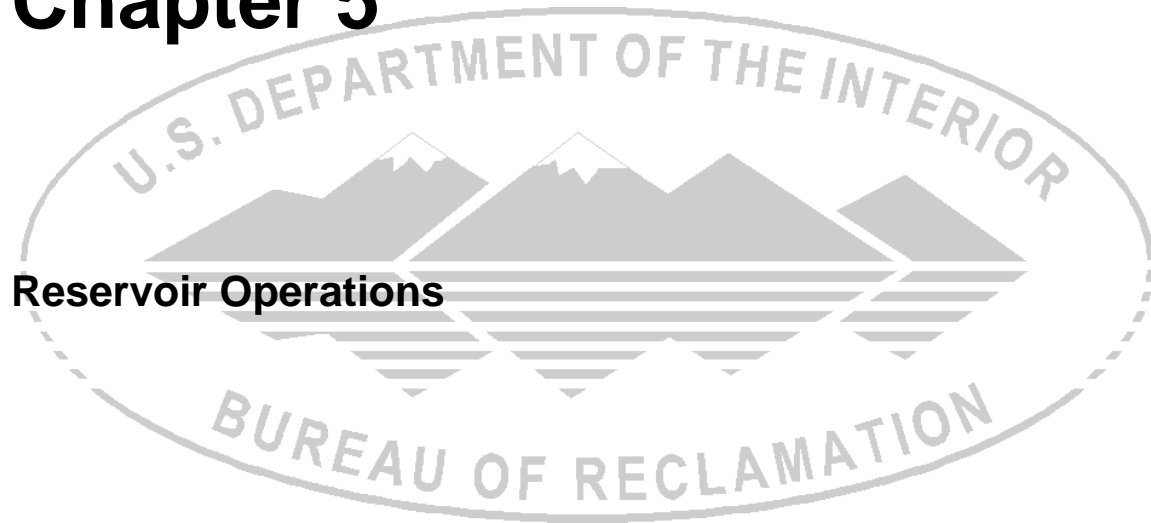


# Chapter 5



**Reservoir Operations**

# Chapter 5 - Reservoir Operations

## Reservoir's Authorized Purposes

Box Butte Dam impounds water from the Niobrara River to form Box Butte Reservoir. The authorized purposes of Box Butte Dam and Reservoir are to provide storage for irrigation, recreation, fish and wildlife, and sediment control.

## Contract between the Mirage Flats Irrigation District, the Nebraska Game and Parks Commission and the United States

In March, 1990 the District, the Commission, and Reclamation entered into an agreement to establish a minimum pool elevation at Box Butte Reservoir of 3978.0 ft. to support and maintain a viable fishery resource in Box Butte Reservoir. This agreement was modified in March, 2000 to add an additional one foot to the minimum pool elevation (3979.0 ft). (See Appendix A5) This agreement is in effect through 2025. These reservoir elevations raised the lowest allowable operating elevation from the previous historical level of 3976.5 ft. At higher reservoir elevations, an effort should be made to provide as near optimum conditions as possible while meeting the other authorized purposes. It is clearly understood that the primary purpose of Box Butte Reservoir is the delivery of water from the storage space for irrigation purposes and that the reservoir level will fluctuate widely above the 3979.0 ft. minimum elevation. There is no agreement for a minimum reservoir releases to the Niobrara River for fish and wildlife purposes.

## Reservoir Operations and Flood Control

The Nebraska-Kansas Area Manager in Grand Island, Nebraska, is responsible for the O&M of the dam and reservoir and appurtenant features. Box Butte Reservoir is not a flood control storage reservoir. Reservoir capacity allocations (storage capacity in relation to water elevations) are shown in Table 6, followed by definitions of the various types of storage. Table 7 shows historic maximum/minimum reservoir levels for 1965 to 2007. No reservoir elevation data is available prior to 1965.

## Chapter 5

**Table 6 – Box Butte Reservoir Capacity Allocations**

| Space                             | Net Capacity (acre-ft) | Water Elevation (feet msl) |
|-----------------------------------|------------------------|----------------------------|
| Dead Storage <sup>1</sup>         | 188                    | 3,969.0                    |
| Inactive Storage <sup>2</sup>     | 2,204                  | 3,979.0                    |
| Conservation Storage <sup>3</sup> | 27,769                 | 4,007.0                    |
| No Flood Pool                     | -----                  | -----                      |
| Surcharge Pool <sup>4</sup>       | 16,740                 | 4,016.0                    |

<sup>1</sup> Dead Storage: Capacity from which stored water cannot be evacuated by gravity.

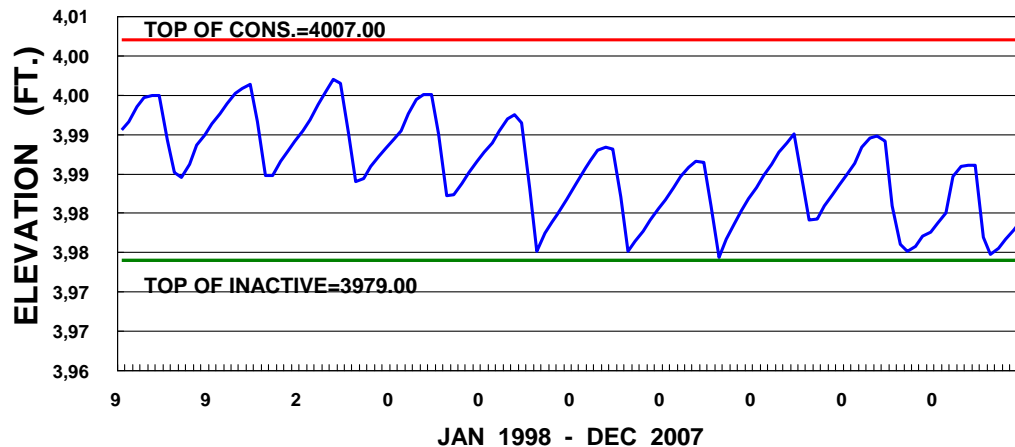
<sup>2</sup> Inactive Storage: Capacity that can be released from the dam but is below design capacity for irrigation.

<sup>3</sup> Conservation Storage: The pool allocated to storage of water for irrigation purposes only.

<sup>4</sup> Surcharge Pool: Capacity between the top of conservation pool (4007.0) and the maximum water surface elevation (4016.0)

## Reservoir Operations and Fisheries

The reservoir experiences extreme water draw-downs usually within a two month period during the summer. This results not only in an extreme loss of benthic fauna and shoreline habitat, but also significant losses in young-of-year fish. Drawdowns concentrate the predators, prey, and fishermen in one small area. The results are that prey is consumed, the predators get larger, and the fishermen catch more fish. This can be a healthy situation if the prey base does not collapse or the angler pressure does not become too extensive.



**Figure 10 – Box Butte Reservoir 10-Year Reservoir Level**

## Reservoir Operations and Recreation

Recreational use of reservoir facilities is somewhat restricted during low-water levels and causes some public-use inconvenience. The fluctuating water levels expose once submerged objects which may become safety hazards to boaters. The Commission does not place buoys around the exposed objects. The bottom of the concrete at the low water boat ramp is elevation 3979.6.

**Table 7 – Maximum and Minimum Reservoir Levels**

| Year | Date    | Max Level<br>(feet msl) | Contents<br>(acre-feet) | Date     | Min. Level<br>(feet msl) | Contents<br>(acre-feet) |
|------|---------|-------------------------|-------------------------|----------|--------------------------|-------------------------|
| 1965 | May 20  | 4002.55                 | 24,440                  | Sept. 7  | 3979.62                  | 3,530                   |
| 1966 | July 11 | 4002.10                 | 23,790                  | Oct. 11  | 3983.00                  | 5,300                   |
| 1967 | July 11 | 4002.08                 | 23,793                  | Sept. 10 | 3986.59                  | 7,560                   |
| 1968 | June 23 | 4003.34                 | 25,555                  | Sept. 15 | 3990.21                  | 10,455                  |
| 1969 | May 26  | 4001.90                 | 23,546                  | Sept. 12 | 3978.30                  | 2,950                   |
| 1970 | June 15 | 3999.35                 | 20,181                  | Sept. 6  | 3971.68                  | 1,105                   |
| 1971 | June 27 | 3999.72                 | 20,652                  | Sept. 4  | 3970.42                  | 868                     |
| 1972 | June 30 | 3996.49                 | 16,749                  | Sept. 9  | 3976.24                  | 2,211                   |
| 1973 | June 12 | 3999.32                 | 20,143                  | Sept. 6  | 3972.95                  | 1,368                   |
| 1974 | May 15  | 3998.51                 | 19,132                  | Aug. 30  | 3975.22                  | 1,918                   |
| 1975 | May 31  | 3996.51                 | 16,761                  | Aug. 30  | 3970.44                  | 872                     |
| 1976 | June 30 | 3994.31                 | 14,391                  | Aug. 23  | 3969.82                  | 764                     |
| 1977 | June 19 | 3994.90                 | 15,009                  | Aug. 31  | 3980.18                  | 3,808                   |
| 1978 | June 10 | 3997.75                 | 18,214                  | Sept. 11 | 3975.75                  | 2,067                   |
| 1979 | May 31  | 3995.81                 | 15,993                  | Sept. 15 | 3980.50                  | 3,962                   |
| 1980 | May 31  | 3998.84                 | 19,540                  | Sept. 5  | 3979.58                  | 3,515                   |
| 1981 | June 10 | 3995.83                 | 16,015                  | Sept. 10 | 3975.70                  | 2,052                   |
| 1982 | July 9  | 3996.09                 | 16,301                  | Sept. 14 | 3981.48                  | 4,470                   |
| 1983 | June 30 | 4001.11                 | 22,475                  | Sept. 10 | 3985.73                  | 6,968                   |
| 1984 | June 30 | 4000.30                 | 21,402                  | Sept. 7  | 3978.15                  | 2,889                   |
| 1985 | May 31  | 3995.28                 | 15,416                  | Aug. 26  | 3969.00                  | 640                     |
| 1986 | June 30 | 3997.70                 | 18,155                  | Sept. 8  | 3976.80                  | 2,391                   |
| 1987 | May 20  | 3998.40                 | 18,996                  | Sept. 1  | 3974.80                  | 1,806                   |
| 1988 | June 21 | 3996.10                 | 16,312                  | Aug. 30  | 3973.01                  | 1,381                   |
| 1989 | May 30  | 3992.09                 | 12,186                  | Aug. 16  | 3969.00                  | 640                     |
| 1990 | June 14 | 3992.47                 | 12,550                  | Aug. 17  | 3980.47                  | 3,947                   |
| 1991 | July 1  | 3998.47                 | 19,082                  | Aug. 31  | 3984.08                  | 5,925                   |
| 1992 | July 8  | 3997.57                 | 18,000                  | Sept. 6  | 3894.97                  | 6,473                   |
| 1993 | July 7  | 3999.75                 | 20,691                  | Sept. 13 | 3985.76                  | 6,988                   |
| 1994 | May 27  | 3999.96                 | 20,961                  | Aug. 31  | 3983.15                  | 5,384                   |
| 1995 | July 4  | 4000.56                 | 21,743                  | Sept. 15 | 3984.60                  | 6,242                   |
| 1996 | June 16 | 3999.46                 | 20,320                  | Aug. 28  | 3987.40                  | 8,150                   |
| 1997 | June 24 | 4000.03                 | 21,051                  | Sept. 5  | 3988.49                  | 8,997                   |
| 1998 | May 22  | 4000.10                 | 21,142                  | Sept. 4  | 3988.89                  | 9,324                   |
| 1999 | July 5  | 4001.43                 | 22,907                  | Sept. 3  | 3988.95                  | 9,374                   |
| 2000 | June 1  | 4002.14                 | 23,876                  | Sept. 2  | 3988.67                  | 9,143                   |
| 2001 | July 14 | 4000.36                 | 21,481                  | Sept. 7  | 3986.34                  | 7,384                   |
| 2002 | May 31  | 3997.55                 | 17,976                  | Aug. 21  | 3979.87                  | 3,652                   |
| 2003 | July 8  | 3994.12                 | 14,195                  | Aug. 24  | 3979.72                  | 3,579                   |
| 2004 | May 19  | 3991.78                 | 11,893                  | Aug. 31  | 3979.39                  | 3,423                   |
| 2005 | June 28 | 3995.04                 | 15,158                  | Sept. 3  | 3982.95                  | 5,270                   |
| 2006 | May 17  | 3994.98                 | 15,094                  | Sept. 11 | 3979.92                  | 3,676                   |
| 2007 | June 21 | 3991.30                 | 11,444                  | Aug. 13  | 3978.91                  | 3,204                   |

(No reservoir elevation data available prior to 1965)

(Note: new area capacity tables effective January 1, 2008)

The Mirage Flats Project map is on page 52a; please refer to it for more

information.

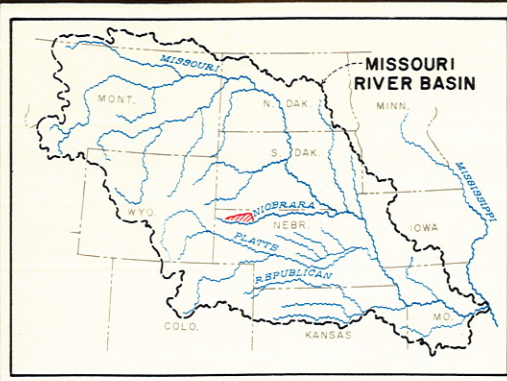
### **Downstream Releases and Operations Land**

The dam, outlet works, and delivery system is operated and maintained by the MFID for the protection of project facilities. The majority of Federal lands located on the downstream side of Box Butte Dam is designated as a WMA, operated and maintained by the Commission. Reclamation retains primary jurisdiction over the designated operations area. Reclamation retains full access to and unlimited use of any area developed for wildlife habitat, if required for the purpose of ensuring proper operations and protection of Box Butte Dam/Reservoir.

The District's contracted irrigation season is from April through September. Irrigation water can be released any time during this period, although the District typically takes water from late June through August. The District has a storage right to store water in Box Butte Reservoir, a supplemental irrigation water right for the release of District water, and a natural flow right for surface water from the Niobrara River. The storage rights, supplemental irrigation right, and appropriated natural flow rights are used in combination with each other to meet the water supply needs for 11,662 acres of irrigable project lands in the District. Water is released from Box Butte Reservoir to the Niobrara River and diverted into the Mirage Flats Canal at the Dunlap Diversion Dam. The diversion dam is located approximately 8 miles downstream of the reservoir.

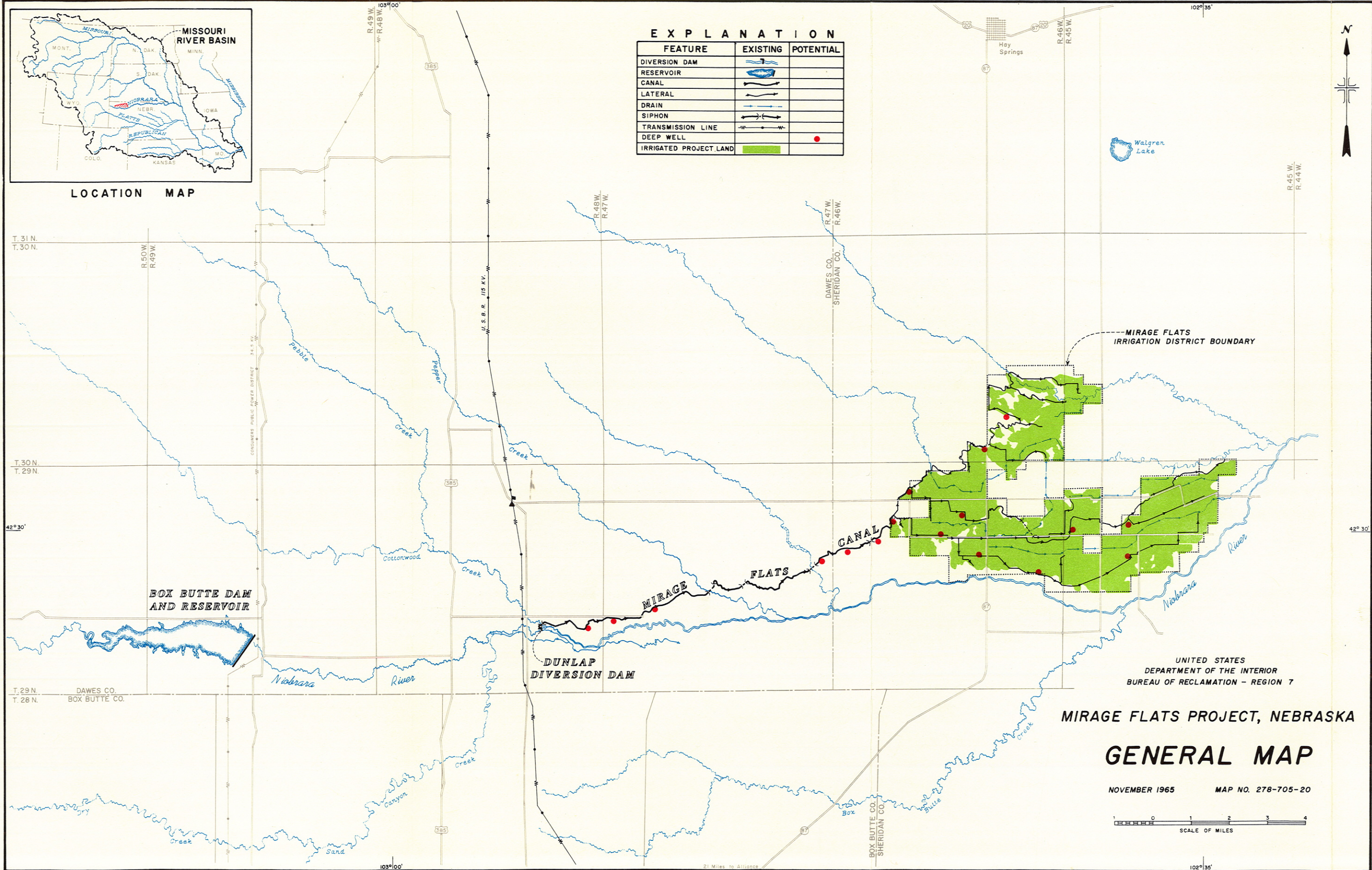
Ground-water depletions of the base flow and numerous farm conservation practices have greatly reduced inflow to the reservoir. Since the mid 1950s the surface water supply in the Niobrara River basin has decreased significantly (see Figure 11). The 10-year average annual inflow to Box Butte Reservoir has decreased from 22,100 acre-feet from 1947 through 1956, to 19,400 acre-feet from 1977 through 1986, to 16,200 acre-feet from 1997 through 2006. Although the District has access to the entire conservation pool of 27,816 acre-feet of water, plus the inflow, average release from Box Butte Reservoir for irrigation over the past 10 years has been approximately 11,800 acre-feet. This average is reduced to approximately 9,800 acre-feet over the past 5 years. This decrease in reservoir inflow has drastically changed District operations. The reduced inflow has created lower pool levels, and the increased demands cause a greater fluctuation in water levels. See Table 7 for historic maximum/minimum reservoir levels for Box Butte Reservoir.





LOCATION MAP

| EXPLANATION            |          |           |
|------------------------|----------|-----------|
| FEATURE                | EXISTING | POTENTIAL |
| DIVERSION DAM          |          |           |
| RESERVOIR              |          |           |
| CANAL                  |          |           |
| LATERAL                |          |           |
| DRAIN                  |          |           |
| SIPHON                 |          |           |
| TRANSMISSION LINE      |          |           |
| DEEP WELL              |          |           |
| IRRIGATED PROJECT LAND |          |           |



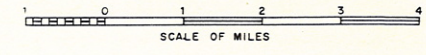
MIRAGE FLATS IRRIGATION DISTRICT BOUNDARY

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION - REGION 7

MIRAGE FLATS PROJECT, NEBRASKA

GENERAL MAP

NOVEMBER 1965 MAP NO. 278-705-20





### BOX BUTTE RESERVOIR Inflow & Outflow

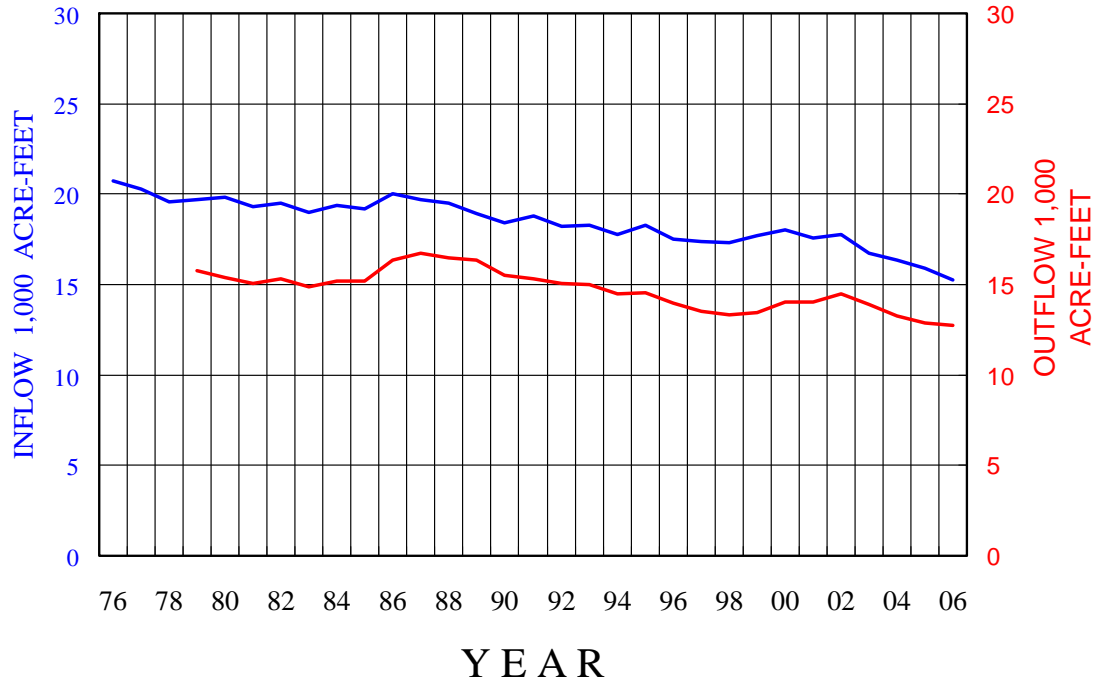


Figure 11 – Box Butte Reservoir Inflow/Outflow