

3.9 RECREATION

3.9.1 INTRODUCTION

The Colorado River, Lake Mead and Lake Powell provide water-based recreation opportunities that are of local, regional and national significance, as well as international interest.

This recreation analysis addresses five specific recreation-related issues associated with potential effects that could result from implementation of the interim surplus criteria alternatives considered in this document. The issues addressed are potential effects to:

- Reservoir marinas and boat launching and shoreline access for Lake Powell and Lake Mead;
- Lake Mead and Lake Powell boating and navigation;
- River and whitewater boating;
- Sport fishing in Lake Powell, Lake Mead and the Colorado River below Hoover Dam; and
- Recreational facilities operational costs.

The interim surplus alternatives would not change the current and projected operations of Lakes Mohave and Havasu and thus would not affect recreation on those reservoirs.

3.9.2 RESERVOIR MARINAS, BOAT LAUNCHING AND SHORELINE ACCESS

This section considers potential effects of the interim surplus criteria alternatives on Lake Powell and Lake Mead marinas, boat launching facilities and other important shoreline access areas.

3.9.2.1 METHODOLOGY

Information in this section was compiled after review of available published and unpublished sources, and through personal communication with Reclamation, NPS and resource specialists. Thorough review of existing literature on the Colorado River provided information on reservoir recreation use for both Lake Powell and Lake Mead. Where available, the number of facilities at each marina, boat launching ramp and shoreline access area are included.

From the information compiled, representative threshold pool elevations were selected for facilities, at or below which certain facilities may be rendered inoperable or relocation of facilities could be required to maintain their operation. These thresholds

were chosen based on either information provided in studies, communications with NPS personnel, or from comments received regarding the DEIS. Discussions of the probabilities of these thresholds occurring is detailed in the Environmental Consequences Section (Section 3.9.2.3). The probability of reservoir elevations occurring below these levels under baseline conditions and the action alternatives was identified using river system modeling as described in Section 3.3.

Data generated from the river system model include the probability (represented graphically in the Environmental Consequences section) that the water level related to each alternative would be above the specified “threshold” pool elevations for each year during the period of analysis. The graphs indicate the general trend of elevation probabilities and present the incremental differences in probabilities for baseline conditions and each of the alternatives.

3.9.2.2 AFFECTED ENVIRONMENT

Recreational boating on Lake Mead and Lake Powell is dependent upon access to the water via shoreline facilities such as marinas, docks and launch ramps. Fluctuation in water levels is a normal aspect of reservoir operations, and facilities are designed and operated to accommodate it. However, decreased pool elevations or increased variations or rates in pool elevation fluctuation could result in increased operation costs, temporary closures or possibly permanent closures.

Reservoir pool elevations at Lake Powell and Lake Mead depend on annual inflow from the Colorado River upstream, and outflow from the respective dam to the Colorado River downstream for water deliveries. Operation of the Colorado River generally results in the highest pool elevations in Lake Powell in mid-summer and in Lake Mead, early winter. In general, pool levels in Lake Powell and Lake Mead tend to fluctuate on an annual cycle rather than on a monthly or seasonal cycle. Lake Powell historical pool fluctuations have normally ranged from 20 to 25 feet per year (Combrinks and Collins, 1992). Since operation of Glen Canyon Dam began in 1966, Lake Mead pool fluctuation has normally ranged from 5 to 25 feet per year.

3.9.2.2.1 Lake Powell Recreation Resources

Lake Powell is located in the Glen Canyon National Recreation Area (GCNRA) in southern Utah and northern Arizona. Typical recreation activities that occur at Lake Powell include swimming and sunbathing, power boating, fishing, off-beach activities associated with boat trips (such as hiking and exploring ruins), house boating, personal water craft use, canoeing, kayaking, sailing, and other activities (USBR, 1995b). A carrying capacity study (NPS, 1991) provided information on the potential limits of boater use on Lake Powell. The study also showed that the average length of stay at the GCNRA is 4.5 days.

Visitation numbers for the entire GCNRA between 1990 and 1999 are provided in Table 3.9-1. The data indicate that there are seasonal variability in recreation use. The majority of use occurs in the summer months of June, July and August. The visitation numbers shown for 1995 through 1999 are considerably lower than visitation between 1990 and 1994 due to changes in NPS methods for calculating visitation. However, the seasonal pattern of visitation does not change; use remains highest in summer months. The majority of visitors to the GCNRA travel either less than 30 miles to visit (29.1 percent) or travel 121 to 240 miles (28.9 percent). This indicates that the area is used predominantly by local and regional visitors.

**Table 3.9-1
Glen Canyon National Recreation Area Visitation**

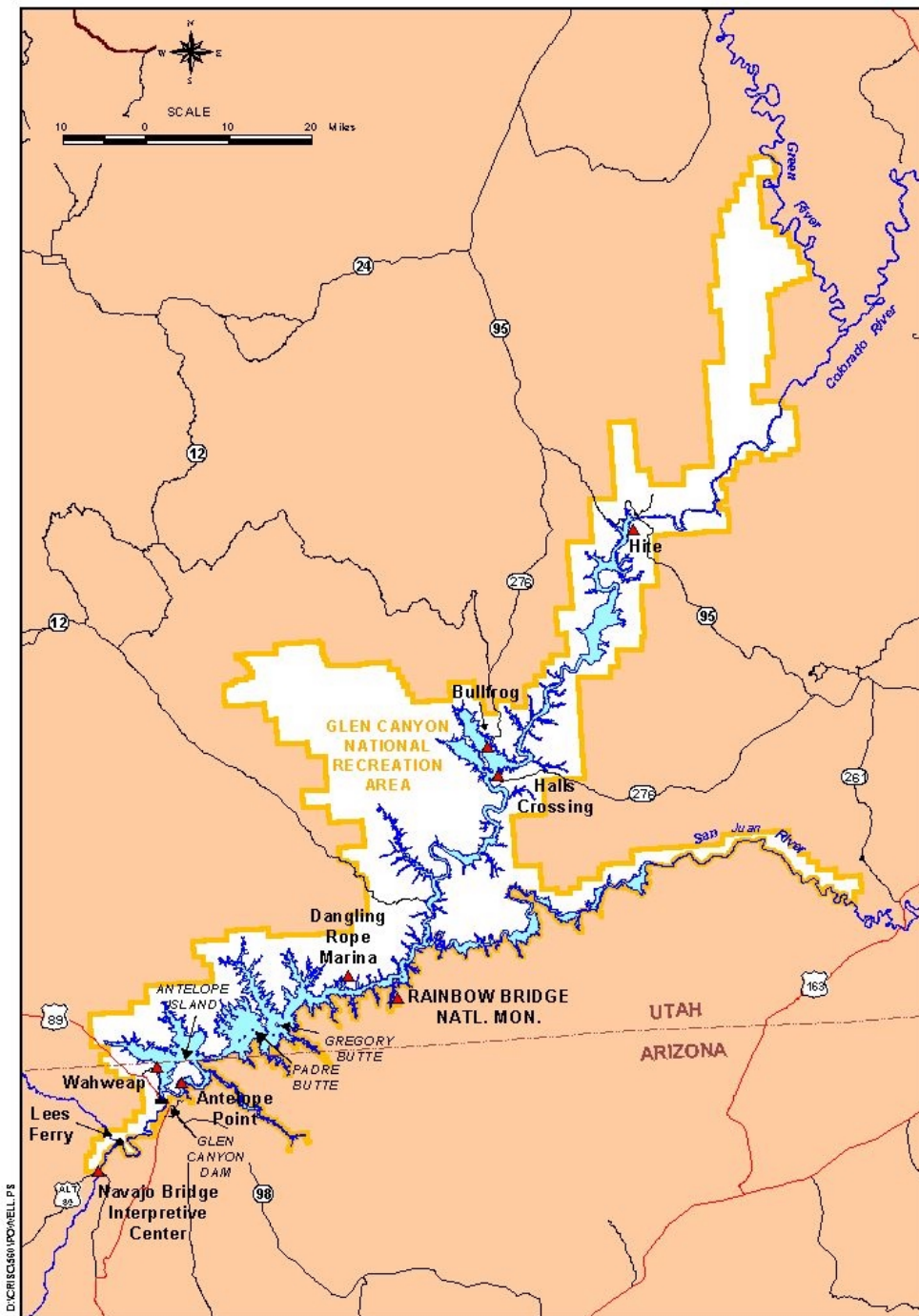
Year	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Total
1990	77,617	109,042	135,039	253,638	289,993	501,288	467,981	483,023	350,026	227,061	129,691	78,750	3,103,129
1991	81,875	97,120	118,182	199,462	346,764	451,674	503,752	568,030	396,785	247,982	120,822	78,442	3,210,890
1992	83,044	114,889	139,787	246,993	346,727	525,610	572,869	659,809	478,032	245,565	122,386	82,847	3,620,558
1993	60,927	83,903	123,836	201,141	372,425	526,202	624,549	644,534	530,550	259,119	111,607	76,031	3,470,194
1994	69,663	120,307	174,272	264,265	364,826	576,355	665,583	439,177	321,961	212,729	99,097	63,607	3,371,842
1995*	35,814	66,553	88,414	151,369	196,905	410,610	435,840	461,431	285,118	192,597	94,508	50,362	2,469,521
1996	41,303	50,553	96,296	209,243	231,655	419,288	447,417	442,180	268,266	187,949	89,670	48,269	2,532,087
1997	49,954	54,401	115,523	157,249	245,000	288,742	420,927	437,846	266,992	187,467	85,595	48,507	2,458,203
1998	39,241	55,538	89,971	171,234	267,509	389,167	445,423	398,776	285,105	197,673	77,247	50,315	2,467,199
1999	44,755	51,657	118,141	155,831	261,931	426,744	515,641	441,791	305,006	200,457	89,799	55,503	2,667,249

Source: Based on NPS data.

* NPS methods for calculating visitation numbers changed in 1995. This resulted in significant reductions in visitation numbers compared to prior years.

Recreation boating is the largest type of boating activity on Lake Powell, with an estimated 1.5 million boater nights per year in 1988. Although use at some of the major marinas, such as Wahweap, Hall's Crossing and Bullfrog, decreased during a low water period in 1989, the total number of boats on Lake Powell was reported to have increased 14.5 percent by July 31, 1989, compared to the same period in 1988 (USBR, 1995b). Specific facilities and reservoir elevations important to their operation are discussed in the following sections. Map 3.9-1 depicts Lake Powell and the locations of shoreline facilities.

**Map 3.9-1
Lake Powell and Associated Shoreline Recreation Facilities**



3.9.2.2.2 Shoreline Public Use Facilities

Public use facilities at Lake Powell that include water-based recreation activities are Wahweap, Dangling Rope Marina, Halls Crossing, Bullfrog, Hite, and Antelope Point. The GCNRA Proposed General Management Plan (NPS, 1979) describes the estimated capacity and development at these areas; these estimates are based on general concepts only and further detailed planning was proposed to begin after the plan's acceptance in 1979. Table 3.9-2 summarizes the activities at each of the sites. If the actual number of improvements (boat slips, mooring buoys, houseboats, etc.) at a facility are known, it is listed in Table 3.9-2; otherwise, the presence of an improvement is indicated with a bullet (•). If an improvement does not exist, it is denoted with "N/A." Below is a description of the shoreline public use facilities at Lake Powell.

Wahweap – The facilities at Wahweap are the closest to Glen Canyon Dam, located off Interstate 89 at the mouth of Wahweap Bay. According to a study that addressed fluctuating lake levels and recreation use, the Stateline Launching Ramp at Wahweap became inoperable in 1989 when the lake elevation decreased to below 3677 feet msl (Combrink and Collins 1992). In 1993, NPS extended the Wahweap and Stateline boat ramps down to an operable level of 3612 feet msl (Henderson, 2000).

Dangling Rope Marina – The facilities at Dangling Rope Marina were proposed to replace the facilities at Rainbow Marina in Forbidding Canyon. All the facilities float, and they are only accessible by boat (NPS, 1979). In addition to the facilities, tour boats depart from Dangling Rope Marina for visits to Rainbow Bridge National Monument during the recreation season (NPS, 1993). There are no known reservoir surface elevations that would impair operation of this facility.

Halls Crossing – The facilities at Halls Crossing are located off Utah Highway 276 on the east shore of Lake Powell, across the bay from Bullfrog Marina. According to a study that addressed fluctuating lake levels and recreation use, the Halls Crossing Ferry Ramp became inoperable in 1989 when the lake elevation decreased to below 3675 feet msl (Combrink and Collins, 1992). In 1993, NPS extended the boat ramp down to an operable level of 3612 feet msl (Henderson, 2000).

Bullfrog – The facilities at Bullfrog are located midway up Bullfrog Bay, off of Utah Highway 276 and across the bay from Halls Crossing. According to a study that addressed fluctuating lake levels and recreation use, the Bullfrog Ferry Ramp became inoperable in 1989 when the lake elevation decreased to below 3675 feet msl. In addition, the Bullfrog Utility Service became inaccessible when the lake elevation decreased to below 3670 feet msl (road access was also unavailable at the slips) (Combrink and Collins, 1992). In 1993, NPS extended the boat ramp down to an operable level of 3612 feet msl (Henderson, 2000).

**Table 3.9-2
Lake Powell Shoreline Public Use Facilities**

Facility	Wahweap	Dangling Rope Marina	Halls Crossing	Bullfrog	Hite	Antelope Point *
Lodging (rooms)	375	N/A	20	56	5	200-225
Restaurant/Snack Bar	2/1	N/A/1	•/1	1/1	N/A	•
Tour boats	9	N/A	N/A	1	N/A	2
Boat slips	870	N/A	165	254	6	250-300
Mooring buoys	180	N/A	141	220	54	N/A
Rental houseboats	175	N/A	89	112	21	60
Rental small boats	150	N/A	44	50	27	60
Dry storage	450	N/A	230	750	109	•
RV park (spaces)	120	N/A	32	24	N/A	150
Marina campstore	1	1	1	1	N/A	1
Store	•	•	1	1	1	1
Boat repair	•	•	•	•	N/A	N/A
Service station	•	•	gas	•	gas	•
Parking (spaces)	2,500	N/A	300	1,575	150	220
Campground (sites)	215	N/A	64	100	6	•
Picnic (sites)	124	N/A	20	50	N/A	N/A
Day use beaches/trails	N/A	N/A	N/A	N/A	N/A	•
Launching ramps	2	N/A	1	1	1	1
Airstrip	N/A	N/A	N/A	3,500- foot, paved	2,100-foot, paved	N/A
Visitor center, cultural center	•	N/A	N/A	N/A	N/A	•
Ranger station	•	N/A	•	•	N/A	•
Employee housing	•	•	•	N/A	•	•
Concessionaire quarters	80	N/A	30	40	10	N/A
Dorm units	119	6	24	96	0	N/A
Capacity (use per day)	7,800- 10,100	2,400- 3,100	3,400- 4,400	7,900- 10,300	2,500- 3,300	N/A

Source: NPS 1979. Proposed General Management Plan and personal communication, Norm Henderson, NPS, 2000.

• indicates presence of an improvement.

N/A not applicable – indicates no improvement.

* Facilities shown are proposed. Existing facilities include an entrance station, gravel parking area, two permanent toilets, and a boat ramp. The Navajo Nation and NPS are in the process of developing the site.

Hite – The facilities at Hite are located off of Utah Highway 95. According to a study that addressed fluctuating lake levels and recreation use, the Hite Launching Ramp became inoperable in 1989 when the lake elevation decreased to below 3677 feet msl (Combrink and Collins 1992). In 1993 NPS extended the boat ramp down to an operable level of 3612 feet msl. However, the ramp area is known to be useable down to 3630 feet msl (Henderson, 2000).

Antelope Point – The facilities at Antelope Point are located off of Arizona Highway 98 on the southern side of Lake Powell. Development of Antelope Point only began recently, and data on visitation has not been collected on a formal basis. Existing facilities at the site consist of an entrance station where fees are collected, two permanent toilets, a large gravel parking area that can accommodate 220 vehicles, and a public boat ramp. The Navajo Nation, in conjunction with NPS, has plans to develop the site as a resort destination, and is in the process of selecting a master developer for the project. Facilities proposed for the site in the Development Concept Plan are listed in Table 3.9-2, above.

The existing boat ramp at Antelope Point currently extends down to 3677 feet msl. NPS provided Reclamation with construction drawings for extending the boat ramp down to 3620 feet msl as water elevation declines. The extended boat ramp would allow houseboats and other watercraft to launch down to elevations around 3625 feet msl, assuming about 5 feet of free board (Bishop, Personal Communication, 2000). NPS also provided Reclamation with a preliminary Antelope Point Marina layout drawing for reservoir elevation of 3600 feet msl, but it has not been established that a marina would be operable at this level.

Rainbow Bridge National Monument – The Rainbow Bridge National Monument is located on the south shore of Lake Powell and is bounded on three sides by the Navajo Reservation near the Utah/Arizona border. The facilities at the monument include courtesy docks, restrooms, a floating walkway, and a floating interpretive platform. Trails from the dock lead to viewing areas. One viewing area is used when Lake Powell is below the full-pool elevation of 3700 feet msl, and the other is used when the reservoir is at full-pool elevation. The docks and trail system are designed to accommodate lake level fluctuations allowed in the operation of Glen Canyon Dam and powerplants (from 3490 feet msl to 3700 feet msl) (NPS, 1993). If the lake levels fall below 3650 feet msl, the dock facilities would be moved and the old land trail through Bridge Canyon (submerged at full pool) would be hardened and used for access. The floating walkway and interpretive platforms would be removed and stored. The courtesy docks would be connected to the land trail with a short walkway (NPS, 1990). However, large quantities of silt that have been deposited where Bridge Creek flows into Lake Powell could create access problems at low water surface elevations. The large silt flats are difficult to cross with floating walkways; special construction techniques may be required to bridge these areas. At some lake elevations, it may be infeasible to maintain water access to the monument (NPS, 1993); however, the specific elevation is not known.

When Lake Powell is operated below 3700 feet msl, some of the Rainbow Bridge National Monument is within a high hazard flash flood area. The 100- and 500-year flood elevations in Bridge Creek are estimated to be 7.5 feet and 10 feet above the creek channel, respectively. For the area well upstream of Lake Powell, the trail follows the creek and is above both the 100- and 500-year floodplains. However, the trail route in the transition zone between the reservoir and creek, along the lake's edge, could be subject to water surface elevation increase, surface turbulence, and significant velocities, depending on the lake elevation at the time of flooding and the magnitude of the flood. For the lake itself, there would be little or no discernable water surface increase and the turbulence would be limited. When Lake Powell is at full operating pool, flash flood areas are well upstream of the reservoir, in the Bridge Creek Canyon drainage outside the monument.

The General Management Plan for Rainbow Bridge includes a Flash Flood Mitigation Plan. In the event of combined low pool elevations and flash flood conditions, there are four components of the mitigation plan that would be put in place. These components include: 1) a wayside exhibit with information to inform visitors of possible flash flood hazards; 2) additional signage in the flood hazard zones to alert visitors where to move in case of a flood; 3) identification of evacuation and emergency measures, including chain of command responsibilities, emergency supply locations, and support facilities; and 4) installation of a warning system that would alert visitors to evacuate.

Prior to the construction of Glen Canyon Dam, access to the area was primarily by foot. Since the creation of Lake Powell, access is now primarily by water, although the area is also accessible by trails through Navajo Mountain. Access to the monument is restricted during the recreation season in accordance with the monument's carrying capacity of 200 people at one time. In addition, access is limited daily during certain times of the day. Boat tours to the monument are allowed during the busier time of the day and originate at Dangling Rock Marina. All tours have an NPS interpreter on board to convey the monument's significance. Access during quieter times of the day is limited to five to eight private boats. During the off-season, access to the monument is unrestricted except that boat tours are managed to ensure that only one tour boat at a time is present at the monument (NPS, 1993).

3.9.2.2.2.1 Threshold Elevations

From the information presented above on reservoir pool elevations, three elevations, 3677 feet msl, 3626 feet msl and 3612 feet msl, were identified as representative threshold elevations below which shoreline facilities at Lake Powell could be affected.

The existing boat ramp at Antelope Point extends down to elevation 3677 feet msl. This elevation is identified as one of the threshold elevations for the analysis of marinas and boat ramps at Lake Powell. As discussed above, the extended boat ramp would be operable down to 3625 feet msl. The elevation of 3626 feet msl is discussed in the boating navigation and safety section (Section 3.9.3.3.1) and is considered to be

representative of the threshold elevation for the extended boat ramp. Since the minimum reservoir elevation at which the Antelope Point Marina would be operable has not yet been established, the threshold elevations of 3626 feet msl (discussed above) and 3612 feet msl (discussed below) are assumed to apply to a future marina at Antelope Point.

As discussed above, the boat ramps at Wahweap, Halls Crossing, Bullfrog, and Hite are designed to operate down to 3612 feet msl. It is not known what adjustments and capital improvement costs would be required if elevations were to decline to below 3612 feet msl. As such, 3612 feet msl is used in this analysis as the lower threshold elevation for marinas and boat ramps at Lake Powell.

The threshold elevations of 3677 feet msl, 3626 feet msl and 3612 feet msl are used to evaluate baseline conditions and the effects of interim surplus criteria alternatives on shoreline facilities at Lake Powell in the Environmental Consequences section (Section 3.9.2.3.1). The threshold elevation of 3626 feet msl is evaluated in Section 3.9.3.3.1.

3.9.2.2.3 Lake Mead Recreation Resources

Lake Mead, the reservoir created by the construction of Hoover Dam, is located in the Lake Mead National Recreation Area (LMNRA) in southern Nevada and northern Arizona. The LMNRA contains 1.5 million acres and encompasses the 100-mile-long Lake Mead, 67-mile-long Lake Mohave, the surrounding desert, and the isolated Shivwits Plateau in Arizona. At a full pool elevation of approximately 1210 feet msl, Lake Mead's surface area is 153,235 acres, the storage capacity is 25.9 maf and there are 695 miles of shoreline (USBR, 1996b). Lake Mead is the largest man-made lake in the Western Hemisphere.

LMNRA receives approximately ten million visitors annually. Typical water-based recreation activities that occur on Lake Mead include: swimming, boating, houseboating, fishing, sailboarding, paddlecraft use, scuba diving (USBR, 1996b). On average, the majority of boats are personal watercraft. There may be as many as 6000 boats combined on Lake Mead and Lake Mohave during a peak recreation use weekend. At Boulder Beach, which is located near the urbanized area of Las Vegas and surrounding communities, the personal watercraft percentage may be as high as 50 percent.

3.9.2.2.4 Shoreline Public Use Facilities at Lake Mead

Six marinas at Lake Mead provide boat launching facilities as well as slips and storage, fuel and boat launches. In addition, there are three boat ramps without associated marinas and one site without a boat ramp. The marinas include Boulder Beach, Las Vegas Bay, Calville Bay, Echo Bay, Overton Beach and Temple Bar. The boat ramps are located at Hemenway, Government Wash and South Cove. Pearce Ferry has no

boat ramp and is used as a take out by private and commercial boaters that kayak and raft the Colorado River into Lake Mead. Facilities at the six marinas are summarized in Table 3.9-3, and all of the sites are described below. If the actual number of improvements (boat slips, etc.) at the facility is known, it is included in the table; otherwise, the presence of an improvement is indicated with a bullet (•). If there are no facilities at a location, this is indicated with an “N/A” for “not applicable.” Map 3.9-2 shows the locations of both developed and undeveloped sites on Lake Mead.

**Table 3.9-3
Lake Mead Marina Public Use Facilities**

Facility	Boulder Beach/ Lake Mead Marina	Las Vegas Bay	Calville Bay	Echo Bay	Overton Beach	Temple Bar
Lodging	•	N/A	N/A	•	N/A	•
Restaurant	•	•	•	•	•	•
Tour boats	•	N/A	N/A	N/A	N/A	N/A
Marina (boat slips)	750	•	650	320	•	•
Mooring buoys	N/A	N/A	N/A	N/A	N/A	N/A
Rental houseboats	N/A	N/A	•	•	N/A	N/A
Rental small boats	•	N/A	N/A	•	N/A	•
Dry storage	•	•	•	•	•	•
RV Park (spaces)	N/A	N/A	N/A	58	N/A	7
Trailer village	•	N/A	•	69	•	111
Trailer sewage dump	•	N/A	•	•	•	•
Grocery/gift store	•	•	•	•	•	•
Gasoline/Propane	•	N/A	•	•	•	•
Boat sewage dump	•	•	•	•	•	•
Parking (spaces)	N/A	N/A	N/A	N/A	N/A	N/A
Campground (sites)	154	89	80	166	N/A	153
Picnic (sites)	•	•	•	N/A	N/A	N/A
Showers	•	N/A	•	•	•	•
Launching ramps	•	•	•	•	•	•
Airstrip	N/A	N/A	N/A	•	N/A	•
Ranger station	•	•	•	•	•	•
Self-service laundry	•	N/A	•	•	•	•
Capacity (use per day)	N/A	N/A	N/A	N/A	N/A	N/A

Source: NPS, 1995

- indicates presence of an improvement
- N/A not applicable – indicates no improvement