2012 – Suitable flooded acres would retain their value (0.20), and unflooded acres (11.90) would be enhanced since reservoir levels were <10 ft within 3 months prior/during the breeding season. A total of 12.10 habitat units would have been achieved. Suitable habitat would be available in this area for a small number of SWFLs in the future.

2013 - Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 9.13 units would have been achieved. Suitable habitat would be available in this area for a small number of SWFLs in the future.

4375-4380 – 1170.50 total acres: 0.10 flooded suitable acres and 174.60 unflooded suitable acres. Total current habitat values = 131.05; maximum potential habitat values = 174.66. SWFL population estimates: 2009-2013 = 0 territories. Although SWFLs may occupy this area at some time in the future, there are currently no SWFL territories to estimate future populations.

2009 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 131.05 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2010 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 131.05 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2011 – Suitable flooded acres would retain their value (0.10), and unflooded acres (174.60) would be enhanced since reservoir levels increased <10 ft prior/during the breeding season. A total of 174.66 habitat units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2012 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 131.05 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

2013 - Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 131.05 units would have been achieved. Suitable habitat would be available if SWFLs did occupy this area in the future.

4380-4385 – 852.00 total acres: 3.20 flooded suitable acres and 22.40 unflooded suitable acres. Total current habitat values = 20.00; maximum potential habitat values = 25.60. SWFL population estimates: 2009-7 territories; 2010-9 territories; 2011- 12 territories; 2012- 14 territories; 2013- 17 territories. Although SWFLs do currently occupy a portion of this area – habitat availability is limited, but is not expected to be a limiting factor over the next five years. This area could support approximately 28 SWFL territories. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 20.00 habitat units would be achieved each year.

4385-4390 – 985.10 total acres: 132.10 flooded suitable acres and 56.10 unflooded suitable acres. Total current habitat values = 174.18; maximum potential habitat values = 188.20. SWFL population estimates: 2009-16 territories; 2010-18 territories; 2011-21 territories; 2012-23 territories; 2013-25 territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 174.18 habitat units would be achieved each year.

4390-4395 – 4355.40 total acres: 209.80 flooded suitable acres and 210.70 unflooded suitable acres. Total current habitat values = 367.83; maximum potential habitat values = 420.50. SWFL population estimates: 2009-31 territories; 2010-37 territories; 2011-43 territories; 2012-49 territories; 2013-54 territories. This elevation range currently supports a significant number (29) of SWFL territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 367.83 habitat units would be achieved each year.

4395-4400 – 1300.90 total acres: 134.70 flooded suitable acres and 292.10 unflooded suitable acres. Total current habitat values = 353.78; maximum potential habitat values = 426.80. SWFL population estimates: 2009-14 territories; 2010-16 territories; 2011-19 territories; 2012-21 territories; 2013-23 territories. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 353.78 habitat units would be achieved each year.

4400-4407 – 2143.70 total acres: 163.80 flooded suitable acres and 269.30 unflooded suitable acres. Total current habitat values = 365.78; maximum potential habitat values = 433.10. SWFL population estimates: 2009-129 territories; 2010-143 territories; 2011-156 territories; 2012-171 territories; 2013-184 territories. Currently, this elevation range supports nearly 50% of the total SWFL territories found in Elephant Butte Reservoir. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 365.78 habitat units would be achieved each year.

>4407 – 973.40 total acres: 29.00 flooded suitable acres and 90.60 unflooded suitable acres. Total current habitat values = 96.95; maximum potential habitat values = 119.60. SWFL population estimates: 2009-44 territories; 2010-47 territories; 2011-51 territories; 2012-54 territories; 2013-58 territories. Currently, this elevation range supports nearly 20% of the total SWFL territories found in Elephant Butte Reservoir. Suitable habitat in this area is readily available to support the increasing SWFL population over the next five years. This portion of Elephant Butte Reservoir is not expected to reach this elevation range at any time over the next five years.

2009-2013 – Suitable flooded and suitable unflooded acres would retain their value, but unflooded would not be enhanced due to low reservoir levels. A total of 365.78 habitat units would be achieved.