Technical Appendix 3

Hydrologic Resources

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Acronyms and Abbreviations

Acronym or Abbreviation	Full Phrase
1944 Water Treaty	1944 United States-Mexico Treaty on Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande
2007 Final EIS	2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead Final Environmental Impact Statement
2007 Interim Guidelines	2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead
2007 ROD	2007 Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead Record of Decision
2016 LTEMP ROD	2016 Glen Canyon Dam Long-Term Experimental and Management Plan Record of Decision
2024 Final SEIS	2024 Near-term Colorado River Operations Final Supplemental Environmental Impact Statement
2024 LTEMP ROD	Supplemental Glen Canyon Dam Long-Term Experimental and Management Plan ROD
2024 ROD	2024 Near-term Colorado River Operations Record of Decision
AAC	All-American Canal
af	acre-feet
Basin	Colorado River Basin
CCS	Continued Current Strategies
CE	current era
cfs	cubic feet per second
CRSP	Colorado River Storage Project
CRSS	Colorado River Simulation System
CY	calendar year
DCP	Drought Contingency Plan
DMDU	Decision Making under Deep Uncertainty
DROA	Drought Response Operations Agreement
EIS	environmental impact statement
EOCY	end of calendar year
EOWY	end of water year
GCNP	Grand Canyon National Park
ICS	Intentionally Created Surplus

kaf	thousand acre-feet
kafy	thousand acre-feet per year
LB Priority	Lower Basin Priority
LB Pro Rata	Lower Basin Pro Rata
Lower Basin	Lower Colorado River Basin
LROC	Long-Range Operating Criteria
maf	million acre-feet
Mexico	United Mexican States
NIB	Northerly International Boundary
Reclamation	Bureau of Reclamation
RM	river miles
ROD	Record of Decision
SEIS	Supplemental Environmental Impact Statement
SIB	Southerly International Boundary
UIU	Upper Initial Unit
Upper Basin	Upper Colorado River Basin
U.S.	United States
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WY	water year

TA 3. Hydrologic Resources

TA 3.1 Affected Environment

This section presents an overview of the hydrology of the Colorado River Basin (Basin) beginning with the full pool elevation of Lake Powell and extending downstream along the Colorado River to the Southerly International Boundary (SIB) with the United Mexican States (Mexico). It also includes groundwater that is under the direct influence of the Colorado River and the Lower Colorado River Basin (Lower Basin) reservoirs, starting with Lake Powell on the upstream end. The geography and connectivity of the hydrologic resources analysis area are the same as what was analyzed in the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead Final Environmental Impact Statement (EIS; 2007 Final EIS; Reclamation 2007a).

The Colorado River has been divided into nine distinct reaches along the study area. These reaches include the full pool Lake Powell to Glen Canyon Dam, from Glen Canyon Dam to Lake Mead at Separation Canyon (which includes the Grand Canyon National Park [GCNP]), the full pool Lake Mead (downstream of Separation Canyon) to Hoover Dam, from Hoover Dam to Davis Dam (including Lake Mohave), Davis Dam to Parker Dam (including Lake Havasu), from Parker Dam to Cibola Gage, from Cibola Gage to Imperial Dam, from Imperial Dam to the Northerly International Boundary (NIB), and from the NIB to the SIB. Refer to **Table 3-1**, Colorado River Reaches and Reach Limits in the Geographic Scope, for a description of the nine Colorado River reaches and their associated river miles and **Map 3-1**, Colorado River Reaches and Geographic Scope, for a map of the Colorado River reaches. Not included in the study area are reservoirs upstream of Lake Powell, the Salton Sea, and portions of northwestern Mexico that are operated independently.

Hydrologic resources within the study area that could potentially be affected by the implementation of any given alternative include:

- Reservoir storage, total system storage, reservoir releases, and corresponding changes in Colorado River flows downstream of the reservoirs
- Groundwater in areas adjacent to and connected to the Colorado River corridor

The overall characteristics and connectivity of the Basin remain unchanged from when the 2007 Final EIS was issued. However, since 2007, several factors have affected hydrologic resources in the Basin. These factors can be divided into two categories: operational changes in the Basin since 2007 and key environmental drivers. Refer to **Chapter 1**, Purpose and Need, **Section 1.8.2.1**, The Law of the River, for a summary of operational changes since 2007.

Worsening drought conditions have been a major driver for changes to hydrologic resources in the Basin. Since 2000, the Basin has experienced persistent drought conditions, exacerbated by a

warming climate resulting in increased evapotranspiration, reduced soil moisture, and ultimately reduced runoff. Runoff conditions in the Basin are below what was contemplated in the Record of Decision for Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead (2007 ROD) resulting in reduced reservoir storage, reservoir releases, and river flows.

TA 3.1.1 Hydrologic Overview

The Colorado River originates at the Continental Divide in Rocky Mountain National Park in Colorado and flows downstream through Utah, Nevada, Arizona, and California to Mexico, where it historically flowed into the Sea of Cortez. Major tributaries to the Colorado River include the Green, San Juan, Yampa, Gunnison, and Gila Rivers. While 85 percent of the Basin is desert and semi-arid rangelands, the remaining 15 percent is comprised of mountainous areas in Wyoming, Colorado, Utah, and New Mexico. These mountainous areas receive snow throughout the winter months, which makes up the majority, approximately 92 percent, of the Colorado River's streamflow. Mountain snowmelt in the Upper Colorado River Basin (Upper Basin) typically results in high river flows in the late spring that diminish quickly by mid-summer. The rest of the arid and semi-arid Basin historically receives fewer than 10 inches of precipitation per year. Flow in the Colorado River is highly variable from year to year because of variations in precipitation in the Basin. However, the Basin is currently experiencing a prolonged dry period resulting in extended periods of drought and record low runoff conditions.

The Colorado River Basin Climate and Hydrology: *State of the Science* report provided a comprehensive assessment of Basin hydroclimate conditions and trends through 2019 (Lukas and Payton 2020). According to the report, the Basin has experienced persistent drought conditions since 2000, exacerbated by increasing temperatures. This drought has led to a 20 percent decrease in average annual Upper Basin (at Lees Ferry Gaging Station) natural flows (Reclamation 2025a). 2000 to 2024 was the driest 25-year period in more than a century. A paleo reconstruction of Colorado River streamflow at Lee Ferry Compact Point, Arizona back to 762 current era (CE) indicates that this 24-year period is lower than any other period in the last 1,200 years (Meko et al. 2007).

These conditions have led to a cumulative streamflow deficit of about 70.0 million acre-feet (maf) relative to twentieth-century conditions (Reclamation 2025a). Historically, the primary driver for the hydrologic drought in the Basin has been below normal precipitation over the winter, resulting in reduced snowmelt in the spring, but warming temperatures are playing an increasing role as evaporative losses and soil moisture deficits increase.

Annual water use in the Basin has exceeded the annual inflows in most years since 2000. This resulted in a depletion of storage to a historic low of 24 percent of the total combined capacity of Lake Powell and Lake Mead (equivalent to approximately 12.68 maf) between March and April of 2023 (Reclamation 2025b). Since publication of the 2007 Final EIS, changes in the Basin have included further increases in temperature, ongoing years of below-normal precipitation, declining snowpack water volume and annual streamflow, and earlier snowmelt runoff. Since 2000, the average temperature across the Lower Basin has been 2.2 degrees Fahrenheit warmer than the twentieth-century average. Since 2007, the average temperature of the Lower Basin has trended upward, with the warmest 10-year period on record occurring from 2012 to 2022 (NOAA 2025).

Multidecadal trends are most informative when describing Basin precipitation due to the high interannual variability of weather events. For example, short term trends like the El Niño-Southern Oscillation can impact Lower Basin precipitation trends on a year-to-year basis. For both the Upper Basin and Lower Basin, a declining (but statistically non-significant) trend was noted over the period from 1980 to 2019. During the 1980 to 2019 period, precipitation over the cold season (October through March), which typically falls as snow, showed a greater declining trend than precipitation over the warm-season months. Because of naturally colder temperatures, snowpack at higher elevations in the Upper Basin has not been affected as much as snowpack at lower elevations; however, studies summarized in the *State of the Science* report indicate that snowmelt runoff is occurring 1–3 weeks earlier than the average timing prior to 2000.

TA 3.1.2 Upper Basin

Congress passed the Colorado River Storage Project Act in 1956, which authorized the construction of the Colorado River Storage Project (CRSP) reservoirs "to initiate the comprehensive development of the water resources of the Upper Basin, for the purposes, among others, of regulating flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods, and for the generation of hydroelectric power, as an incident of the foregoing purposes…"

In addition to Lake Powell, the CRSP reservoirs include the Upper Basin reservoirs, known as CRSP Upper Initial Units (UIU). The CRSP UIU are Flaming Gorge in Utah, Navajo in New Mexico, and Blue Mesa in Colorado. These four CRSP reservoirs were constructed in the 1960s and took several years to begin filling. Excluding surcharge space, the total storage volume of the four CRSP reservoirs is 29.5 maf.

Flaming Gorge Reservoir has a total storage capacity of 3.79 maf and from 1980 to the implementation of the 2007 ROD, the average storage capacity (as a percentage of the total capacity) of Flaming Gorge Reservoir was approximately 82 percent. From 2007 through 2024, the average storage capacity of Flaming Gorge Reservoir was 83 percent. Flaming Gorge Reservoir experienced the two lowest storage capacities from 2002 to 2004 and spring 2023 of 68 percent and 65 percent of the total capacity, respectively.

Navajo Reservoir has a total storage capacity of 1.71 maf and from 1980 to the implementation of the 2007 ROD, the average storage capacity (as a percentage of the total capacity) of Navajo Reservoir was approximately 80 percent. From 2007 through 2024, the average storage capacity of Navajo Reservoir was 71 percent. Navajo Reservoir experienced the two lowest storage capacities from 2002 to 2004 and spring 2023 of 41 percent and 49 percent of the total capacity, respectively.

Blue Mesa Reservoir is part of the Aspinall Unit in Colorado, which also includes Crystal Reservoir and Morrow Point Reservoir. Blue Mesa has the largest capacity of the Aspinall Unit reservoirs with a total capacity of 941.0 thousand acre-feet (kaf). Crystal Reservoir has a total capacity of 26.0 kaf and Morrow Point has a total capacity of 117.0 kaf. From 1980 to the implementation of the 2007

ROD, the average storage capacity (as a percentage of the total capacity) of Blue Mesa Reservoir was approximately 61 percent. From 2007 through 2024, the average storage capacity of Blue Mesa Reservoir was 56 percent. Blue Mesa Reservoir experienced the two lowest storage capacities in the winters of 2018 and 2021 of 21 percent and 22 percent of the total capacity, respectively.

Release operations under the 2019 Drought Response Operations Agreement (DROA) began in 2021 and included releases from Flaming Gorge, Navajo, and Blue Mesa. In 2022, DROA operations included releases from Flaming Gorge. In 2023, DROA operations included recovery of storage at Flaming Gorge, Navajo, and Blue Mesa (Reclamation 2024a).

While the alternatives analyzed may include the operation of reservoirs upstream of Lake Powell (CRSP UIUs) to protect Glen Canyon Dam infrastructure, these Operations are intended to remain within the scope of the existing Records of Decision (RODs) for the respective facilities. Accordingly, the Final EIS does not expand the geographic scope of analysis upstream of Lake Powell.[1]

TA 3.1.3 Lake Powell and Glen Canyon Dam

Lake Powell is a reservoir that is located primarily in southern Utah with a portion extending into northern Arizona. Inflows into Lake Powell originate from the mainstream Colorado River which is dammed near Page, Arizona by Glen Canyon Dam. The concrete arch dam was constructed from 1956 to 1964, and rises 710 feet above the bedrock of Glen Canyon. Lake Powell is relatively narrow and when it is full, stretches over 180 miles in length along the mainstream Colorado River in Glen Canyon. When full, it also includes approximately 25 miles of Cataract Canyon and 50 miles of the San Juan River. The water surface operating range of Lake Powell runs between 3,490 feet (corresponding to the minimum power pool) and 3,700 feet (corresponding to the top of Glen Canyon Dam spillway). The total live storage capacity of Lake Powell at the full pool elevation of 3,700 feet is 23.31 maf (excluding approximately 1.9 maf of Flood Control space).

The 2007 Final EIS and 2024 Final Supplemental EIS (SEIS) noted that groundwater adjacent to Lake Powell may increase or decrease in correlation with corresponding changes in pool elevations. This EIS will consider qualitative impacts on groundwater elevations adjacent to the reservoirs, including Lake Powell. The Arizona Department of Water Resources Groundwater Site Inventory website (ADWR 2025) tracks depth to water measurements for three active groundwater monitoring wells located adjacent to Lake Powell near Glen Canyon Dam. All three groundwater monitoring wells show a decreasing groundwater elevation trend beginning in the early 2000s, with the lowest groundwater elevations occurring in 2022.

Releases are typically made through the penstock intakes which are eight 15-foot diameter steel pipes that deliver water to the Glen Canyon Powerplant turbines. Releases can be made from Glen Canyon Dam from 3,490 feet down to 3,370 feet (corresponding to dead pool) through the four 8-

[1] While the Secretary will consider and prioritize operations at these facilities that are consistent with existing RODs, the Secretary retains the authority to operate outside those RODs if necessary. The modeling assumptions regarding operation of the Upper Initial CRSP Units presented in this Final EIS are not intended to, and do not, limit the Secretary's ability to operate these facilities as necessary to respond to hydrologic conditions in accordance with applicable federal law, including operations for the authorized purposes as stated in the 1956 Colorado River Storage Project Act.

foot diameter river outlet works, however, according to the 2024 Establishment of Interim Operating Guidance for Glen Canyon Dam during Low Reservoir Levels at Lake Powell Technical Memorandum, the river outlet works were not intended for long-term use at low reservoir levels (Reclamation 2024b). The cutoff elevation for routine operations of Glen Canyon Dam is considered 3,490 feet. Lake Powell also services direct water delivery to the City of Page, Arizona and the LeChee Chapter of the Navajo Nation through three different intakes, one of which can access water as low as 3,362 feet through the outlet works (Reclamation 2023a).

In 1968, the Colorado River Basin Project Act directed the Secretary to establish the Long-Range Operating Criteria (LROC) which was developed in 1970 to establish operating criteria for Colorado River reservoirs that were compliant with the Law of the River. According to the LROC "the objective shall be to maintain a minimum release of water from Lake Powell of 8.23 million acre-feet for that year." Releases above this amount only occurred if Upper Basin storage exceeded the requirements listed in Section 602(a) of the Colorado River Basin Project Act, storage in Lake Powell exceeded storage in Lake Mead, and if a spill was anticipated. Lake Powell and Glen Canyon Dam are operated consistent with the Colorado River Storage Project Act.

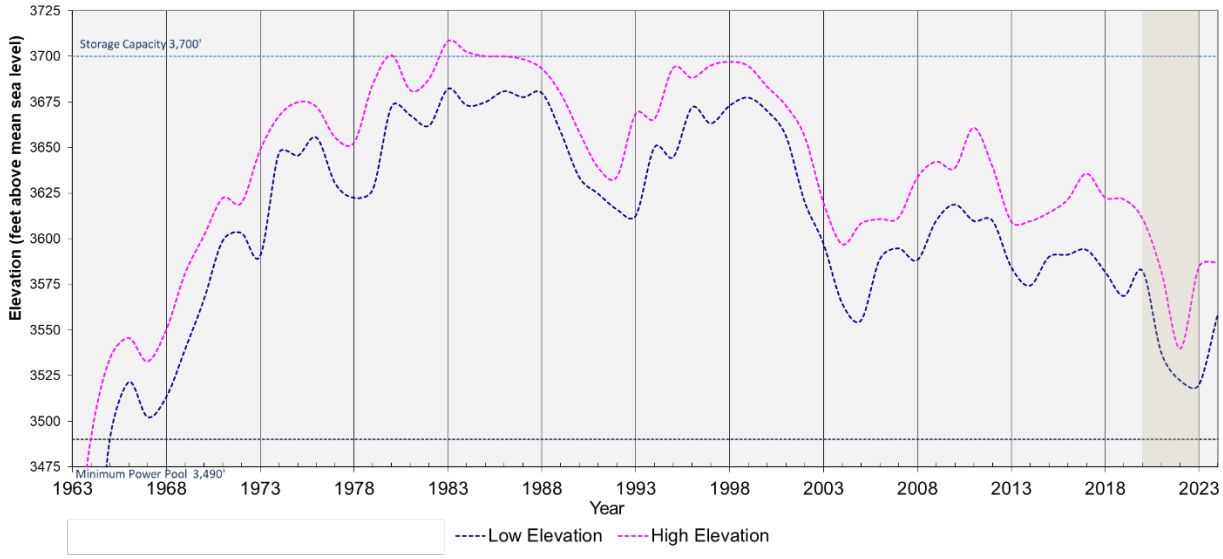
Unregulated inflows to Lake Powell from the Upper Basin vary year to year based on hydrologic conditions. According to a study that reconstructed historic conditions as far back as 600 CE, the current drought is the driest to occur since 800 CE (Wahl 2022). During the current 24-year drought period, unregulated water year (WY) inflows (the Colorado River WY refers to the period from October 1 to September 30 of the following calendar year [CY]) to Lake Powell ranged from 2.64 maf in 2002 to 15.97 maf in 2011 with an average of 8.29 maf (Reclamation 2025c). From 2020 to 2022, the Basin experienced three of the lowest consecutive inflow WYs on record, with inflows for those three years totaling around 15.5 maf (with 2021 having the lowest inflow of 3.5 maf). This continued period of drying and decrease in inflows in recent years has resulted in critically low elevations at Lake Powell.

Lake Powell began filling in 1963. The lake reached its highest elevation of 3,708.34 feet in 1983. Since Lake Powell is fed by inflows from the Upper Basin, water surface elevations are variable due to hydrologic conditions. To capture conditions since the implementation of the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead (2007 Interim Guidelines), water surface elevation data were analyzed for the years 2008 through 2025 from the Bureau of Reclamation's (Reclamation's) Upper Basin Hydrologic dataset (Reclamation 2025b). The operating range during this period was between a low of 3,519.92 feet (occurring in 2023) and a high of 3,660.9 feet (occurring in 2011). The average operating elevation since the implementation of the 2007 Interim Guidelines was 3,602.3 feet, which is well below the average elevations in the 1980s and late 1990s, which were 3,683 feet and 3,679 feet, respectively. Since 2017, the annual average water surface elevation at Lake Powell has declined by approximately 87 feet, with the two largest year-over-year declines occurring in 2021 and 2022.

Lake Powell's annual high-water elevation and annual low-water elevation for 1963 through 2024 are shown in **Figure TA 3-1**. Note that these data include changes to elevations associated with operation of Lake Powell in accordance with the 2007 ROD, the Drought Contingency Plans (DCP; Reclamation 2019; implemented starting in 2020), and the Glen Canyon Dam Long-Term

Experimental and Management Plan Record of Decision (2016 LTEMP ROD; Reclamation 2016). The shaded box indicates four consecutive low elevation years (2020-2023), including the historical minimum of 3,520 feet (excluding the 1960s when Lake Powell was filling for the first time).

Figure TA 3-1
Lake Powell Annual High and Low Elevations (1963-2024)



Source: Reclamation 2025b

As mentioned previously, 2000 to 2024 is the driest 25-year period in more than a century. The start of these drought conditions in the 2000s triggered the need to outline specific operations to provide a greater degree of certainty to Colorado River water users about timing and volumes of potential water delivery reductions during low reservoir elevations. The result was the 2007 ROD, which adopted the 2007 Interim Guidelines (in effect through 2026) for the operation of Lake Powell and Lake Mead to manage potential water delivery reductions and provide flexibility to conserve and store water in the system.

The 2007 Interim Guidelines governed annual releases from Glen Canyon Dam based on the end of water year (EOWY) surface elevations of Lake Powell and Lake Mead. Different release volumes from Glen Canyon Dam were categorized by the following assigned Operational Tiers for Lake Powell[2]:

- Equalization Tier: releases are 8.23 maf or greater (to the extent necessary) to avoid spills or equalize storage in the two reservoirs as nearly as practicable. The "Equalization Volume" is the amount of water released above 8.23 maf in this Tier
- Upper Elevation Balancing Tier: releases depend on the elevation of Lake Powell and Lake Mead at the EOWY and are either 8.23 maf, or between 7.0 maf and 9.0 maf to balance contents

[2] The operational tiers are described in more detail in Sections 6.A through 6.D of the 2007 Interim Guidelines (Reclamation 2007b).

- Mid-Elevation Release Tier: releases depend on the elevation of Lake Powell and Lake Mead at the EOWY and are either 8.23 maf or 7.48 maf
- Lower Elevation Balancing Tier: releases between 7.0 maf and 9.5 maf as needed to balance contents

Since 2008, the most common Operational Tier has been the Upper Elevation Balancing Tier, which allowed releases from 7.0 maf to 9.0 maf (see **Table TA 3-1**). Glen Canyon Dam releases since 2007 have been between 7.0 maf to 12.52 maf (averaging 8.62 maf). This annual average of 8.62 maf is 1.13 maf lower than the average annual release from 1996 to 2007 of 9.75 maf, which can be attributed to hydrologic conditions in the Basin and operations under the 2007 Interim Guidelines.

Table TA 3-1
Summary of Lake Powell and Lake Mead Coordinated Operations 2008-2024

Year	Lake Powell Operations					Lake Mead Operations
	Operational Tier	Adjustment	Operating Year Unregulated Inflow (% Average) [6]	Release Volume (maf)	Equalization Volume (maf)	Operating Condition
2008	Upper Elevation Balancing	Equalization	126	8.98	0.75	Normal/Intentionally Created Surplus (ICS) Surplus
2009	Upper Elevation Balancing	None	106	8.24 [1]		Normal/ICS Surplus
2010	Upper Elevation Balancing	None	88	8.23		Normal/ICS Surplus
2011	Upper Elevation Balancing	Equalization	166	12.52	4.29 [2]	Normal/ICS Surplus
2012	Equalization	N/A	51	9.47	1.23 [3]	Normal/ICS Surplus
2013	Upper Elevation Balancing	None	53	8.23		Normal/ICS Surplus
2014	Mid-Elevation Release	N/A	108	7.48		Normal/ICS Surplus
2015	Upper Elevation Balancing	Balancing	106	9.00		Normal/ICS Surplus
2016	Upper Elevation Balancing	Balancing	100	9.00		Normal/ICS Surplus
2017	Upper Elevation Balancing	Balancing	124	9.00		Normal/ICS Surplus
2018	Upper Elevation Balancing	Balancing	48	9.00		Normal/ICS Surplus
2019	Upper Elevation Balancing	Balancing	135	9.00		Normal/ICS Surplus
2020 [4]	Upper Elevation Balancing	None	61	8.23		Normal/ICS Surplus and DCP Contributions

Year	Lake Powell Operations					Lake Mead Operations
	Operational Tier	Adjustment	Operating Year Unregulated Inflow (% Average) [6]	Release Volume (maf)	Equalization Volume (maf)	Operating Condition
2021 [4]	Upper Elevation Balancing	None	36	8.23		Normal/ICS Surplus and DCP Contributions
2022 [4]	Mid-Elevation Release	Adjusted in May 2022	63	7.00 [5]		Level 1 Shortage and DCP Contributions
2023 [4]	Lower Elevation Balancing	Balancing	140	8.58		Level 2 Shortage and DCP Contributions
2024 [4]	Mid-Elevation Release	None	83	7.48		Level 1 Shortage and DCP Contributions
2025 [4]	Mid-Elevation Release	None	50	7.48		Level 1 Shortage and DCP Contributions

Source: Adapted from Reclamation 2024c

[1] In 2009, while the scheduled release volume was 8.23 maf, the actual release was 8.24 maf due to rounding and a release of 5,702 acre-feet (af) above 8.23. Balancing did not occur in 2009.

[2] The total 2011 equalization volume was 5.52 maf, with 4.29 maf released in operating year 2011. The remaining equalization volume was released as soon as practicable and was released fully by December 31, 2011.

[3] Although Lake Powell operated in the Equalization Tier in 2011, 8.23 maf was released in operating year 2012 due to dry conditions. The additional release of 1.23 maf was operating year 2011 equalization water released during operating year 2012. The difference between 9.47 maf and 8.23 maf is due to rounding.

[4] Supplemental data for 2020 - 2024 provided by Annual Operating Plan (Reclamation 2020, 2021, 2022a, 2023b, 2024d, 2025d, 2025e).

[5] Lake Powell's release was reduced by 480,000 af during WY 2022 in May 2022 (Reclamation 2022b).

[6] The unregulated inflow statistics (percent average) are based on a mean of the 30-year period 1991-2020 for all years (9.6 maf).

Drought conditions from 2020 to 2022 triggered the need to supplement the 2007 Interim Guidelines with near-term provisions for addressing extremely low reservoir levels. The result was the 2024 Near-term Colorado River Operations Record of Decision (2024 ROD; Reclamation 2024e), which adopted modified operations to stabilize the declining reservoir elevations while still allowing for water releases and delivery to downstream water users. Beginning in 2024, releases from Lake Powell were based on the following modified Operational Tiers:

- Equalization Tier: remains the same as the 2007 ROD (Reclamation 2007b)
- Upper Elevation Balancing Tier: remains the same as the 2007 ROD (Reclamation 2007b)
- Mid-Elevation Release Tier: remains the same as the 2007 ROD (Reclamation 2007b) except that Reclamation may reduce releases to a minimum of 6.0 maf, if needed
- Lower Elevation Balancing Tier: remains the same as the 2007 ROD (Reclamation 2007b) except that Reclamation may reduce releases to a minimum of 6.0 maf, if needed
- If Lake Powell elevations are projected to drop below 3,500 feet, Reclamation facilities may be operated in a manner that protects the Colorado River system if hydrologic conditions require such action.

Releases from Glen Canyon Dam are scheduled on an annual, monthly, and hourly basis. Any sub annual releases comply with the 2016 LTEMP ROD and Supplemental Glen Canyon Dam Long-Term Experimental and Management Plan ROD (2024 LTEMP ROD) minimum daily and hourly flows of 5,000 cubic feet per second (cfs) at night and 8,000 cfs during the day through Glen Canyon Dam (Reclamation 2016).

TA 3.1.4 Lees Ferry Gaging Station

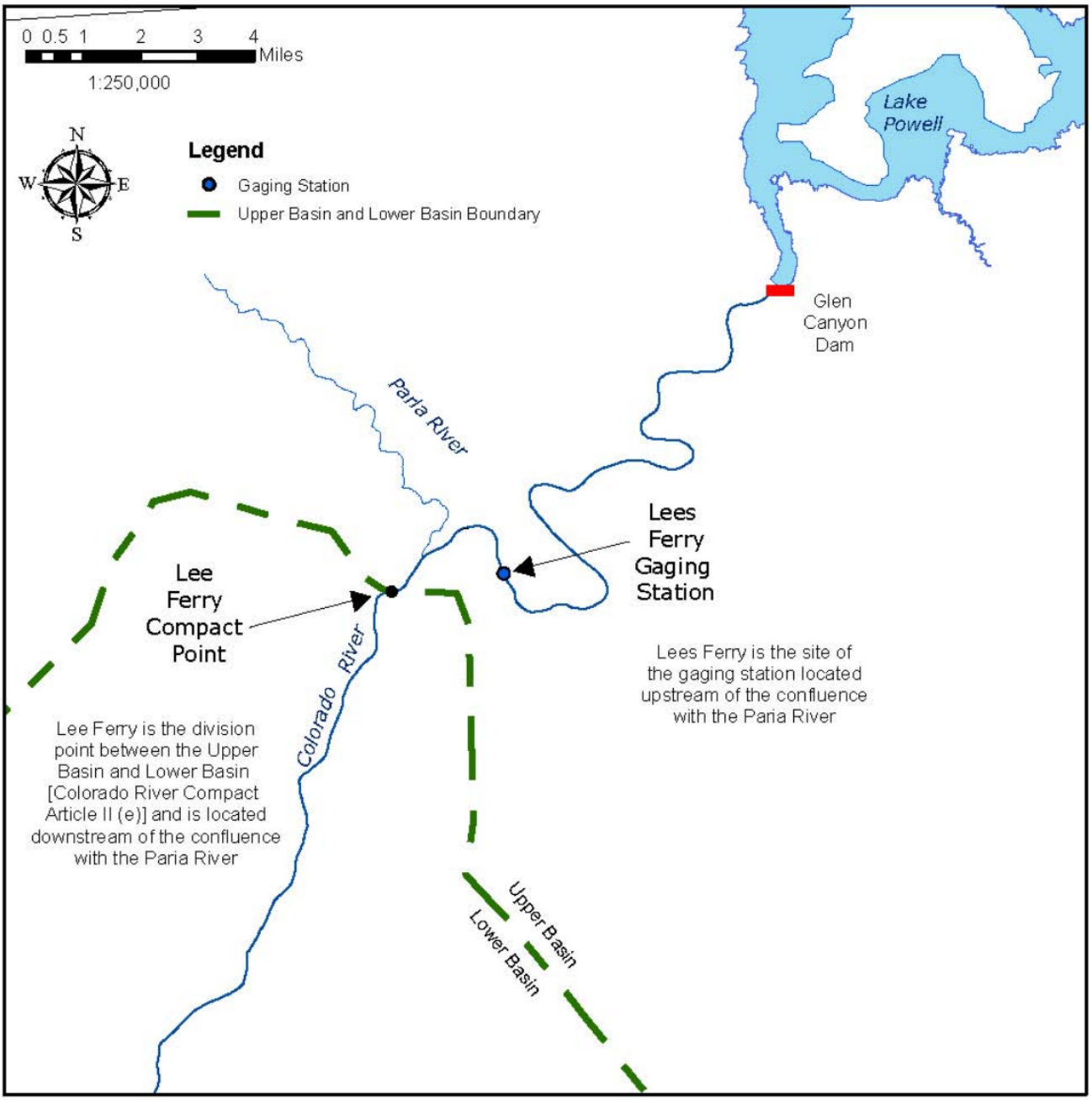
The Lees Ferry Gaging Station is located in Arizona, approximately 15.9 river miles (RMs) downstream of Glen Canyon Dam, but upstream of the confluence with the Paria River. The Lees Ferry Gaging Station differs from the Lee Ferry Compact Point, which is the division point between the Upper Basin and Lower Basin as established by the 1922 Colorado River Compact. The Lee Ferry Compact Point is located a few miles downstream of the Lees Ferry Gaging Station and is downstream of the confluence with the Paria River. **Figure TA 3-2** shows the difference between the Lees Ferry Gaging Station location and the Lee Ferry Compact Point Location.

Natural flows at Lees Ferry are calculated based on observed (gage) flow and corrected by Reclamation for upstream reservoir changes in storage and release, losses including evaporation, and depletions due to agriculture and domestic uses. The calculated natural flow record for Lees Ferry begins in 1922. Natural flows at Lees Ferry for 1906 to 1921 are also available from reconstructions using gage records in the Upper Basin.

From 1906 to 2007, the average annual natural flow at the Lees Ferry was calculated to be 14.9 maf and ranged from 5.4 maf to 24.4 maf. Since the implementation of the 2007 ROD (2008 to 2025), the annual natural flow at the Lees Ferry averaged 12.7 maf and has ranged from a low of 6.7 maf (2021) to 20.3 maf (2011). **Figure TA 3-3** shows the WY natural flows calculated at the Lees Ferry for 1906 through 2025.

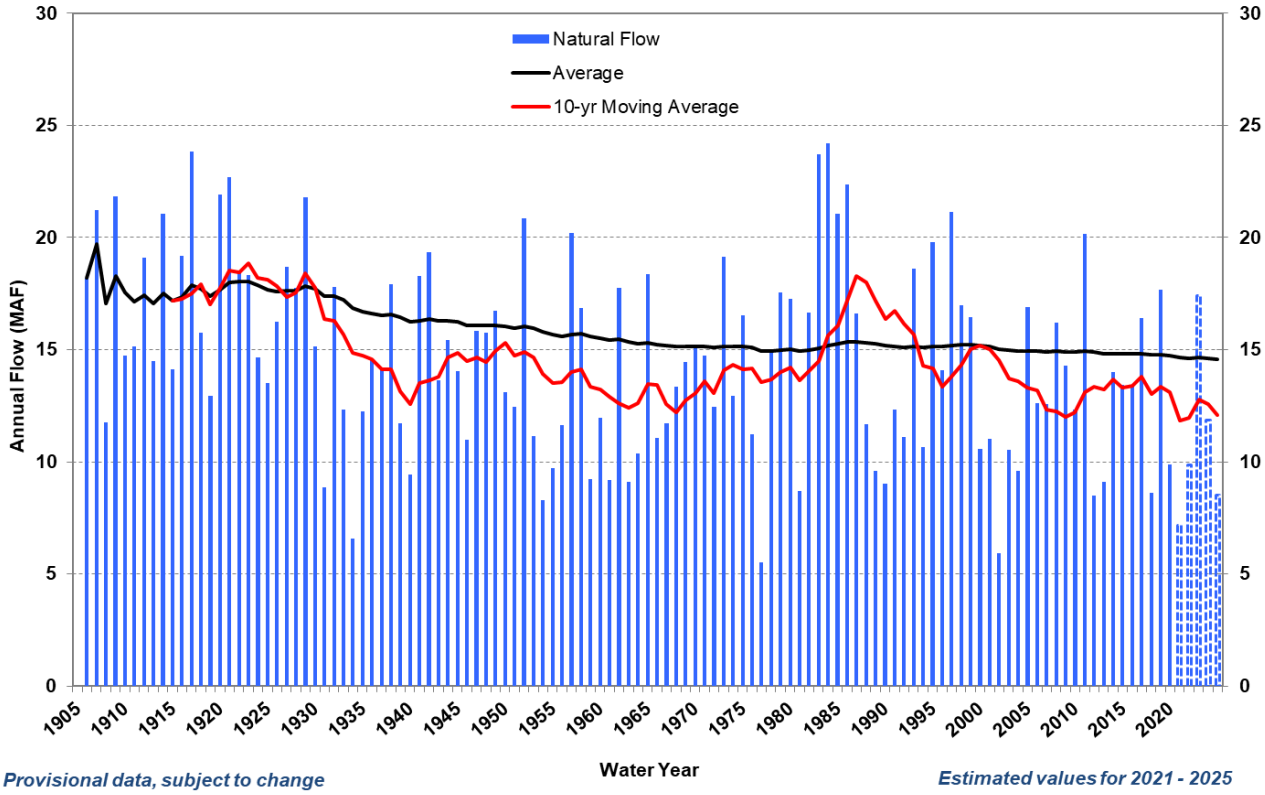
According to the 2020 *State of the Science* report, a 2-year average natural flow of less than 15.0 maf at Lees Ferry is considered a streamflow deficit (Lukas and Payton 2020). During the 1963–2007 period, the maximum 2-year average natural Lees Ferry flow was 24.0 maf in 1984. For comparison, since implementation of the 2007 ROD, the maximum 2-year average natural Lees Ferry flow was 16.27 maf in 2011. Other than the high flows in 2011, the 2-year average natural Lees Ferry flows since 2007 have been below 15.0 maf. Based on the 2020 *State of the Science* report's definition of a streamflow deficit, and the natural flow at Lees Ferry data, the system has been in a streamflow deficit since 2011 (Lukas and Payton 2020).

Figure TA 3-2
Lees Ferry Gaging Station and Lee Ferry Compact Point



Source: Reclamation 2007a

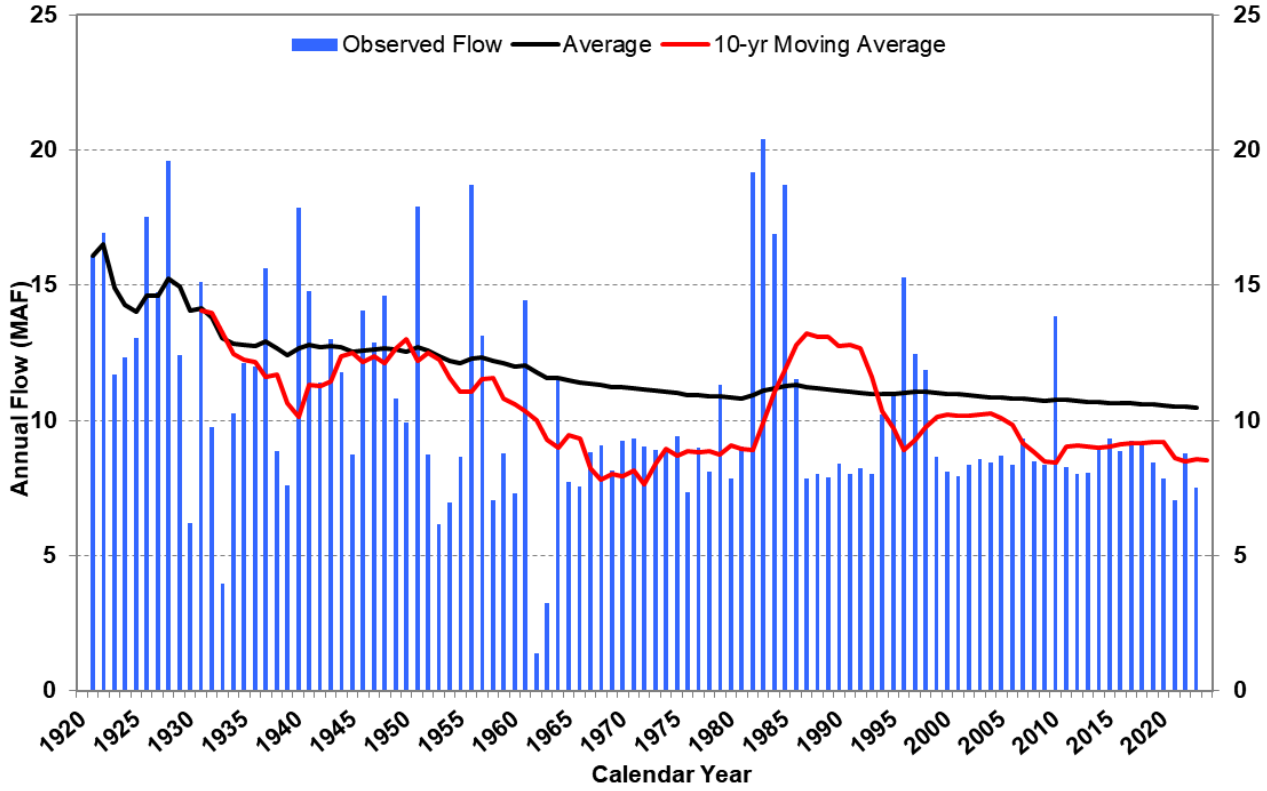
Figure TA 3-3
WY Colorado River Calculated Natural Flow at Lees Ferry Gaging Station, Arizona (1906-2025)



Source: Reclamation 2025f

The annual observed flow at Lees Ferry differs from natural flow in that it does not account for the above-mentioned factors and is simply the recorded gage data with infrastructure in place. The annual observed flow at Lees Ferry since Glen Canyon Dam was built (1963) until the 2007 ROD was implemented ranged from 1.4 maf (following when the dam was built in 1963) to 20.4 maf (1984) with an average of 9.8 maf. Since the implementation of the 2007 ROD (2008 to 2024), the annual observed flows at the Lees Ferry Gaging Station have generally decreased, ranging from 7.0 maf (in 2022) to 13.9 maf (in 2011) and averaging 8.8 maf. This average annual observed flow is approximately 1.0 maf less than the average observed flow from 1962-2007. **Figure TA 3-4** shows the observed flows recorded at the Lees Ferry for 1922 through 2024.

Figure TA 3-4
Colorado River Observed Flow at Lees Ferry Gaging Station, Arizona (1922-2024)



Source: Reclamation 2025f

TA 3.1.5 Glen Canyon Dam to Lake Mead

The narrow 292-mile reach between Glen Canyon Dam and Lake Mead flows through Marble Canyon, Glen Canyon, and GCNP. The reach through Glen Canyon is 15 miles long and the reach through the Grand Canyon reach is 277 miles long. Flows within this reach primarily consist of flow from Glen Canyon Dam releases but include contributions from perennial tributaries located between Glen Canyon Dam and Lake Mead. The two largest tributaries are the Paria River and Little Colorado River. The 95-mile long Paria River starts in the Grand Staircase-Escalante National Monument and joins the Colorado River approximately five miles downstream from Glen Canyon Dam. The 340-mile long Little Colorado River drains a region of the Colorado River watershed to the southeast of Lake Powell, including the Painted Desert. The smaller creeks entering the GCNP from side canyons include Bright Angel Creek, Shinumo Creek, Tapeats Creek, Kanab Creek, Havasu Creek, and Diamond Creek.

Based on historical United States Geological Survey (USGS) gage data, inflows from the Paria River and Little Colorado River make up approximately three percent of the total flow in this reach of the Colorado River (USGS 2025a). From 1906 to 2005, the annual inflow of the Paria River averaged 21 thousand acre-feet per year (kafy) and the Little Colorado River averaged 180.0 kafy. Since 2007, the annual inflows from the Paria River averaged 17.0 kafy and the Little Colorado River averaged 274.0

kaf. Just below the confluence of the Little Colorado River (USGS gage 09402500), the flows in Colorado River ranged from 7.56 maf to 14.24 maf (averaging 9.31 maf; USGS 2024).

The Stream Flow and Losses of the Colorado River in the Southern Colorado Plateau White Paper 5 (White Paper 5; Wang et al. 2020) stated that there is approximately 150.0 kaf a year of seepage loss around Glen Canyon Dam and this volume has remained consistent.

Downstream of Glen Canyon Dam is the incised Grand Canyon, which limits hydraulic connection to groundwater to sandbars. Debris flows from side canyons result in deposits into the Grand Canyon of boulders and sand to replenish sandbars during elevated flows. Refer to **TA 5**, Geomorphology and Sediment, for more details regarding physical geotechnical characteristics of the Grand Canyon. Effects on groundwater elevations through the Grand Canyon were not considered in the 2007 Final EIS or the 2024 Near-term Colorado River Operations Final SEIS (2024 Final SEIS). While the flows in the Colorado River would not affect groundwater in the region, changes to the groundwater systems in the Grand Canyon due to climate trends may be an additional environmental factor that affects flows in the Colorado River.

TA 3.1.6 Lake Mead and Hoover Dam

Lake Mead is a reservoir that is located on both sides of the Arizona-Nevada state line. Inflows into Lake Mead are from the Colorado River through Black Canyon, which is dammed by Hoover Dam and also from the Virgin River and Muddy River tributaries to the north of the reservoir. The concrete, thick arch dam was constructed from 1931 to 1936 and rises 726 feet as the highest concrete dam in the United States (U.S). When full, Lake Mead is 112 miles long.

The water surface elevation operating range of Lake Mead is set between 895 feet and 1,219.6 feet, with a maximum elevation of 1,229 feet. The total live storage capacity of Lake Mead at the full pool elevation of 1,219.6 feet is 26.12 maf (excluding 1.5 maf of Flood Control space).[3]

Groundwater basins adjacent to Lake Mead are generally small in size and are bound by zones of non-water bearing rock. Previous efforts in the 2007 Final EIS and 2024 Final SEIS noted that groundwater adjacent to Lake Mead may increase or decrease in correlation with changes in pool elevations. The Arizona Department of Water Resources Groundwater Site Inventory website (ADWR 2025) tracks depth to water measurements for one active groundwater monitoring well located to the south of Lake Mead, near the Detrital Wash. Groundwater elevations have remained steady since the groundwater monitoring well was installed in 1984 with the exception of two low groundwater elevation measurements in 2021 and 2022.

Beginning in 2011 and continuing for several years, Hoover Dam underwent improvements consisting of the installation of five new wide-head turbines to improve hydropower operations at lower water levels resulting in the lowering of the minimum power pool elevation from 1,050 feet to 950 feet. Low water level releases (below elevation 950 feet to elevation 895 feet) would continue through the four intake towers and penstocks but would no longer be able to be released through

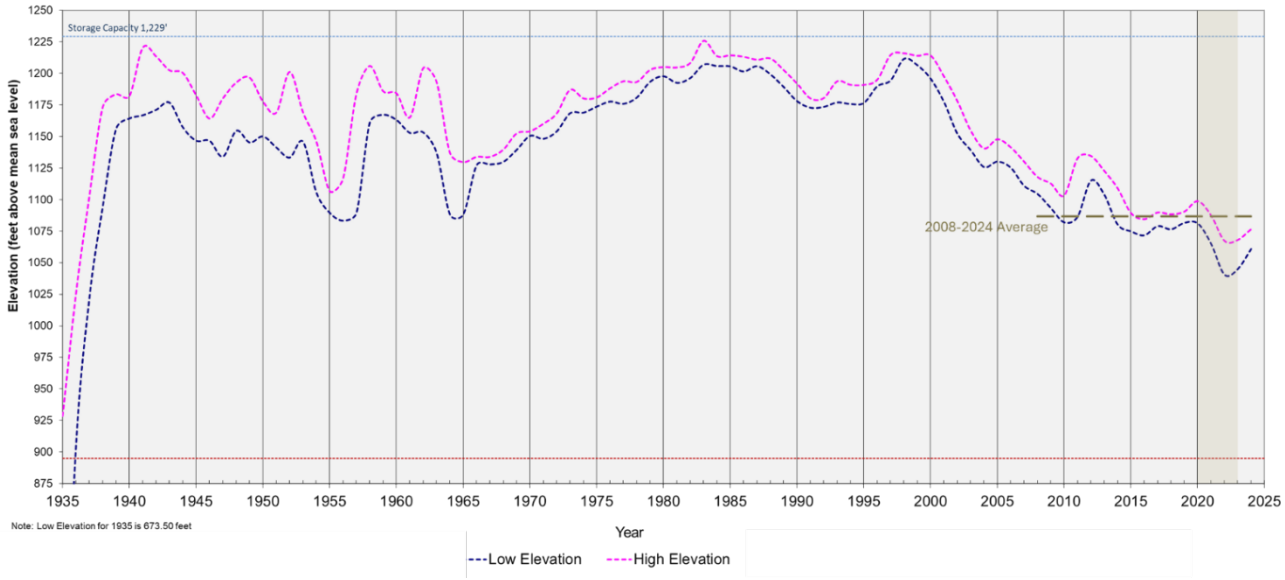
[3] Exclusive flood control space of 1.5 maf at elevation 1,219.6 feet as defined in the Field Working Agreement Between Department of the Interior, Bureau of Reclamation and Department of the Army, Corps of Engineers for Flood Control of Hoover Dam and Lake Mead, Colorado River, Nevada-Arizona, February 8, 1984.

the hydropower turbines; instead, below 950 feet, water would only be released through the river outlet works. When elevations drop below 895 feet (referred to as dead pool), water is no longer able to be delivered downstream from Hoover Dam.

Lake Mead took approximately four years to fill to an average annual water surface elevation of 1,172 feet following the construction of Hoover Dam in 1936, but levels were highly variable. From 1939 to 1963, until Glen Canyon Dam and Lake Powell came online, the reservoir's water surface elevation fluctuated from 1,098 feet to 1,195 feet. Average annual peak elevation steadied in 1983 at 1,215 feet, then decreased through the late 1980s and early 1990s. In 1998, the average annual elevation peaked again at 1,214 feet before sharply declining to a new low of 1,118 feet in 2007. From 1939 to 2007, the average annual water surface elevation of Lake Mead was 1,170 feet.

Since 2007, water surface elevations at Lake Mead have generally declined. Reclamation's hydrologic database collected water surface elevation data from 2008 through 2024 which showed that the average annual operating range was between 1,040.6 feet (2022) and 1,134.5 feet (2011). The average annual operating elevation was 1,086.8 feet, approximately 83.2 feet lower than the historical average annual from 1939 to 2007. **Figure TA 3-5** shows the annual high-water elevation and annual low-water elevation of Lake Mead from 1935 to 2024 with the average elevation of 1,086.8 feet from 2007 to 2024 shown as a dashed line, for reference.

Figure TA 3-5
Lake Mead Annual High and Low Elevations (1935-2024)



Source: Reclamation 2025b

The Compact apportioned 7.5 maf of water per year for beneficial consumptive use to the Lower Division States. The LROC established operating criteria for Colorado River reservoirs including criteria for Normal, Surplus, and Shortage operating conditions at Lake Mead pursuant to Section II(B) of the Supreme Court Decree in *Arizona v. California* 1964 and the 2006 Consolidated Decree.

Prior to the 2007 ROD, there were no objective criteria to reduce deliveries to Lower Basin water users below normal apportionment.

The 2007 ROD also adopted criteria for storing and delivering conserved Colorado River system and non-system water in Lake Mead. Water conserved under this program is called Intentionally Created Surplus (ICS). The program allowed for additional flexibility in meeting water needs during drought and bolstered Lake Mead during low reservoir conditions. The 2019 DCP modified and expanded the original ICS program. Since the 2007 ROD, Lake Mead has operated on a normal/ICS condition each year from 2008 through 2021 (refer to **Table TA 3-1**, Summary of Lake Powell and Lake Mead Coordinated Operations 2008-2024, above for Lake Mead's operating condition). In 2022, Reclamation declared the first ever Level 1 Shortage Condition for Lake Mead. Hydrologic conditions worsened and Lake Mead operated at a Level 2 Shortage Condition in 2023. In 2024 and 2025, Lake Mead operated in a Level 1 Shortage Condition. From 2020 through 2025, contributions from the Lower Basin DCP were required when the elevation of Lake Mead was below elevation 1,090 feet.

2007 Interim Guidelines shortage, DCP contributions, and ICS activity since the 2007 ROD have contributed to decreases in Hoover Dam releases. Annual Hoover Dam releases from Lake Mead ranged from 8.275 maf to 12.781 maf (averaging 10.199 maf) from 1996 through 2007 but have since ranged from 8.515 maf to 9.615 maf (averaging 9.185 maf) from 2008 through 2024.

Hoover Dam releases are managed on an hourly basis to maximize the value of generated power by providing peaks during high-demand periods. Releases from Hoover Dam are also based on Flood Control regulations are directed by the U.S. Army Corps of Engineers (USACE). Approximately 1.5 maf of space must be reserved within Lake Mead at all times exclusively for Flood Control purposes.

TA 3.1.7 Hoover Dam to Lake Mohave

The 67-mile reach from Hoover Dam (Lake Mead) to Davis Dam forms Lake Mohave. The upper part of this reach consists of Pyramid Canyon, El Dorado Canyon, and Black Canyon. The steep walls of these canyons bound most of this reach. The narrow Lake Mohave is less than four miles across its widest point. The lake creates some minor side washes but flow within this reach is almost entirely comprised of releases from Hoover Dam (Reclamation 2007a).

Since the issuance of the 2007 ROD, releases from Hoover Dam have decreased to meet monthly elevation targets, resulting in lower river flows through this reach. The 2007 Interim Guidelines have reduced average annual releases from Hoover Dam by approximately 1.014 maf (annually averaging 9.185 maf).

The target water surface elevation range of Lake Mohave and Davis Dam were not affected by the 2007 Interim Guidelines, with target water surface elevation levels between elevation 633 feet to 645 feet. Lake Mohave generally reaches its lowest elevations in the fall as Reclamation aims to provide Flood Control capacity for runoff that results from hurricane-type storms from Baja California, Mexico. Lake Mohave generally reaches its highest elevations in the spring. The average storage in Lake Mohave has remained constant at approximately 1.6 maf over the past few decades, with an

average annual water surface elevation of approximately 640.8 feet from 1996 to 2007 and 640.9 feet since 2008.

With Black Canyon located directly downstream of Hoover Dam, the bedrock canyon limits the connection to groundwater with a few small sandbars. The 2007 Final EIS identified no anticipated impacts on the groundwater basins from the 2007 Interim Guidelines.

TA 3.1.8 Davis Dam to Lake Havasu

The 84-mile reach from Davis Dam to Parker Dam forms Lake Havasu, which provides a forebay and desilting basin that pumps water for delivery to the Metropolitan Water District of Southern California and Central Arizona Project service areas. Minor tributaries are located above the reservoir, but flow in this reach primarily consists of releases from Davis Dam.

Bill Williams River, the largest of the tributaries in this reach, flows directly into Lake Havasu. The small inflows (on the order of 50 cfs) from this tributary flow and are regulated by the USACE operations of Alamo Dam. Based on historical USGS gage data, from 1906 to 2007, the annual inflow ranged from 1,300 af to 702,000 af and averaged 102,000 af (USGS 2025b). Flood Control operations at the Alamo Dam occasionally contribute to increased flows to Lake Havasu. The 2007 Interim Guidelines did not affect these operations. Annual Alamo Dam releases from 2008 to 2022 have ranged from 15.4 af to 501,900 af and averaged 105,000 af. Bill Williams River flow contributions to the reach have remained unchanged.

Parker Dam is operated under the same rule curve that sets end-of-month target elevations as prior to the 2007 Interim Guidelines, maintaining Lake Havasu's water surface elevation between 445 and 450 feet. Seasonal adjustments to the reservoir's water surface elevation allow for Flood Control in the fall and higher water levels in the spring. The average annual elevation was 447.5 feet from 1996 to 2007, and approximately 447.7 feet from 2008 to 2022, remaining consistent for the last several decades.

This reach flows through two separate groundwater basins separated by the bedrock Topock Narrows: the Mohave Valley (north) and Chemehuevi Valley (south). Based on the 2007 Final EIS hydrologic and hydraulic models, the Mohave Valley aquifer, which is mostly alluvial fill, groundwater elevations were assumed to have decreased by approximately 0.25 feet since 2007. Water levels in the Chemehuevi Valley groundwater basin are assumed to have remained relatively consistent since 2007.

TA 3.1.9 Parker Dam to Cibola Gage

The 105-mile reach starting at Lake Havasu's Parker Dam is bounded on the downstream end by Reclamation's Cibola Gage. This reach primarily consists of releases from Parker Dam, which is considered the last major storage facility on the Colorado River.

Parker Dam releases are scheduled on a daily and hourly basis to meet demand for power while supplementing water supply downstream. The 2007 Interim Guidelines did not explicitly target Parker Dam operations but have resulted in decreased annual release rates since implementation. Current minimum releases of the dam are 1,600 cfs daily, 1,400 cfs hourly, releasing 95,000 af during

a 30-day month. The 2007 Final EIS stated Parker Dam releases from Lake Havasu ranged from 6.19 maf to 10.3 maf (averaged 7.4 maf) from 1996 to 2007. Since 2008, annual dam releases ranged from 6.2 maf to 6.7 maf (averaged 6.4 maf) through 2022. The average annual Parker Dam releases decreased by 1.0 maf post-implementation of the 2007 Interim Guidelines.

Two major diversion dams located in this reach are Headgate Rock Dam and Palo Verde Diversion Dam. The impoundments of these dams are used to facilitate the diversion of water for the Colorado River Indian Tribes and the Palo Verde Irrigation District. Current reservoir operations keep these reservoir levels at constant elevations.

The only large groundwater basin (mostly alluvial fill) within this reach is referred to by separate valley names: Parker Vally, Cibola Valley, and Palo Verde Valley. The 2007 Final EIS determined that groundwater elevations would decrease by approximately 0.15 feet to 0.30 feet in these areas based on hydrologic and hydraulic models and corresponding reductions in river flow. Therefore, groundwater levels have been assumed to have decreased since 2007 due to a decreasing trend in river flows.

TA 3.1.10 Cibola Gage to Imperial Dam

The 38-mile reach from Cibola Gage is bounded on the downstream end by Imperial Dam. Flows in this reach are primarily comprised of releases from Parker Dam. Imperial Dam is located approximately 18 miles northeast of Yuma, Arizona and provides enough increase in water surface elevation for gravity flow diversions to the All-American Canal (AAC) and the Gila Main Canal. The 2007 Interim Guidelines did not affect these diversions.

The Imperial Dam impoundment operates at a nearly constant elevation to meet water delivery requirements. The 2007 Interim Guidelines did not change operations of Parker Dam, but annual releases have decreased since 2008 due to decreased upstream releases from Lake Powell and Lake Mead, which translated to decreased inflows into Lake Havasu. Average flow rates in this reach ranged from 1,488 cfs to 18,168 cfs (averaged 8,931 cfs) from 1996 to 2007, and from 2,224 cfs to 18,751 cfs (averaged 7,632 cfs) since 2008. The reach has seen an average decrease of 1,299 cfs.

This reach is located in a narrow alluvial fill valley without irrigated agriculture, and many backwaters are located in the southern half of the reach. Groundwater elevations are assumed to have decreased in this reach since 2007.

TA 3.1.11 Imperial Dam to NIB

The 26-mile reach extends from Imperial Dam to the NIB between the U.S. and Mexico. The channel of the Colorado River through this reach is bounded by a system of levees. Flow through this reach is comprised of water released from Imperial Dam to make downstream deliveries, water leaked from the California sluiceway gates and return flow from Imperial Dam diversions.

Imperial Dam was constructed to raise the water surface elevation enough to provide gravity-controlled flow into the AAC on the California side and the Gila Gravity Main Canal on the Arizona side to meet water deliveries. The AAC diverts water for the Imperial Irrigation District, the

Coachella Valley Water District, the Yuma Project, and the City of Yuma. The AAC also has a desilting works used to remove sediment from the Colorado River prior to diversion into the AAC. The Gila Gravity Main Canal diverts water for Gila Valley, Yuma Mesa, and the Wellton-Mohawk area. Imperial Dam also regulates deliveries to Mexico.

Downstream of Imperial Dam, in the upper portion of the reach, flows are typically around 250 cfs to 350 cfs. Laguna Dam is located approximately 5 miles downstream from Imperial Dam and was initially constructed to divert water to the Yuma Project area. However, since the AAC was built, Laguna Dam has been used as a regulating structure to manage sluicing flows from Imperial Dam and to protect the toe of Imperial Dam. Approximately 9 miles downstream from Laguna Dam is the confluence with Gila River, which is a major tributary to the Colorado River.

The 2007 ROD did not affect the operations and flows in the upper portion of this reach. The Yuma Valley groundwater basin and the South Gila Valley groundwater basin were also not anticipated to be affected from the 2007 Interim Guidelines. Reclamation assumed that groundwater levels have remained essentially the same since 2007.

TA 3.1.12 NIB to SIB

The Morelos Diversion Dam, located 1.1 miles downstream of the NIB, impounds the majority of the water supply that is diverted by Mexico into the Reforma Canal. The dam is owned, operated, and maintained by Mexico per the 1944 United States-Mexico Treaty on Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande (1944 Water Treaty). The dam's flow in the limitrophe to the SIB consists of water in excess of Mexico's scheduled delivery due to Flood Control operations at Hoover Dam, seepage from Morelos Diversion Dam, irrigation return flows, groundwater inflow, and any water released for environmental purposes in the Colorado River Delta.

To ensure the annual 1.5 maf water delivery under Normal Conditions per the 1944 Water Treaty, the Morelos Diversion Dam operations have not changed as a result of the 2007 ROD or the 2024 ROD. In Minute 323 to the 1944 Water Treaty, Mexico agreed to reductions and savings under low elevation reservoir conditions. Refer to **Appendix N**, International Border Region of the Colorado River, for more details related to an overview of previous binational coordination efforts.

The Flood Control releases from Lake Mead and Hoover Dam upstream are largely dependent on hydrologic conditions and therefore have potential impacts. The average flows to Mexico in excess of the required delivery volume were approximately 114,081 af from 1974 to 2012, until Warren H. Brock Reservoir was built to reduce excess flows at the NIB. Prior to completion, the 10-year annual average flow from 2003 to 2012 was 82,853 af. Since completion of the reservoir, flows in excess of the required delivery volume have decreased by approximately two thirds, or by 56,000 af, per year. Additionally, considerations for hydrologic conditions, rainfall events, and other operational variables are relevant to the volume of flows in excess of the required delivery volume.

This reach is in the Colorado River Delta groundwater basin and is referred to as the limitrophe. It is characterized as a dry or minimally flowing streambed with an annual rainfall of less than three inches. Flows in this reach can be from releases from Morelos Diversion Dam, various wasteway

discharges from the Yuma area irrigation system, or from nearby agricultural fields percolating into the hyporheic zone and subsurface alluvium.

Due to high groundwater levels in adjacent irrigated fields, the upper portion of the limitrophe is a gaining reach that receives perennial inflow from the groundwater basin. Depths to groundwater increase in the southern portions of the limitrophe reach, towards the SIB, which is considered a losing reach. Groundwater elevations in this reach dropped around 27 feet between 1960 and 2009 (refer to **Appendix N**, International Border Region of the Colorado River, for more details related to the affected environment description for the border region).

TA 3.2 Environmental Consequences

This section provides an analysis of the extent and magnitude of potential impacts on hydrologic resources under the No Action Alternative, four action alternatives (as described in **Appendix S**), the Continued Current Strategies (CCS) Comparative Baseline (as described in **Chapter 3 , Section 3.2.3**), and the Representative Preferred Alternative (as described in **Chapter 2**).

As discussed in **Chapter 2**, the Preferred Alternative is a multi-year decision framework that establishes the process and criteria that would govern development and adoption of operating guidelines through 2036. The decision framework is anticipated to be implemented in two-year operating intervals. Unlike other alternatives, the operating guidelines for each interval are not specified in this Final EIS. The sideboards provide a basis for assumptions included in the Representative Preferred Alternative which captures the range of operating guidelines that may be adopted during each interval, but exact operations would be subject to the guidelines in place during each interval.

Methodology

Reclamation uses the Colorado River Simulation System (CRSS) model for long-term planning studies. CRSS simulates Basin conditions decades into the future (the full analysis period is through 2060) and can be used to account for hydrological uncertainty. CRSS is a monthly time-step model that produces reservoir elevations, releases and river flows as outputs. Refer to **Appendix A**, CRSS Model Documentation, for more details related to model documentation. Analysis in this appendix uses output from CRSS.

Decision Making under Deep Uncertainty (DMDU) is the approach used for quantitative analysis. It is a non-probabilistic evaluation framework that compares alternatives based on their ability to meet specific performance criteria in many potential future conditions and analyzes how the alternatives respond to specific hydrologic conditions. Additional background and technical details about the DMDU framework are provided in **Appendix E**, DMDU Overview and Approach.

Throughout the analysis there are three standard figures: conditional boxplots, robustness heatmaps, and vulnerability bar plots. Each type of figure explains key information regarding performance. When taken together, the figures provide a full picture of how the alternatives compare and whether significant negative impacts are reasonably foreseeable under each alternative. The conditional

boxplot figures show how the alternatives respond to different categories of preceding hydrology and enable a comparison of alternatives in specific hydrologic conditions (e.g., average conditions or dry conditions). To create these figures, all 34 years (2027–2060) from all 400 simulated futures (13,600 data points per alternative) are separated into five categories based on their preceding 3-year average Lees Ferry natural flow. Robustness heatmaps show the alternatives' ability to meet different levels of performance over one or more decades in the wide range of potential future conditions used in the analysis. Vulnerability bar plots provide complementary analysis to the robustness heatmaps by identifying the specific hydrologic conditions in which each alternative is likely to succeed or fail the preferred minimum performance level. For more information about these figures and detailed interpretation guidance, see **Chapter 3**, **Section 3.2.6**

Impact Analysis Area

The geographic scope of the hydrologic resources analysis is the Colorado River corridor from the upstream limits of full pool elevation of Lake Powell to the downstream limits of the SIB. Reservoirs upstream of Lake Powell are operated pursuant to their own RODs, which are not altered by the proposed alternatives.

Assumptions

The hydrologic resources results are direct outputs from CRSS. Refer to **Appendix A**, CRSS Model Documentation, for more details related to model assumptions and documentation. All action alternatives except for the Basic Coordination Alternative incorporate mechanisms related to the storage and delivery of conserved water in Lake Powell and/or Lake Mead (see **Appendix S**, Additional Description of Alternatives). Unless otherwise specified, impacts reflect modeling assumptions about voluntary conservation behavior.

Impact Indicators

The following indicators were used to assess impacts on hydrologic resources:

- **Reservoir elevations**: impacts on reservoir elevations due to operational activities
- **System storage**: impacts on system storage due to operational activities
- **Reservoir releases:** impacts on reservoir releases due to operational activities
- **River flows:** impacts on river flows due to operational activities
- **Groundwater**: qualitative impacts on groundwater adjacent to reservoirs and river reaches due to operational activities

TA 3.2.1 Issue 1: Reservoir Elevations

Issue 1 addresses how operational activities for the various alternatives would affect reservoir elevations. This includes comparing the various action alternatives to the No Action Alternative and the CCS Comparative Baseline for the following metrics:

- Lake Powell pool elevations
- Lake Mead pool elevations
- Impacts of modeling assumptions for Upper Basin and Lower Basin conservation activity on Lake Powell and Lake Mead storage

Lake Powell

This section presents a comparison of the No Action Alternative, CCS Comparative Baseline, and action alternatives with respect to EOWY and minimum water year elevations at Lake Powell. Note that the performance of the Lower Basin Priority (LB Priority) approach and the Lower Basin Pro Rata (LB Pro Rata) approach under the Supply Driven Alternative will not differ in Lake Powell elevations because they use the same operation of Lake Powell. Critical Lake Powell elevations are listed in **Table TA 3-2** below. The total live storage capacity of Lake Powell at the full pool elevation of 3,700 feet is 23.31 maf (excluding approximately 1.9 maf of Flood Control space).

Table TA 3-2
Critical Elevations at Lake Powell

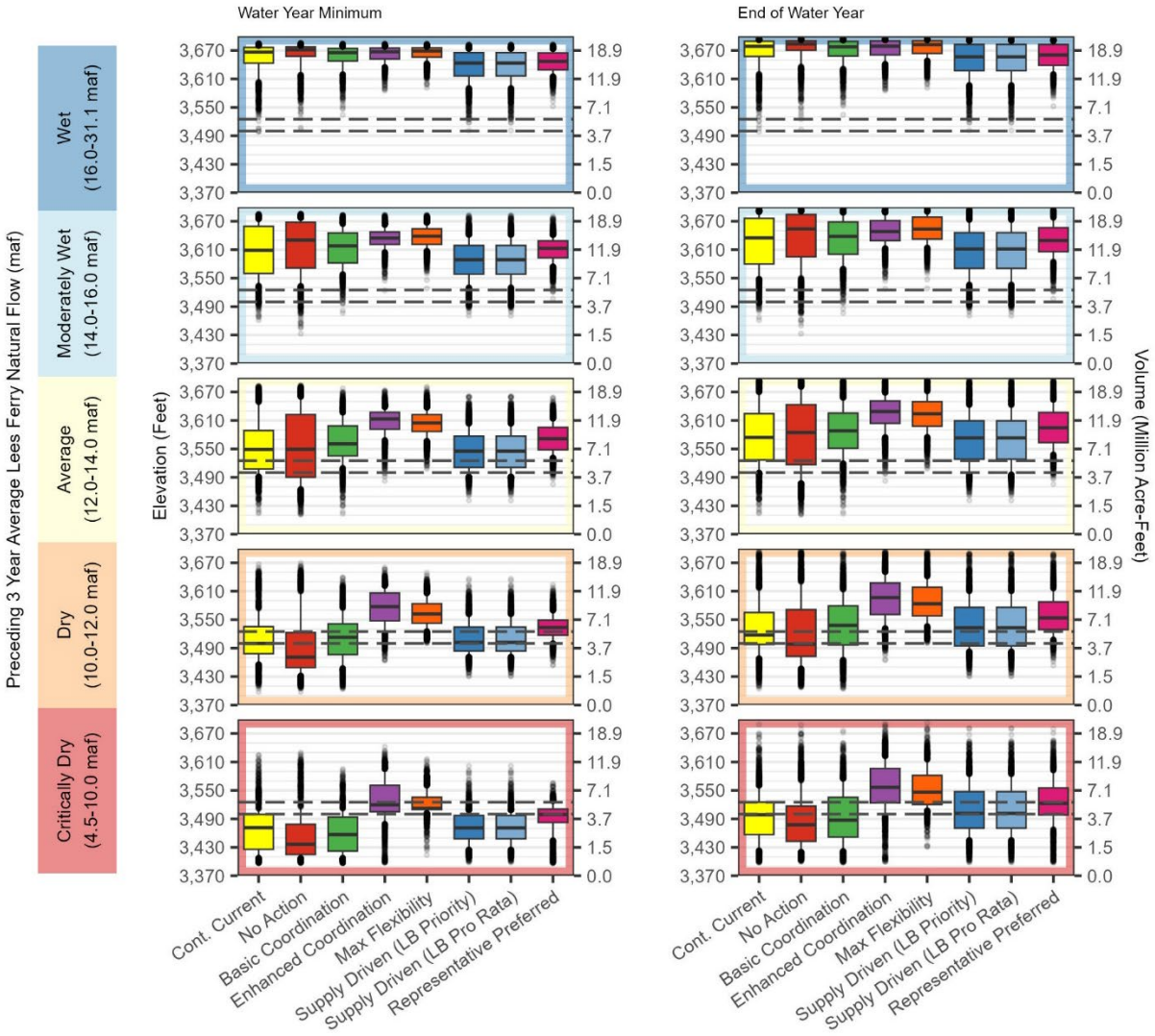
Critical Condition	Associated Elevation	Description of Critical Elevation
Spillway	3,700 feet	Top of Glen Canyon Dam spillway
Spill Avoidance	3,680 feet	At high elevations, releases deviate from the planned release for spill avoidance and infrastructure protection. Capacity between this elevation and the top of the spillway allows for 1.9 maf of Flood Control storage
Buffer Elevation	3,525 feet	35-foot buffer elevation above 3,490 feet; may trigger additional (within Record of Decision) releases from CRSP UIUs (Flaming Gorge, Navajo, and Blue Mesa Reservoirs) for certain alternatives
Buffer Elevation	3,500 feet	10-foot buffer elevation above 3,490 feet
Minimum Power Pool	3,490 feet	Water can only be released through the river outlet works below this elevation; no longer able to produce hydropower at Glen Canyon Dam; releases below this elevation are constrained; extended operations through the river outlet works may cause cavitation damage, tailrace scour and sediment deposition, and could compromise the reliability and operational flexibility of Glen Canyon Dam and affect the ability to meet critical downstream water supply needs
Dead Pool	3,370 feet	No longer able to release water downstream through Glen Canyon Dam

Figure TA 3-6 presents conditional boxplots of the minimum WY elevations and EOWY elevations at Lake Powell (feet) under varying hydrologic conditions, defined by the preceding three-year average of Lees Ferry natural flow. The figure shows how the alternatives perform across these flow categories. See **Table TA 3-3** and **Table TA 3-4** at the end of this TA for the full statistical summaries, including the maximum, 90th percentile, 75th percentile, median, 25th percentile, 10th percentile, and minimum elevations (feet). **Figure TA 3-6** visualizes the same data as **Table TA 3-3** (left column) and **Table TA 3-4** (right column) using two side-by-side conditional box plot panels. The bold center line of each box represents the median value. The bottom and top of each box captures the 25th to 75th percentile of the modeled results, respectively. The lines extend to the 10th and 90th percentiles, and outliers are shown as dots.

In each flow category shown in the box plots, the critical elevation thresholds of 3,525 feet and 3,500 feet are identified with dashed lines. These elevations are important because they provide a 10-foot and a 35-foot buffer above 3,490 feet - the elevation below which water can only be released through the river outlet works. Operating below 3,490 feet limits the volume of water that can be

released, since water can only pass through the river outlet works. As described in **Chapter 1**, Purpose and Need, **Section 1.8.4.1**, there are infrastructure concerns associated with the uncertainty of extended operations through the river outlet works as the sole means of sustained water releases from Glen Canyon Dam that could compromise the reliability and operational flexibility of Glen Canyon Dam and affect the ability to meet critical downstream water supply needs. There are additional impacts to hydropower associated with operating below 3,490 feet as this is minimum power pool.

Figure TA 3-6
Water Year Minimum and End of Water Year (EOWY) Elevations and Storage Volumes of Lake Powell



In the Average Flow Category for EOWY elevations, the 25th, 50th, and 75th percentiles (hereafter, 25th-75th percentiles) for all alternatives and the CCS Comparative Baseline remains above 3,500 feet. Similarly, all alternatives and the CCS Comparative Baseline have 25th-75th percentiles that

remain above 3,525 feet except for the No Action Alternative, which has a 25th percentile elevation of 3,517 feet. The Enhanced Coordination and Maximum Operational Flexibility Alternatives have higher, less variable results centered around 3,625 feet, while the CCS Comparative Baseline and the No Action, Basic Coordination, Supply Driven (both LB Priority and LB Pro Rata approaches), and Representative Preferred Alternatives have median elevations around 3,580 feet.

In drier flow categories, the median EOWY elevations for the CCS Comparative Baseline and the No Action and Basic Coordination Alternatives shift notably toward and below 3,500 feet, with the 25th-75th percentiles for the CCS Comparative Baseline and the No Action Alternative falling below 3,525 feet in the Critically Dry Flow Category (4.5-10.0 maf). The Enhanced Coordination and Maximum Operational Flexibility Alternatives show less of a decline across all flow categories; even in the Critically Dry Flow Category the 25th-75th percentiles for both remain above the critical threshold of 3,500 feet, with median reservoir elevations of 3,557 feet and 3,546 feet, respectively. In the Critically Dry Flow Category, median EOWY elevations shift below 3,500 feet for the Basic Coordination Alternative (3,487 feet), the No Action Alternative (3,478 feet), and the CCS Comparative Baseline (3,499 feet).

In the Dry Flow Category (10.0-12.0 maf) for EOWY elevations, the Representative Preferred Alternative has a median elevation of 3,554 feet with 25th and 75th percentiles of 3,529 feet and 3,588 feet, respectively. In the Critically Dry Flow Category for EOWY elevations, the Representative Preferred Alternative has a median elevation of 3,523 feet and decreasing variability, with 25th-75th percentiles spanning from 3,498 feet to 3,555 feet. With respect to the buffer elevation of 3,500 feet, the Representative Preferred Alternative remains above this threshold in more than 90 percent of years in the Dry Flow Category and in nearly 75 percent of years in the Critically Dry Flow Category; with respect to the buffer elevation of 3,525 feet, the Representative Preferred Alternative remains above this threshold in about 75 percent of years in the Dry Flow Category and nearly 50 percent of years in the Critically Dry Flow Category.

For the WY minimum panel, the comparisons across alternatives and flow categories are the same as in the EOWY elevations panel, but the distributions of elevations shift lower since Lake Powell generally reaches its minimum elevation in March before spring runoff begins and elevations increase by EOWY.

The alternatives and CCS Comparative Baseline generally perform similarly under Wet and Moderately Wet Flow Categories (16.0-31.1 maf and 14.0-16.0 maf), except for the Supply Driven Alternative (both LB Priority and LB Pro Rata approaches) which has a lower median reservoir elevation. Performance deviations increase under drier conditions because operations at lower elevations vary widely across alternatives.

In the Dry Category for WY minimums, the Representative Preferred Alternative has a median elevation of 3,534 feet and an interquartile range (32 feet, calculated as 75th percentile minus 25th percentile) which is the smallest of any alternative. In the Critically Dry Flow Category for WY minimums, the Representative Preferred Alternative has a median elevation of 3,499 feet. With respect to the buffer elevation of 3,500 feet, the Representative Preferred Alternative remains above this threshold in 90 percent of years in the Dry Flow Category and about 50 percent of years in the

Critically Dry Flow Category; with respect to the buffer elevation of 3,525 feet, the Representative Preferred Alternative remains above this threshold in about 50 percent of years in the Dry Flow Category and about 10 percent of years in the Critically Dry Flow Category.

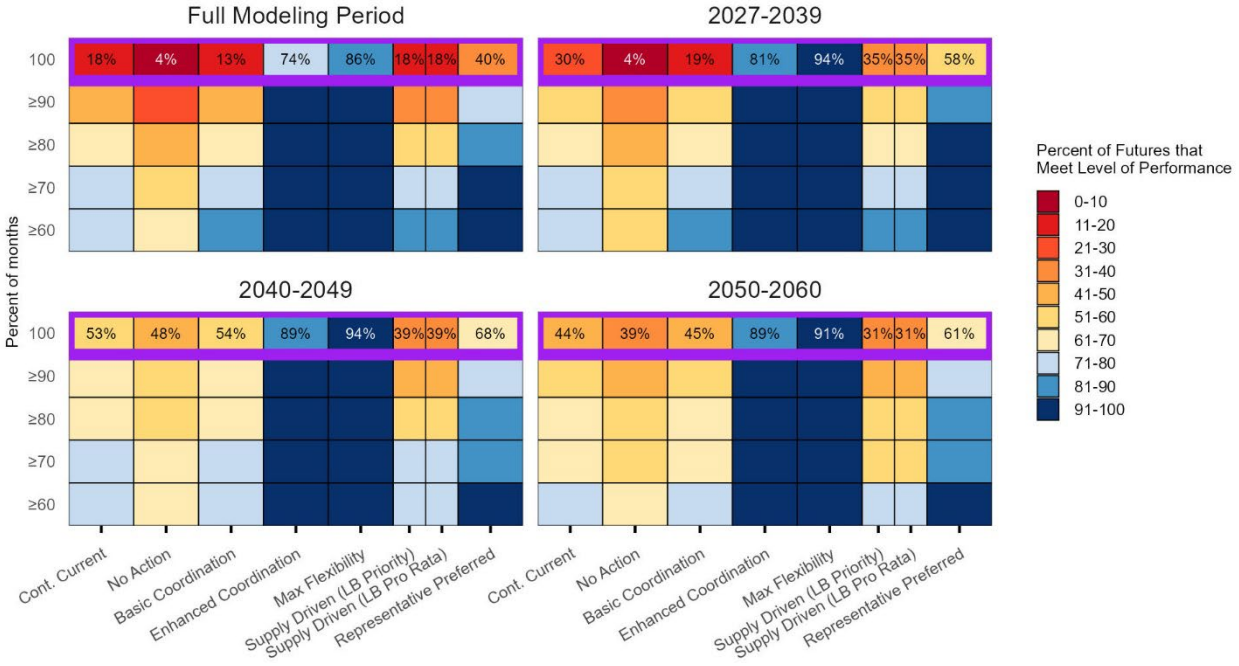
Lake Powell 3,500 Feet Robustness and Vulnerability

Figure TA 3-7 compares alternatives with respect to keeping Lake Powell above an elevation of 3,500 feet. As described above, this elevation is important because it provides a 10-foot buffer to protect critical infrastructure, water supply, and hydropower, which are critically impacted at an elevation of 3,490 feet.

The rows of the heat map reflect the percent of months in which Lake Powell elevation stays above 3,500 feet. Higher percentages of years are preferable and harder to achieve.

The purple highlighted row represents the preferred minimum level of performance and captures the percentage of futures that an alternative keeps Lake Powell above 3,500 feet in 100 percent of the months. 100 percent of months was chosen as the preferred minimum level of performance because of the importance of avoiding critical impacts on water deliveries and hydropower.

Figure TA 3-7
Lake Powell 3,500 Feet: Robustness.
Percent of futures in which Lake Powell elevation stays above 3,500 feet in the percent of months specified by each row



In the Full Modeling Period, the Enhanced Coordination and Maximum Operational Flexibility Alternatives can meet the preferred level of performance in 74 percent and 86 percent of the modeled futures, respectively, which is considerably more robust than the other alternatives. The CCS Comparative Baseline and the No Action, Basic Coordination, and Supply Driven (both LB

Priority and LB Pro Rata approaches) Alternatives are the least robust and are only able to meet the preferred minimum performance in 18 percent, 4 percent, 13 percent, and 18 percent of futures, respectively.

Based on the planned length of this decision, it is important to note that in the first modeling period (2027-2039) the Enhanced Coordination and Maximum Operational Flexibility Alternatives are most robust, achieving the preferred minimum level of performance in 81 percent and 94 percent of futures respectively. The Supply Driven Alternative (both LB Priority and Pro Rata approaches) and the CCS Comparative Baseline are less robust meeting the preferred minimum performance in 35 percent and 30 percent of futures respectively. The No Action and Basic Coordination Alternatives are least robust in the first modeling period meeting the preferred minimum performance in only 4 percent and 19 percent of futures respectively.

In the three subperiods, the alternatives meet the preferred minimum level of performance in greater percentages of futures because the preferred standard is easier to meet over shorter timespans than over the full 34 years. Additionally, the observed data prior to modeling and the initial system state (2027 begins with relatively low reservoir elevations) cause worse performance in the first decade.

In the lower rows of the heat maps, which reflect lower percentages of months where Lake Powell elevation stays above 3,500 feet, all alternatives improve.

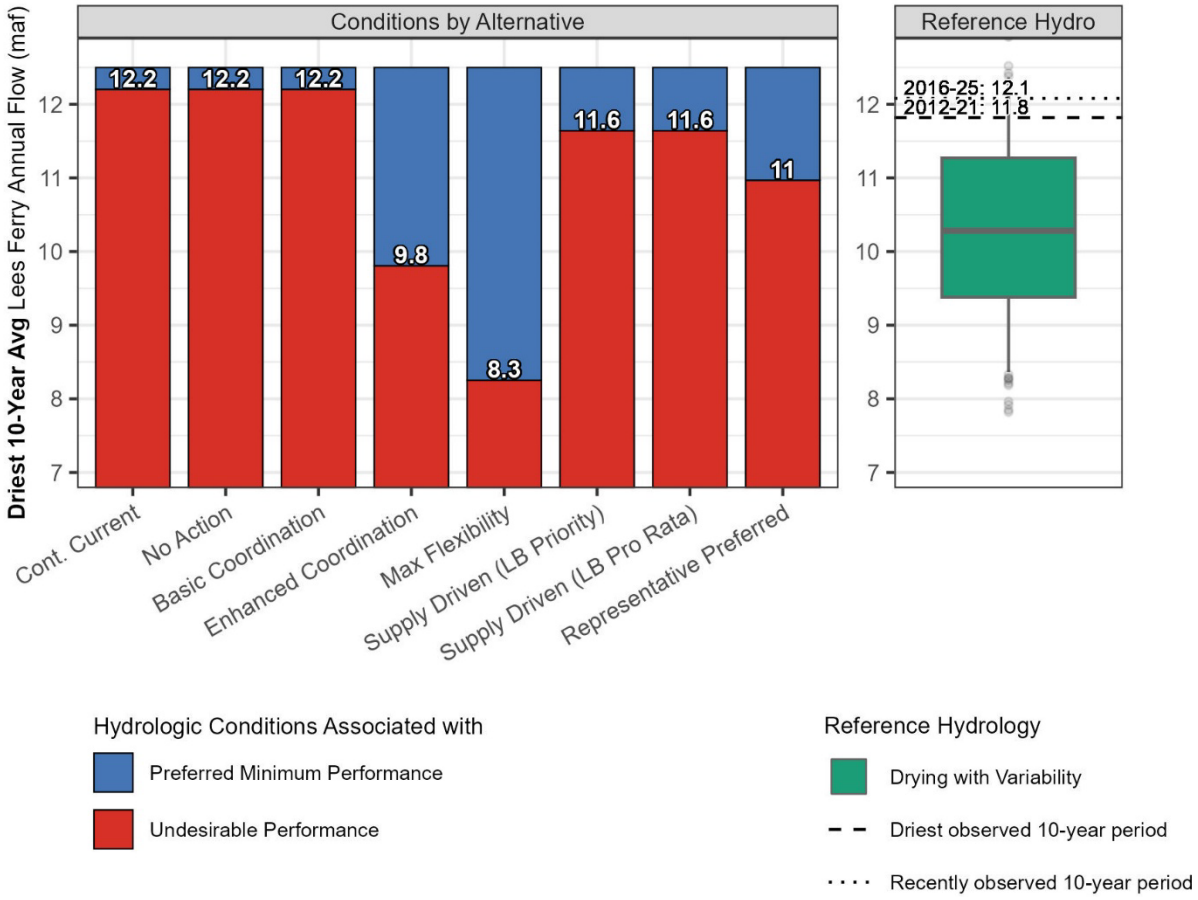
The Representative Preferred Alternative meets preferred level of performance in 40 percent of modeled futures in the Full Modeling Period. Based on the planned length of this decision, it is important to note that the Representative Preferred Alternative meets the preferred minimum performance level in 58 percent of futures in the first modeling period (2027-2039).

Figure TA 3-7 highlights the preferred minimum performance level of keeping Lake Powell above an elevation of 3,500 feet because this elevation provides a 10-foot buffer to protect critical infrastructure, water supply, and hydropower, which are critically impacted at an elevation of 3,490 feet. To identify the hydrologic conditions that could cause undesirable performance, the incidence of Lake Powell elevations dropping below 3,500 feet for at least one month in any year across the 34-year modeling period was analyzed in **Figure TA 3-8**.

The driest 10-year average Lees Ferry annual flow was identified as a good predictor of undesirable performance. The reference hydrology panel shows the range of driest 10-year average flows represented along with the most recent and driest observed 10-year periods.

The CCS Comparative Baseline and the No Action, Basic Coordination, and the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives are likely to result in undesirable performance under a wide range of hydrologic conditions, ranging between driest 10-year averages of 11.6 maf to 12.2 maf or lower (more than 75 percent of the reference hydrology traces). The Enhanced Coordination Alternative is vulnerable to undesirable performance if 10-year average flows are 9.8 maf or lower (fewer than 50 percent of the reference hydrology traces), and the Maximum Operational Flexibility Alternative is vulnerable to undesirable performance if 10-year average flows are 8.3 maf or lower (about 10 percent of the reference hydrology traces).

Figure TA 3-8
Lake Powell 3,500 Feet: Vulnerability.
Conditions that could cause Lake Powell elevation to fall below 3,500 feet in one or more months



The driest 10-year period in the observed record had an average of 11.8 maf and the most recent 10-year period had an average of 12.1 maf; the CCS Comparative Baseline, No Action, Basic Coordination, and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives are vulnerable to conditions near what has already occurred, both in the observed record and the most recent 10-year period.

Modeling indicates that the Representative Preferred Alternative would likely be vulnerable to at least one occurrence of Lake Powell elevation below 3,500 feet under a 10-year average flow of 11 maf. While these conditions have not yet been observed, absent additional action, this alternative is reasonably likely to be vulnerable in the next 10 years because these conditions occur in nearly 75 percent of the traces in the Drying with Variability Ensemble, which represents a drier future.

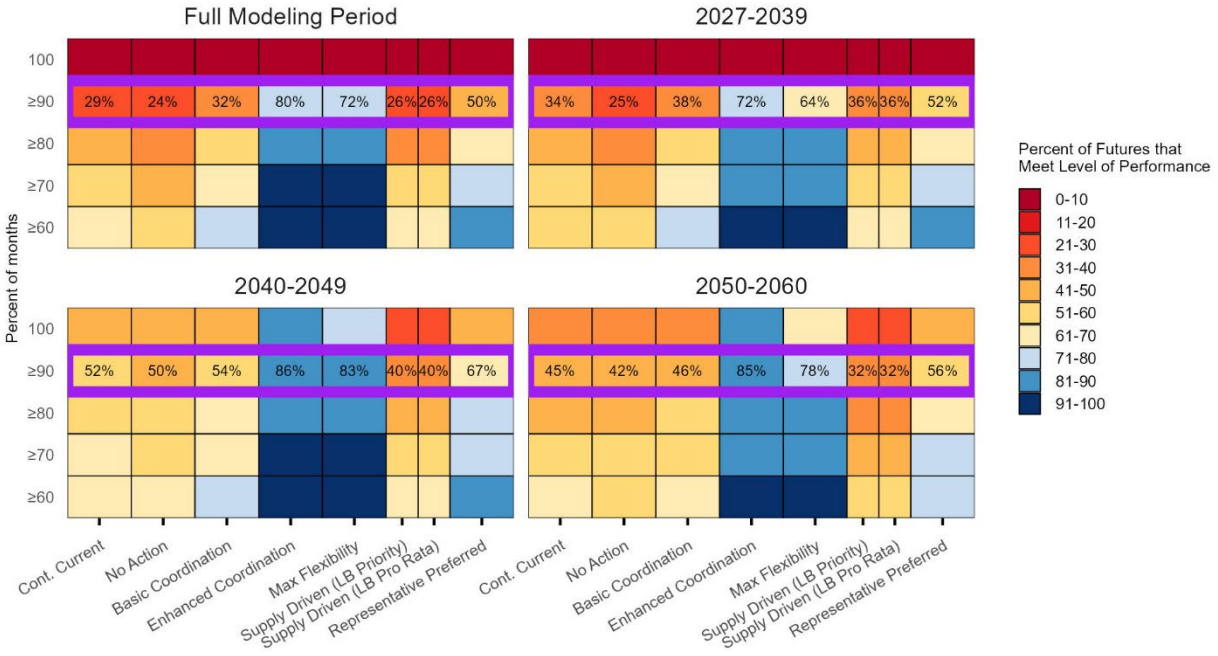
Lake Powell 3,525 Feet Robustness and Vulnerability

Figure TA 3-9 compares alternatives with respect to keeping Lake Powell above elevation 3,525 feet. This elevation is important because it provides a 35-foot buffer to protect critical infrastructure, water supply, and hydropower, which are critically impacted at an elevation of 3,490 feet.

The rows of the heat map reflect the percent of months in which Lake Powell elevation stays above 3,525 feet. Higher percentages of years are preferable and harder to achieve.

The purple highlighted row captures the preferred minimum level of performance of keeping Lake Powell above 3,525 feet in at least 90 percent of months. Greater than or equal to 90 percent of months was chosen as the preferred minimum level of performance because it provides a reasonable amount of flexibility to go below 3,525 feet occasionally in very dry hydrology while avoiding critical impacts on water deliveries.

Figure TA 3-9
Lake Powell 3,525 Feet: Robustness.
Percent of futures in which Lake Powell stays above 3,525 feet in the percent of months specified by each row



In the Full Modeling Period, the Enhanced Coordination and the Maximum Operational Flexibility Alternatives can meet the preferred minimum level of performance in 80 percent and 72 percent of the modeled futures, respectively, which is considerably more robust than the other alternatives. The CCS Comparative Baseline and No Action Alternative are only able to meet the preferred minimum performance in 29 percent and 24 percent of futures, respectively. The Representative Preferred Alternative meets preferred level of performance in 50 percent of modeled futures in the Full Modeling Period. For the more stringent performance standard of keeping Lake Powell above 3,525 feet in 100 percent of months, all alternatives and the CCS Comparative Baseline show poor levels of performance and can only meet the more stringent standard in 0-10 percent of futures.

Based on the planned length of this decision it is important to note that in the first subperiod (2027-2039) the Enhanced Coordination and Maximum Operational Flexibility Alternatives meet the preferred minimum performance in 72 percent and 64 percent of futures respectively. The CCS

Comparative Baseline and Basic Coordination and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives are similarly less robust meeting the preferred minimum performance in 34 percent, 38 percent, and 36 percent of futures respectively. The No Action Alternative is least robust meeting the preferred minimum performance in only 25 percent of futures in the first subperiod.

The Representative Preferred Alternative meets the preferred minimum performance level in 52 percent of futures in the first modeling period (2027-2039).

The alternatives meet the preferred minimum level of performance in greater percentages of futures in subperiods than the Full Modeling Period because the preferred standard is easier to meet over shorter timespans than over the full 34 years. Additionally, the observed data prior to modeling and the initial system state (2027 begins with relatively low reservoir elevations) cause worse performance in the first decade than the following two decades. The robustness ranking across the three alternatives in each subperiod is consistent with the ranking in the Full Modeling Period.

With respect to lower rows in the heatmap, which reflect lower percentages of years where Lake Powell elevation is above 3,525 feet, all alternatives improve.

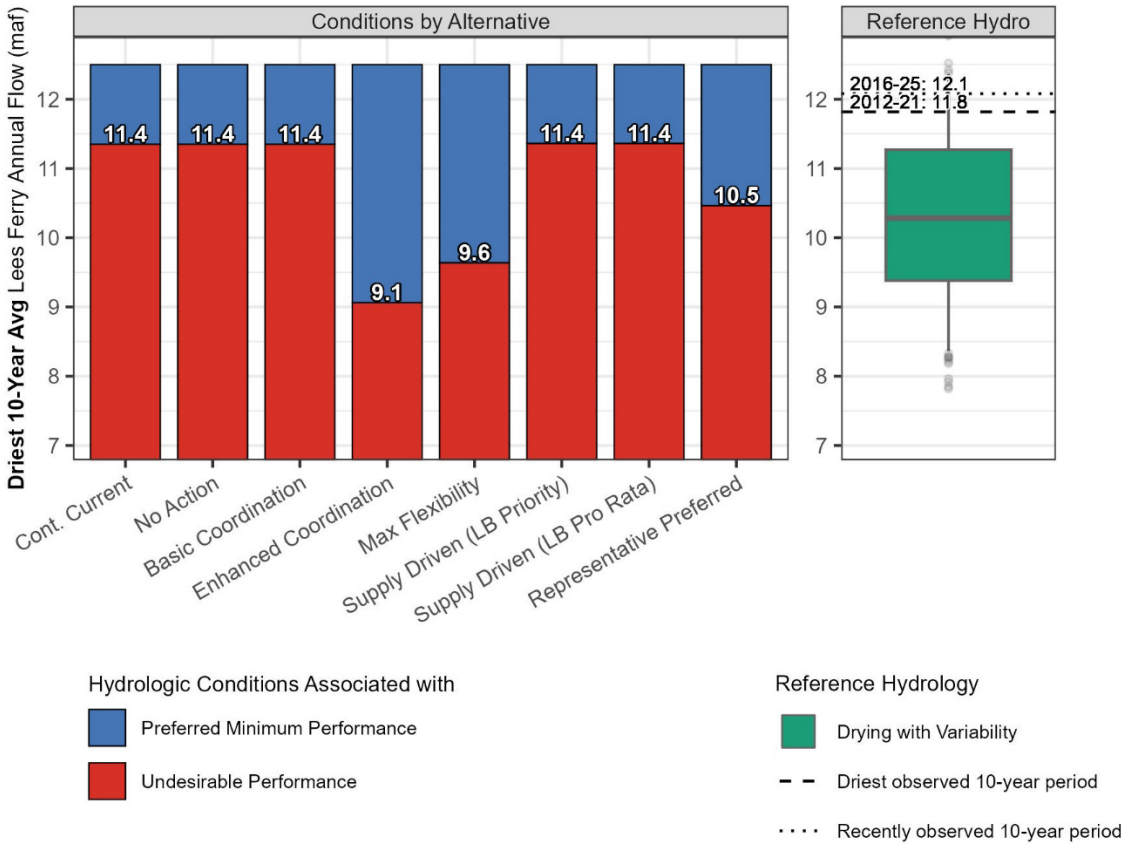
Figure TA 3-9 highlights the preferred minimum performance level of keeping Lake Powell elevation above 3,525 feet in more than 10 percent of months. To identify the hydrologic conditions that could cause undesirable performance, the incidence of Lake Powell elevations dropping below 3,525 feet in more than 10 percent of months across the 34-year modeling period was analyzed in **Figure TA 3-10**.

The driest 10-year average Lees Ferry annual flow was identified as a good predictor of undesirable performance. The reference hydrology panel shows the range of driest 10-year average flows represented along with the most recent and driest observed 10-year periods.

The CCS Comparative Baseline and the No Action, Basic Coordination, and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives are vulnerable to undesirable performance at 11.4 maf or lower. Vulnerabilities for the Enhanced Coordination and Maximum Operational Flexibility Alternatives occur at much lower driest 10-year average flows: 9.1 maf or lower and 9.6 maf or lower, respectively.

Modeling indicates that the Representative Preferred Alternative would likely be vulnerable to Lake Powell elevation falling below 3,525 feet more than 10 percent of the time under a 10-year average flow of 10.5 maf. While these conditions have not yet been observed, absent additional action, this alternative is reasonably likely to be vulnerable in the next 10 years because these conditions occur in more than 50 percent of the traces in the Drying with Variability Ensemble, which represents a drier future.

Figure TA 3-10
Lake Powell 3,525 Feet: Vulnerability.
Conditions that could cause Lake Powell elevation to fall below 3,525 feet in more than 10% of months



Lake Mead

This section presents a comparison of the No Action Alternative, CCS Comparative Baseline, and action alternatives with respect to minimum calendar year and end of calendar year (EOCY) elevations at Lake Mead. Critical elevations at Lake Mead listed in **Table TA 3-5** below preserve infrastructure and ensure Hoover Dam continues to operate under its intended design for purposes of downstream water releases. The total live storage capacity of Lake Mead at the full pool elevation of 1,219.6 feet is 26.12 maf (excluding approximately 1.5 maf of Flood Control storage available above the maximum operating elevation).

Figure TA 3-11 presents conditional boxplots of Lake Mead minimum CY and EOCY elevations (feet) and storage volumes under varying hydrologic conditions. The figure shows how the alternatives perform across these flow categories. See **Table TA 3-6** and **Table TA 3-7** at the end of this TA for the full statistical summaries. **Figure TA 3-11** visualizes the same data as **Table TA 3-6** (right column) and **Table TA 3-7** (left column) using two side-by-side conditional box plot panels. In each flow category, the critical thresholds of 1,000 feet and 975 feet are identified with dashed lines.

Table TA 3-5
Critical Elevations at Lake Mead

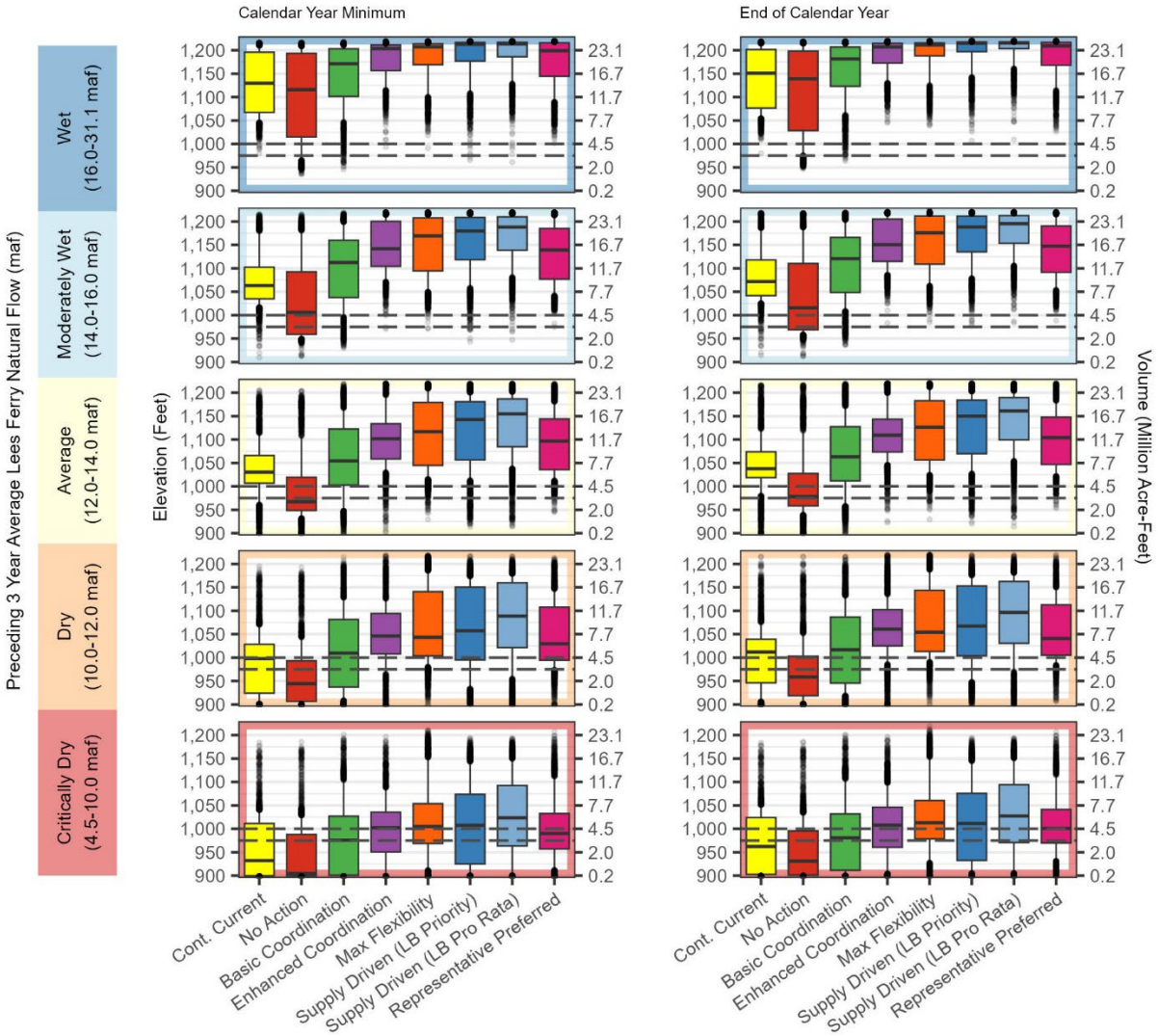
Critical Condition	Associated Elevation	Description of Critical Elevation
Spillway	1,221 feet	Top of Hoover Dam spillway.
Maximum Operating Elevation	1,219.6 feet	Allows for 1.5 maf of exclusive Flood Control space between elevations 1,219.6 feet and 1,229 feet (full pool).
Hydropower Critical Elevation	1,035 feet	Elevation at which 12 of the 17 turbines are no longer able to be used
Buffer Elevation	1,000 feet	Elevation of historical water supply significance that provides analysis continuity
Buffer Elevation	975 feet	25-foot buffer elevation[4] above minimum power pool (950 feet) for critical infrastructure and hydropower
Minimum Power Pool	950 feet	No longer able to produce hydropower at Hoover Dam; releases below this elevation are constrained.
Dead Pool	895 feet	No longer able to deliver water downstream through Hoover Dam.

In the Average Flow Category (12.0-14.0 maf) for EOCY elevations, the 25th-75th percentiles for all action alternatives and the CCS Comparative Baseline remain above the critical thresholds of 1,000 feet and 975 feet, while the median for the No Action Alternative (978 feet) falls between these critical elevations and the 25th percentile for the No Action Alternative drops below 975 feet. The Maximum Operational Flexibility and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives have the highest medians and similar 75th percentile elevations, but the Maximum Operational Flexibility Alternative is more variable with a lower 25th percentile elevation. The CCS Comparative Baseline falls between the No Action and Basic Coordination Alternatives in terms of median elevation.

As flow categories get drier, the EOCY elevations for all alternatives and the CCS Comparative Baseline shift notably toward and below 1,000 feet and 975 feet in the Critically Dry Flow Category, with exception of the Maximum Operational Flexibility Alternative, which maintains a 25th percentile elevation of 979 feet. The Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives all have median elevations above the critical threshold of 1,000 feet even in the Critically Dry Flow Category. For the Basic Coordination Alternative in the Critically Dry Flow Category, the median elevation of 981 feet falls between the two critical thresholds. In the Critically Dry Flow Category, the CCS Comparative Baseline and the No Action Alternative have median elevations of 962 feet and 931 feet, respectively, and fall below both critical thresholds.

[4] A larger buffer above the hydropower and critical infrastructure elevation is used at Lake Mead (25 feet) than at Lake Powell (10 feet) because Reclamation is required to deliver water orders that have already been approved and therefore does not have as much flexibility to adjust releases from Hoover Dam as from Glen Canyon Dam.

Figure TA 3-11
Calendar Year Minimum and End of Calendar Year Elevations and Storage Volumes of Lake Mead



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

In the Dry Flow Category for EOCY elevations, the Representative Preferred Alternative has a median elevation of 1,041 feet and average variability compared to other alternatives and the CCS Comparative Baseline, with 25th and 75th percentiles of 1,005 feet and 1,113 feet. In the Critically Dry Flow Category for EOCY elevations, the Representative Preferred Alternative has a median elevation of 1,001 feet and decreasing variability, with 25th and 75th percentiles of 970 feet and 1,041 feet. With respect to the critical threshold of 975 feet, the Representative Preferred Alternative remains above this elevation in more than 90 percent of years in the Dry Flow Category and in close to 75 percent of years in the Critically Dry Flow Category; with respect to the critical threshold of 1,000 feet, the Representative Preferred Alternative remains above this elevation in more than 75

percent of years in the Dry Flow Category and in 50 percent of years in the Critically Dry Flow Category.

For the CY minimums panel, distributions of elevations shift lower since Lake Mead generally reaches its minimum elevation in July. The comparisons across alternatives and flow categories are similar to the EOCY elevations panel, but with the 25th-75th percentiles shifted slightly lower as well as some median elevations. In the Critically Dry Flow Category, the CY minimum elevation of Lake Mead falls below the critical threshold of 975 feet in more than 25 percent of years for all alternatives and the CCS Comparative Baseline. The CCS Comparative Baseline and No Action Alternative performed the worst with CY minimum elevations falling below 975 feet in more than 50 percent of years and almost 75 percent of years respectively.

In the Dry Category for CY minimums, the Representative Preferred Alternative has a median elevation of 1,030 feet and average variability compared to the other alternatives and the CCS Comparative Baseline, with 25th and 75th percentiles of 995 feet and 1,108 feet, respectively. In the Critically Dry Flow Category for CY minimums, the Representative Preferred Alternative has a median elevation of 990 feet and the least variability compared to the other alternatives and the CCS Comparative Baseline, with 25th and 75th percentiles ranging from 957 feet to 1,033 feet. With respect to the critical threshold of 975 feet, the Representative Preferred Alternative remains above this threshold in almost 90 percent of years in the Dry Flow Category and in more than 50 percent of years in the Critically Dry Flow Category; with respect to the critical threshold of 1,000 feet, the Representative Preferred Alternative remains above this threshold in about 75 percent of years in the Dry Flow Category and in nearly 50 percent of years in the Critically Dry Flow Category.

Lake Mead 975 Feet Robustness and Vulnerability

Figure TA 3-12 compares alternatives with respect to keeping Lake Mead above elevation 975 feet. Elevation 975 feet is important because it provides a 25-foot buffer to protect critical infrastructure and hydropower, which can no longer be produced at elevation 950 feet.

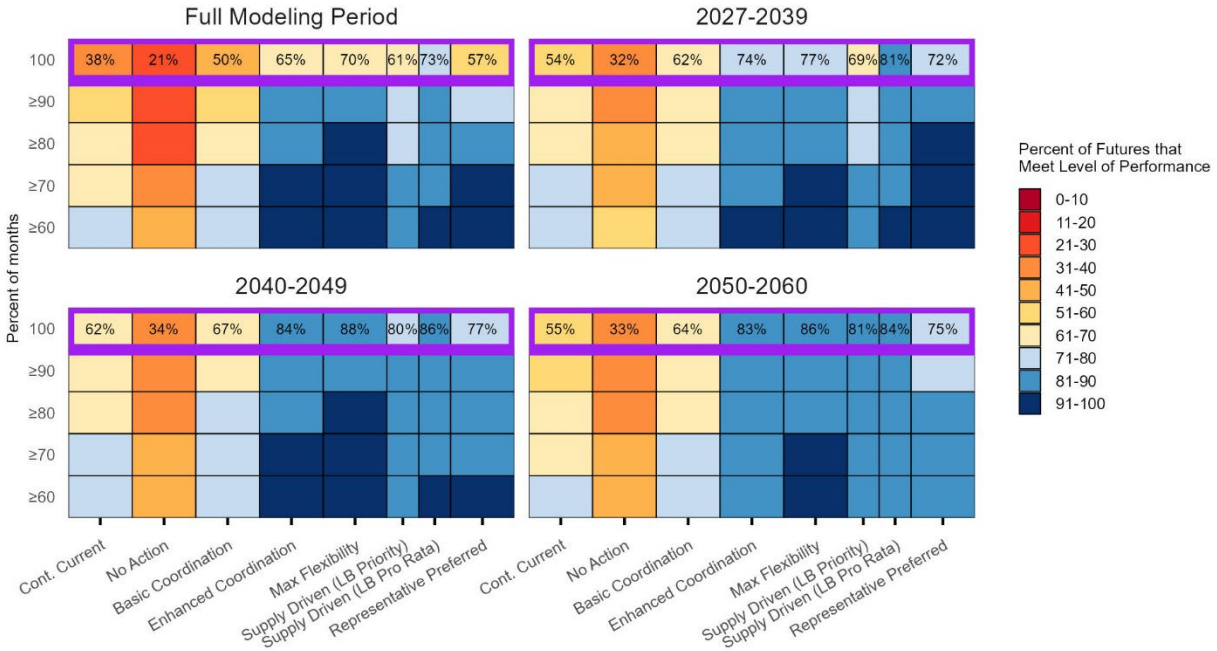
The rows of the heat map reflect the percent of months in which Lake Mead elevation stays above 975 feet. Higher percentages of years are preferable and harder to achieve.

The purple highlighted row represents the preferred minimum level of performance of keeping Lake Mead above 975 feet in 100 percent of months. 100 percent of months was chosen as the preferred minimum performance because of the importance of avoiding impacts on critical infrastructure and hydropower that occur if elevations dropped to 950 feet.

In the Full Modeling Period, the CCS Comparative Baseline and No Action Alternative meet the preferred minimum performance in 38 percent and 21 percent of futures, respectively. All action alternatives are more robust than the CCS Comparative Baseline and the No Action Alternative. The Basic Coordination Alternative meets the preferred minimum performance in 50 percent of futures. The Enhanced Coordination, Supply Driven (LB Priority approach) and Representative Preferred Alternatives are similarly robust, meeting the preferred minimum performance in 65 percent, 61 percent, and 57 percent of futures, respectively. The Maximum Operational Flexibility and Supply

Driven (LB Pro Rata approach) Alternatives are also similarly robust, meeting the preferred minimum performance in 70 and 73 percent of futures, respectively.

Figure TA 3-12
Lake Mead 975 Feet: Robustness.
Percent of futures in which Lake Mead elevation stays above 975 feet in the percent of months specified by each row



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

The action alternatives and the CCS Comparative Baseline show increasing robustness with darker shades of blue, as the specified frequency is relaxed in lower rows. Even when the frequency is relaxed to keeping Lake Mead above 975 feet only 60 percent of the time, the No Action Alternative only achieves the preferred minimum performance in 41-50 percent of futures.

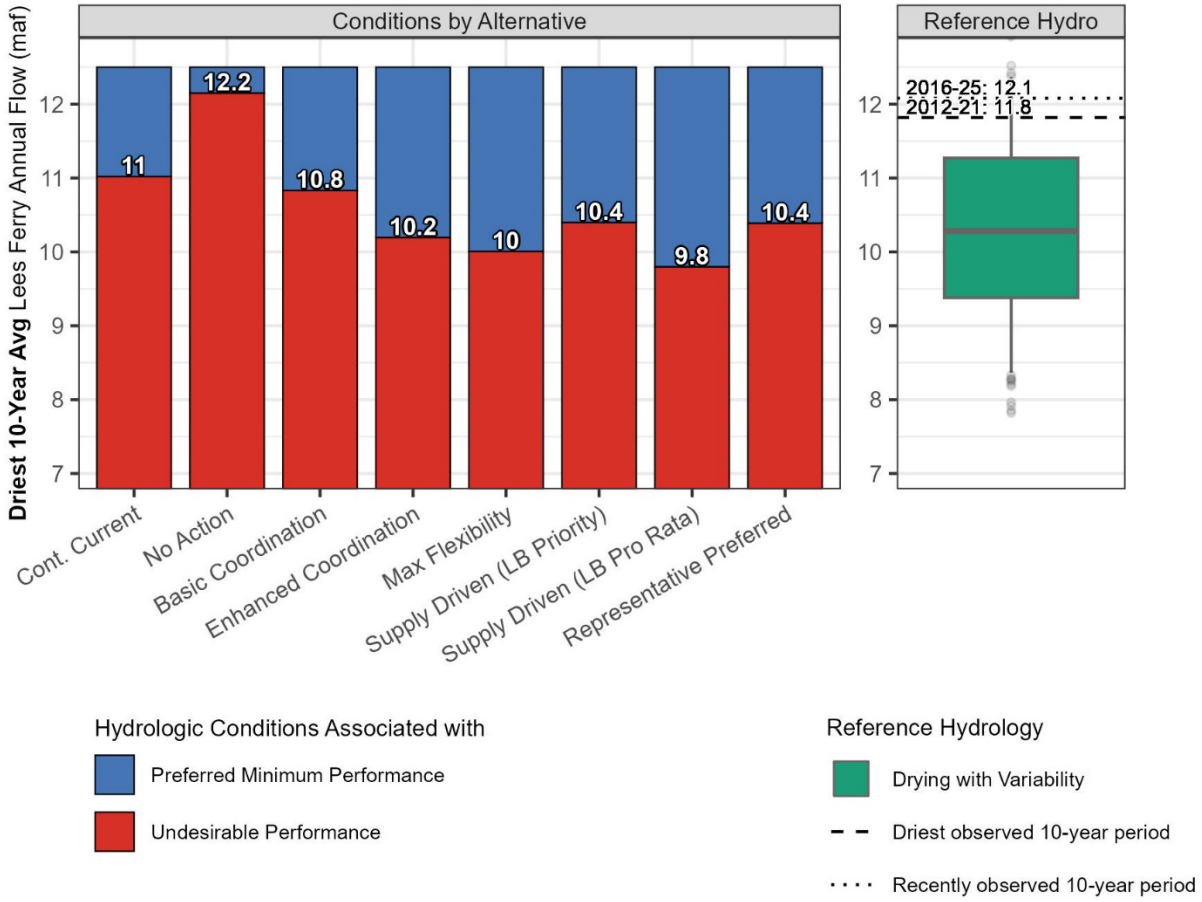
In the first subperiod (2027-2039) the Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven (LB Pro Rata approach) Alternatives are most robust meeting the preferred minimum performance in 74 percent, 77 percent, and 81 percent of futures respectively. The CCS Comparative Baseline, and the Basic Coordination and Supply Driven (LB Priority approach) Alternatives are somewhat less robust meeting the preferred minimum performance in 54 percent, 62 percent and 69 percent of futures respectively. The No Action Alternative is least robust in the first modeling period meeting the preferred minimum performance in only 32 percent of futures.

Based on the planned length of this decision, it is important to note that the Representative Preferred Alternative meets the preferred minimum performance level in 72 percent of futures in the first modeling period.

In the three subperiods, the alternatives meet the preferred minimum level of performance in greater percentages of futures because the preferred standard is easier to meet over shorter timespans than over the full 34 years. The robustness ranking across the three alternatives in each subperiod is generally consistent with the ranking in the Full Modeling Period.

Figure TA 3-12 highlights the preferred minimum performance level of keeping Lake Mead elevation above 975 feet in one or more months because this provides a 25-foot buffer for critical infrastructure and hydropower, which are critically impacted at an elevation of 950 feet. To identify the hydrologic conditions that could cause undesirable performance, the incidence of Lake Mead elevations dropping below 975 feet for at least one month in any year across the 34-year modeling period was analyzed in **Figure TA 3-13**.

Figure TA 3-13
Lake Mead 975 Feet: Vulnerability.
Conditions that could cause Lake Mead elevation to fall below 975 feet in one or more months



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

The driest 10-year average Lees Ferry annual flow was identified as a good predictor of undesirable performance. The reference hydrology panel shows the range of driest 10-year average flows represented along with the most recent and driest observed 10-year periods.

The Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven (LB Pro Rata approach) Alternatives are vulnerable to undesirable performance at 10-year average flows of 10.2 maf or lower, 10.0 maf or lower, and 9.8 maf or lower, respectively. About 50 percent of the reference hydrology traces include averages this low or lower. The Supply Driven Alternative (LB Priority approach) is vulnerable to undesirable performance at a 10-year average flow of 10.4 maf or lower, which falls between the 50th and 75th percentiles of the reference hydrology ensemble. The CCS Comparative Baseline and the Basic Coordination Alternative are vulnerable to undesirable performance at 10-year average flows of 11.0 maf or lower and 10.8 maf or lower, respectively; about 75 percent of the reference hydrology traces include averages this low or lower.

The No Action Alternative is the most vulnerable, with a 10-year average flow of 12.2 maf or lower leading to undesirable performance. The driest 10-year period in the observed record had an average Lees Ferry flow of 11.8 maf and the most recent 10-year period had an average Lees Ferry flow of 12.1 maf; the No Action Alternative is vulnerable to conditions that are wetter than what has already occurred, both in the most recent and driest observed 10-year periods.

Modeling indicates that the Representative Preferred Alternative would likely be vulnerable to at least one occurrence of Lake Mead elevation falling below 975 feet under a 10-year average flow of 10.4 maf. While these conditions have not yet been observed, absent additional action, this alternative is reasonably likely to be vulnerable in the next 10 years because these conditions occur in about 50 percent of the traces in the Drying with Variability Ensemble, which represents a drier future.

Lake Mead 1,000 Feet Robustness and Vulnerability

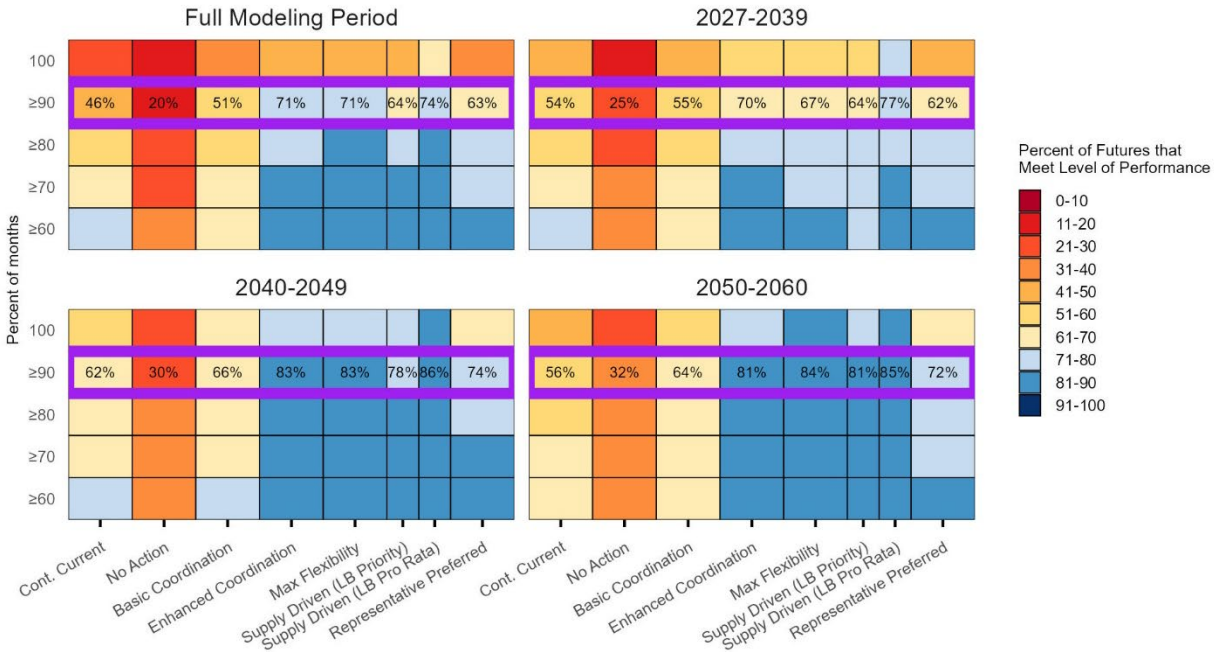
Figure TA 3-14 compares alternatives with respect to keeping Lake Mead's elevation above 1,000 feet, which is an elevation of historical significance to water supply that provides analysis continuity.

The rows of the heat map reflect the percent of months in which Lake Mead elevation stays above 1,000 feet. Higher percentages of years are preferable and harder to achieve.

The purple highlighted row represents the preferred minimum level of performance and captures the percentage of futures that an alternative keeps Lake Mead above 1,000 feet in 90 percent or more of the months. This threshold was chosen as the preferred minimum level of performance because it provides a reasonable amount of flexibility to go below 1,000 feet occasionally in very dry hydrology.

In the Full Modeling Period, the Enhanced Coordination, Maximum Operational Flexibility, Supply Driven (LB Priority approach), and Supply Driven (LB Pro Rata approach) Alternatives are similarly robust, meeting the preferred minimum level of performance in 71 percent, 71 percent, 64 percent, and 74 percent of futures, respectively. The CCS Comparative Baseline and No Action Alternative are the least robust, meeting the preferred minimum performance in 46 percent and 20 percent of futures, respectively.

Figure TA 3-14
Lake Mead 1,000 Feet: Robustness.
Percent of futures in which Lake Mead elevation stays above 1,000 feet in the percent of months specified by each row



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

Based on the planned length of decision, it is important to note that in the first decade (2027-2039) Enhanced Coordination, Maximum Operational Flexibility, Supply Driven (LB Priority approach), and Supply Driven (LB Pro Rata approach) Alternatives are similarly robust, meeting the preferred minimum level of performance in 70 percent, 67 percent, 64 percent, and 77 percent of futures respectively. The CCS Comparative Baseline and Basic Coordination Alternatives are somewhat less robust, meeting the preferred minimum performance in 54 percent and 55 percent of futures respectively. In the first modeling period, the No Action Alternative is the least robust, meeting the preferred minimum performance in 25 percent of modeled futures.

The Representative Preferred Alternative meets the preferred minimum level of performance in 63 percent of modeled futures in the full modeling period. Based on the planned length of this decision, it is important to note that the Representative Preferred Alternative meets the preferred minimum performance level in 62 percent of futures in the first modeling period (2027-2039).

In the three subperiods, the alternatives meet the preferred minimum level of performance in greater percentages of futures because the preferred standard is easier to meet over shorter timespans than over the full 34 years. Additionally, the observed data prior to modeling and the initial system state

(2027 begins with relatively low reservoir elevations) cause worse performance in the first decade. The robustness ranking across the three alternatives in each subperiod is consistent with the ranking in the Full Modeling Period.

With respect to lower rows in the heatmap which reflect lower percentages of years where Lake Mead elevation is above 1,000 feet, all alternatives improve, although the No Action Alternative is only able to meet the most relaxed performance standard (e.g., greater than or equal to 60 percent of months) in 31-40 percent of modeled futures.

Figure TA 3-14 highlights the preferred minimum performance level of keeping Lake Mead elevation above 1,000 feet in more than 90 percent of months because this represents an elevation of historical significance to water supply that provides analysis continuity. To identify the hydrologic conditions that could cause undesirable performance, the incidence of Lake Mead elevations dropping below 1,000 feet in more than 10 percent of months across the 34-year modeling period was analyzed in **Figure TA 3-15**.

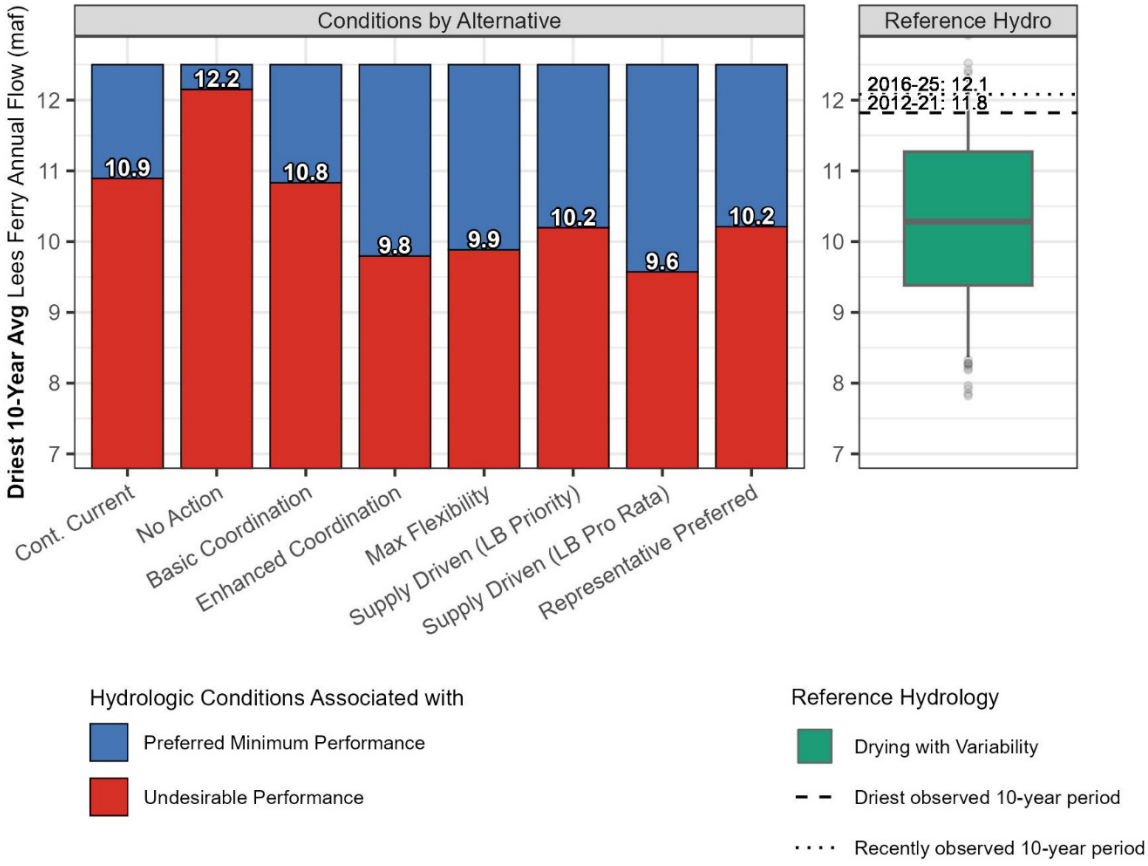
The driest 10-year average Lees Ferry annual flow was identified as a good predictor of undesirable performance. The reference hydrology panel shows the range of driest 10-year average flows represented along with the most recent and driest observed 10-year periods.

The Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven (LB Pro Rata approach) Alternatives are vulnerable to undesirable performance at 10-year average Lees Ferry flows of 9.8 maf or lower, 9.9 maf or lower, and 9.6 maf or lower, respectively. These conditions are slightly below the 50th percentile of the reference hydrology ensemble, meaning that about 50 percent of the traces in the reference hydrology ensemble are wetter than these values. The Supply Driven Alternative (LB Priority approach) is vulnerable to undesirable performance at 10-year average flows of 10.2 maf or lower, which is near the 50th percentile of the reference hydrology ensemble. The Basic Coordination Alternative and the CCS Comparative Baseline are vulnerable to undesirable performance at 10-year average flows of 10.8 maf or lower and 10.9 maf or lower, respectively, which are slightly below the 75th percentile of the reference hydrology ensemble.

The No Action Alternative is the most vulnerable, with a 10-year average flow of 12.2 maf or lower leading to undesirable performance in the modeling results. The driest 10-year period in the observed record had an average Lees Ferry flow of 11.8 maf and the most recent 10-year period had an average Lees Ferry flow of 12.1 maf; the No Action Alternative is vulnerable to conditions wetter than what has already occurred, both in the most recent and driest observed 10-year periods.

Modeling indicates that the Representative Preferred Alternative would likely be vulnerable to Lake Mead elevation falling below 1,000 feet more than 10 percent of the time under a 10-year average flow of 10.2 maf. While these conditions have not yet been observed, absent additional action, this alternative is reasonably likely to be vulnerable in the next 10 years because these conditions occur in about 50 percent of the traces in the Drying with Variability Ensemble, which represents a drier future.

Figure TA 3-15
Lake Mead 1,000 Feet: Vulnerability.
Conditions that could cause Lake Mead elevation to fall below 1,000 feet in more than 10% of months



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

Impacts of Modeling Assumptions for Upper Basin and Lower Basin Conservation Activity on Lake Powell and Lake Mead Storage

The following section describes the impacts of modeling assumptions for conservation activities for the various alternatives by showing how removing all conservation activity results in differences to reservoir elevations at Lake Powell and Lake Mead.

Table TA 3-8 below summarizes the various conservation mechanisms for each action alternative. All action alternatives, except for the Basic Coordination Alternative, incorporate mechanisms related to the storage and delivery of newly conserved water in Lake Powell and Lake Mead. Refer to **Appendix S,** Addtional Description of Alternatives, for specifics related to each alternative's conservation mechanisms. While the No Action and Basic Coordination Alternatives do not include mechanisms to conserve and store water in Lake Powell or Lake Mead, the alternatives include assumptions for the delivery of existing ICS that was conserved prior to

2027. For modeling purposes only, assumptions about storage and delivery of previously conserved water were developed to show the maximum impacts of the conservation pools on reservoir elevations and downstream flows; they are not intended to represent specific activities or constrain individual users. Refer to **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water, for more details related to the conservation assumptions for each alternative. The modeling results that incorporate the assumptions in this paragraph are labeled 'conservation-on'.

Table TA 3-8
Summary of Conservation Mechanisms by Alternative

Alternative	Conservation Pool Volume	Conservation Pool Mechanism
Continued Current Strategies Comparative Baseline	0.5 maf	Upper Basin pool in Lake Powell
	4.2 maf	Lower Basin pool in Lake Mead
No Action		No new mechanism; delivery of pre-2027 conservation only
Basic Coordination		No new mechanism; delivery of pre-2027 conservation only
Enhanced Coordination	2 maf	Upper Basin pool in Lake Powell
	5 maf	Lower Basin pool in Lake Mead
	2 maf	Protection Pool in Lake Mead
Maximum Operational Flexibility	5 maf	Upper Basin pool (distributed strategically across Lake Powell and Lake Mead)
	3 maf	Lower Basin pool (distributed strategically across Lake Powell and Lake Mead)
Supply Driven (both approaches)	3 maf	Upper Basin pool in Lake Powell
	8 maf	Lower Basin pool in Lake Mead
Representative Preferred	3 maf	Upper Basin pool in Lake Powell
	7 maf	Lower Basin pool in Lake Mead
	1 maf	Federally Managed Water Resources Pool in Lake Mead

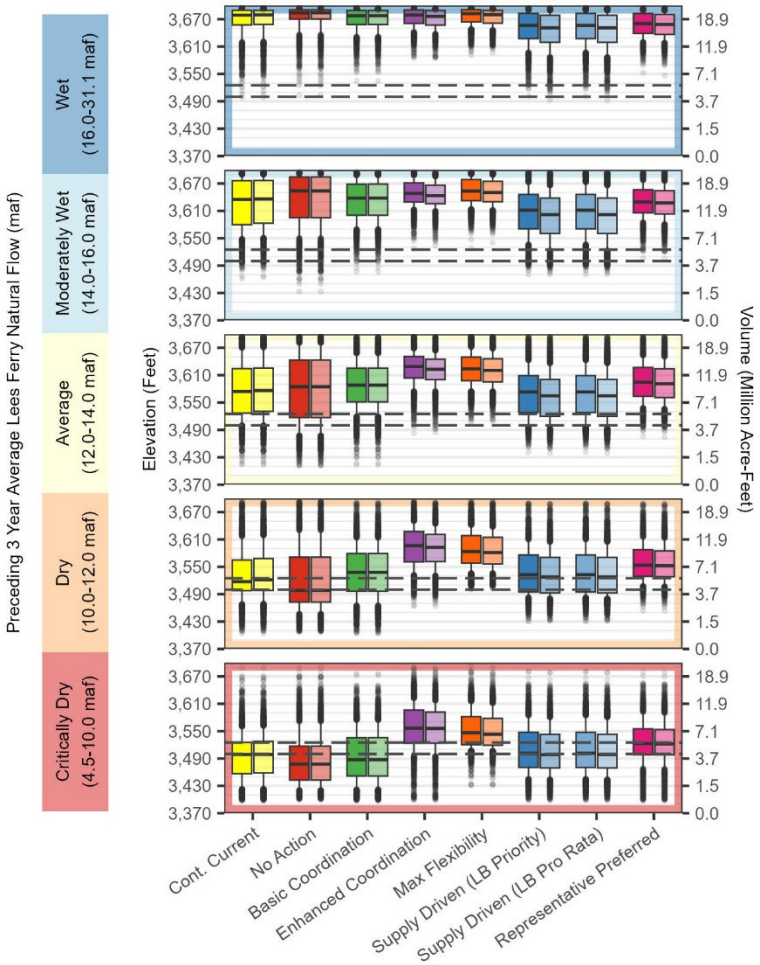
In the 'conservation-off' results, there are no mechanisms for the storage or delivery of newly conserved water. Furthermore, delivery of pre-2027 conservation is turned off for all the alternatives and the CCS Comparative Baseline.

Figure TA 3-16 presents conditional boxplots of how conservation activity affects Lake Powell EOWY elevations (feet). In each boxplot pair, conservation activity is on in the left box (black outline with darker shading) and off in the right box (gray outline with lighter shading). See **Table TA 3-9** at the end of this TA for the full statistical summary.

Across all hydrologic flow categories, the Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives have higher median Lake Powell elevations when conservation is on (left box) compared to when it is off (right box), with

differences ranging from 0.5 to 9.8 feet. Additionally, across all flow categories, the 25th-75th percentiles for these alternatives shift upward when conservation is on compared to when it is off.

Figure TA 3-16
Impacts of Modeling Assumptions for Conservation Activity on End of Water Year Elevations (Feet) at Lake Powell



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

For the No Action and Basic Coordination Alternatives, the 25th-75th percentile elevations are very similar when comparing conservation activity on and conservation activity off across all flow categories.

The CCS Comparative Baseline has lower 25th-75th percentile elevations across all flow categories when conservation is on compared to when it is off, which differs from all alternatives. In the Average Flow Category and the Dry Flow Category, the CCS Comparative Baseline has lower median elevations in Lake Powell when conservation activity is on by 2.1 feet and 4.0 feet,

respectively; for the other flow categories, the CCS Comparative Baseline has very similar medians for both conservation activity on and conservation activity off.

In the Dry Flow Category, with conservation activity on, the median Lake Powell elevation for the Representative Preferred Alternative is 3,554 feet (1.2 feet higher than with conservation activity off). In the Critically Dry Flow Category, with conservation activity on, the median Lake Powell elevation for the Representative Preferred Alternative is 3,523 feet (0.8 feet higher than with conservation activity off). The variability is similar with conservation on and off in both the Dry and Critically Dry Flow Categories.

Figure TA 3-17 presents conditional boxplots of how conservation activity affects Lake Mead EOCY elevations (feet) and storage volumes. In each boxplot pair, conservation activity is on in the left box (black outline with darker shading) and off in the right box (gray outline with lighter shading). See **Table TA 3-10** at the end of this TA for the full statistical summary.

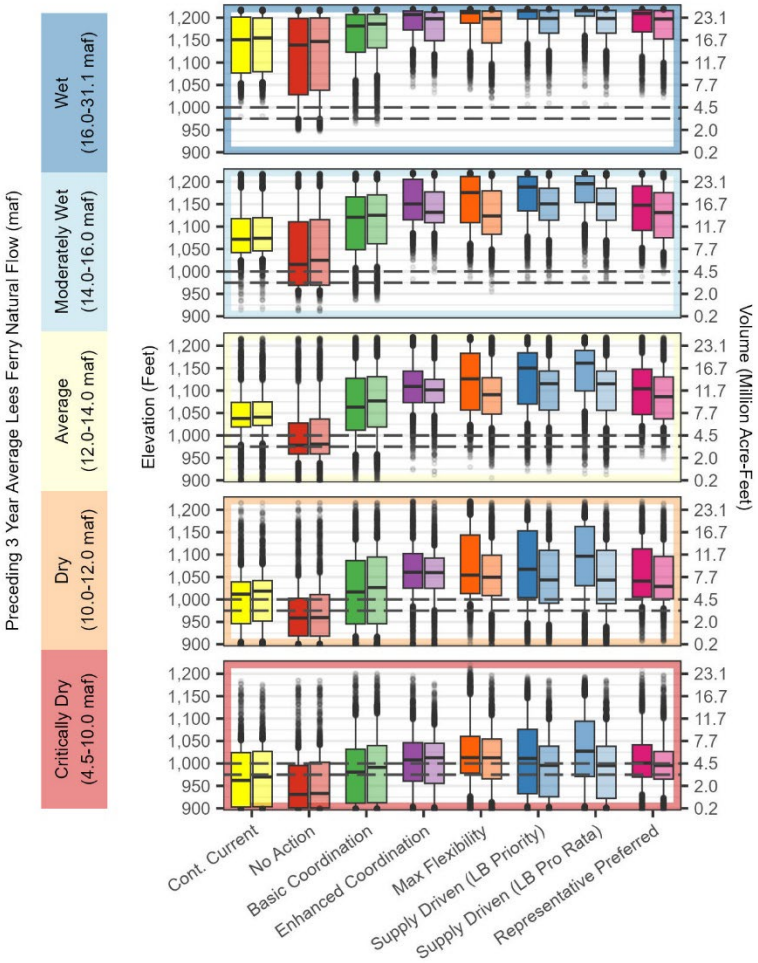
The Enhanced Coordination, Maximum Operational Flexibility, and the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives have higher median Lake Mead elevations when conservation activity is on across all flow categories except the Critically Dry Flow Category. Within the Critically Dry Flow Category, only the Maximum Operational Flexibility and the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives show higher median Lake Mead elevations when conservation is on. For these alternatives, the 25th-75th percentile elevations also shift upward when conservation is on across all hydrologic conditions, following the same general pattern as the median elevations. The CCS Comparative Baseline, the No Action Alternative and the Basic Coordination Alternative all have lower 25th-75th percentile elevations that shift downward when conservation is on, across all flow categories.

With respect to the critical elevation of 975 feet, the No Action Alternative falls below the critical threshold in almost 50 percent of years in the Average Flow Category for both conservation activity on and conservation activity off, while the CCS Comparative Baseline only falls below the threshold in more than 50 percent of years in the Critically Dry Flow Category for both conservation activity on and conservation activity off. With respect to the critical elevation of 1,000 feet, the No Action Alternative falls below the critical threshold between 25 and 50 percent of years in the Average Flow Category for both conservation activity on and conservation activity off and in about 75 percent of years in the Critically Dry Flow Category for both conservation activity on and conservation activity off. With respect to the critical elevation of 1,000 feet, the CCS Comparative Baseline falls below the critical threshold in fewer than 25 percent of years in the Average Flow Category for both conservation activity on and conservation activity off and in fewer than 75 percent of years in the Critically Dry Flow Category for both conservation activity on and conservation activity off.

In the Dry Flow Category, under the Representative Preferred Alternative the median Lake Mead elevation with conservation activity on is 1,041 feet (11.8 feet higher than with conservation activity off). Performance of the Representative Preferred Alternative in this category is most similar to the Basic Coordination Alternative but with 25th percentile values that are closer to the median (reduced variability) for both conservation activity on and off. In the Critically Dry Flow Category, under the Representative Preferred Alternative, the median Lake Mead elevation with conservation activity on

is 1,001 feet (5.6 feet higher than with conservation activity off). Performance of the Representative Preferred Alternative is again similar to the Basic Coordination Alternative, but with reduced variability for both conservation activity on and off.

Figure TA 3-17
Impacts of Modeling Assumptions for Conservation Activity on EOCY Elevations and Storage Volumes for Lake Mead



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

With respect to the critical elevation of 975 feet, the Representative Preferred Alternative falls below the critical threshold in less than 10 percent of years in the Dry Flow Category and more than 25 percent of years in the Critically Dry Flow Category, for both conservation activity on and conservation activity off. With respect to the critical elevation of 1,000 feet, the Representative Preferred Alternative falls below the critical threshold in about 25 percent of years in the Dry Flow Category and around 50 percent of years in the Critically Dry Flow Category for both conservation activity on and conservation activity off.

Lake Mohave and Lake Havasu

Lake Mohave and Lake Havasu are operated under an existing rule curve that determines specific target elevations at the end of each month (refer to **TA 6**, Water Quality). The existing rule curves were used in CRSS and applied to operations for all alternatives and the CCS Comparative Baseline.

Although inflows into Lake Mohave vary across alternatives due to differences in releases from Lake Mead, target elevations are maintained within the rule curve bounds. As a result, lake elevations are not affected by the different upstream operations occurring in the alternatives or the CCS Comparative Baseline.

Similarly, although inflows into Lake Havasu from upstream operations (Davis Dam releases) vary across alternatives, target elevations are maintained within the rule curve bounds. As a result, lake elevations are not affected by the different upstream operations occurring in the alternatives or the CCS Comparative Baseline.

TA 3.2.2 Issue 2: System Storage

Issue 2 addresses how operational activities would affect system storage. This was evaluated by comparing the various action alternatives to the No Action Alternative and the CCS Comparative Baseline for the following metrics:

- Combined System Storage at Lake Powell and Lake Mead
- Combined System Storage at CRSP reservoirs
- Combined System Storage at all seven reservoirs

Combined System Storage at Lake Powell and Lake Mead

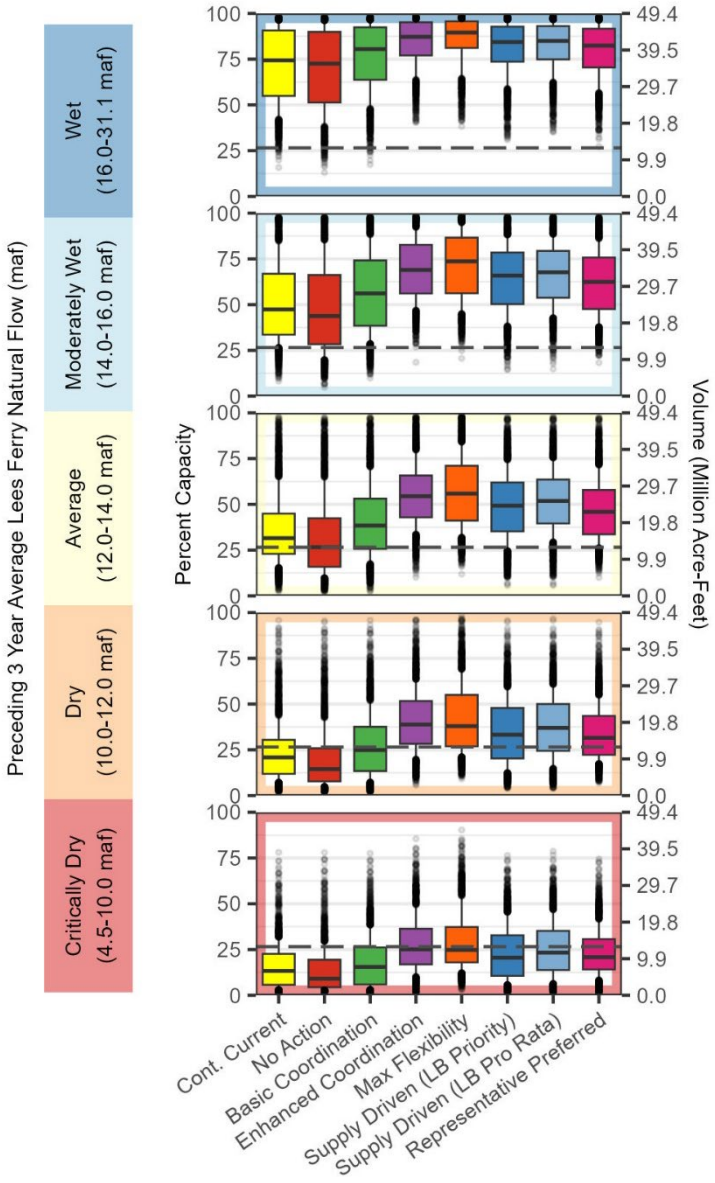
This section compares all alternatives and the CCS Comparative Baseline with respect to EOWY combined storage of Lake Powell and Lake Mead. Analysis of the combined storage of these two reservoirs provides insight into overall system conditions because their combined volume makes up about 85 percent of the volume in the major system reservoirs.[5] Excluding space allocated for surcharge and Flood Control, the live storage capacity at Lake Powell is 23.31 maf and 26.12 maf at Lake Mead, resulting in a maximum combined live storage of 49.43 maf.

Figure TA 3-18 presents conditional boxplots of EOWY combined storage in Lake Powell and Lake Mead, expressed as a percentage of total storage capacity. The vertical axis shows combined percent full on the left and volume of storage on the right. A threshold line indicates the lowest observed EOWY combined storage, which occurred in September 2022, at 26.55 percent full (equivalent to 13.1 maf). See **Table TA 3-11** at the end of this TA for the full statistical summary.

In the Average Flow Category, the Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven (LB Pro Rata approach) Alternatives all have median Lake Powell and Lake Mead combined storage volumes above 50 percent of the total combined storage capacity. Fewer than 10 percent of modeled years (corresponding to the 10th percentile) for these action alternatives fall below the lowest observed EOWY storage reference of 26.55 percent. In terms of interquartile

[5] Specifically, Lake Powell and Lake Mead account for 85 percent of the live storage capacity of the seven largest reservoirs in the system (Flaming Gorge, Blue Mesa, Navajo, Powell, Mead, Mohave, and Havasu).

Figure TA 3-18
EOWY Powell and Mead Combined Storage[6]



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

range, the Maximum Operational Flexibility Alternative shows the greatest variability, with the highest 75th percentile storage volume; the Enhanced Coordination Alternative has the least variability; and the Supply Driven Alternative (LB Pro Rata approach) has the lowest 25th percentile storage volume. By comparison, the CCS Comparative Baseline and the Basic Coordination and No

[6] Dashed reference line is historical EOWY minimum 26.55 percent in September 2022.

Action Alternatives have lower median storage volumes, at 32, 38, and 27 percent of total capacity, respectively. Under the CCS Comparative Baseline, more than 25 percent of years (corresponding to the 25th percentile), fall below the lowest observed EOWY storage reference of 26.55 percent. Under the No Action Alternative, almost 50 percent of years (corresponding to the 50th percentile) fall below the lowest observed EOWY storage reference of 26.55 percent.

In the Critically Dry Flow Category, the same general trends are observed. For the Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven (LB Pro Rata approach) Alternatives, about 50 percent of modeled years (corresponding to the 50th percentile) fall below the lowest observed EOWY storage reference of 26.55 percent. For the CCS Comparative Baseline and No Action and Basic Coordination Alternatives, more than 75 percent of years (corresponding to the 75th percentile) fall below this reference.

In the Dry Flow Category, the Representative Preferred Alternative has a median of 32 percent combined storage, with 25th and 75th percentiles of 22 and 44 percent combined storage, respectively. In the Critically Dry Flow Category, the Representative Preferred Alternative has a median of 21 percent combined storage, with 25th and 75th percentiles of 14 and 31 percent combined storage. Under the Representative Preferred Alternative, more than 25 percent of years in the Dry Flow Category and nearly 75 percent of years in the Critically Dry Flow Category have combined storage below the lowest observed historical value of 26.55 percent.

Combined System Storage at CRSP Reservoirs

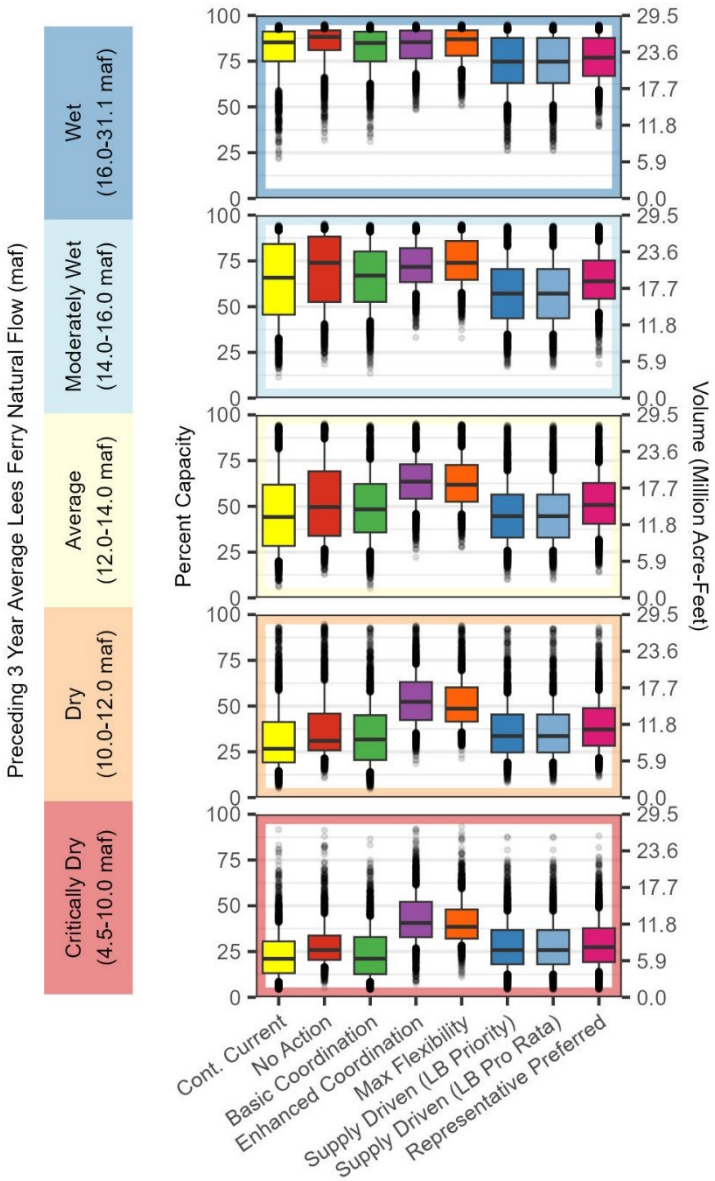
This section compares all alternatives and the CCS Comparative Baseline with respect to EOWY combined storage of the CRSP reservoirs, including Lake Powell and the CRSP UIUs—Flaming Gorge, Navajo, and Blue Mesa. Analysis of the combined storage provides insight into the system conditions at Lake Powell and the CRSP UIUs, and this volume is the criteria for Lake Powell releases in the Maximum Operational Flexibility Alternative. The CRSP UIU reservoirs can be operated in accordance with their respective RODs, subject to hydrologic conditions, to help protect infrastructure at Glen Canyon Dam.

Specifically, the CCS Comparative Baseline, along with the Basic Coordination and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives, assume additional releases from the CRSP UIUs when Lake Powell is projected to, or physically falls below, elevation 3,525 feet. The CCS Comparative Baseline and Basic Coordination Alternative include additional releases from Flaming Gorge, Blue Mesa, and Navajo Reservoirs, while the Supply Driven Alternative (both LB Priority and LB Pro Rata approaches) assumes additional releases only from Flaming Gorge.

Excluding surcharge space, the total storage volume of the four CRSP reservoirs is approximately 29.5 maf, with Lake Powell accounting for approximately 80 percent. Because storage at the CRSP UIUs varies minimally across alternatives, most differences in performance are attributable to Lake Powell operations. Additionally, because transfers within the CRSP reservoirs, from the UIUs downstream to Lake Powell, do not change total combined storage, these intra-system balancing operations are not visible in the conditional box plots. Differences across alternatives are therefore driven primarily by Lake Powell operations, as described in Issue 1 above.

Figure TA 3-19 presents conditional boxplots of EOWY CRSP combined system storage, expressed as a percentage of total storage capacity. See **Table TA 3-12** at the end of this TA for the full statistical summary.

Figure TA 3-19
EOWY CRSP Combined Storage



The alternatives and the CCS Comparative Baseline generally perform similarly under the Wet Flow Category, except for the Supply Driven (both LB Priority and LB Pro Rata approaches) and the Representative Preferred Alternatives, which have the lowest median combined CRSP reservoir storage (as a percent of the total capacity). As flow categories become drier, combined CRSP reservoir storage decreases and differences between alternatives become more apparent.

In the Average Flow Category, the median EOWY CRSP combined storage values for the CCS Comparative Baseline, No Action, Basic Coordination, and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives are near 50 percent of the total capacity, while the Enhanced Coordination and Maximum Operational Flexibility Alternatives have higher median storage values, at 63 percent and 62 percent, respectively. Among these alternatives, the Enhanced Coordination Alternative has the highest 75th percentile storage but the smallest interquartile range, reflecting higher upper-end storage with relatively lower variability. By comparison, the No Action Alternative has a similar 75th percentile and the largest interquartile range, indicating greater variability in combined CRSP storage.

In the Critically Dry Flow Category, median and interquartile range patterns shift as hydrologic conditions worsen. The Enhanced Coordination and Maximum Operational Flexibility Alternatives have the highest median storage values (41 and 38 percent, respectively). The remainder of the alternatives and the CCS Comparative Baseline have similar medians (21 to 26 percent). Considering the 10th through 90th percentile values, the CCS Comparative Baseline and Basic Coordination Alternative result in the least CRSP combined storage. The No Action Alternative exhibits the least variability (interquartile range of 13 percent) followed by the Maximum Operational Flexibility Alternative (16 percent), while the Basic Coordination Alternative exhibits the most variability (20 percent).

In the Dry Flow Category for EOWY CRSP combined storage, the Representative Preferred Alternative has a median of 37 percent combined storage, with 25th and 75th percentiles ranging from 28 to 49 percent combined storage. In the Critically Dry Flow Category, the Representative Preferred Alternative has a median of 27 percent combined storage, with 25th and 75th percentiles of 19 and 38 percent combined storage, respectively.

Combined System Storage at Seven-Reservoirs

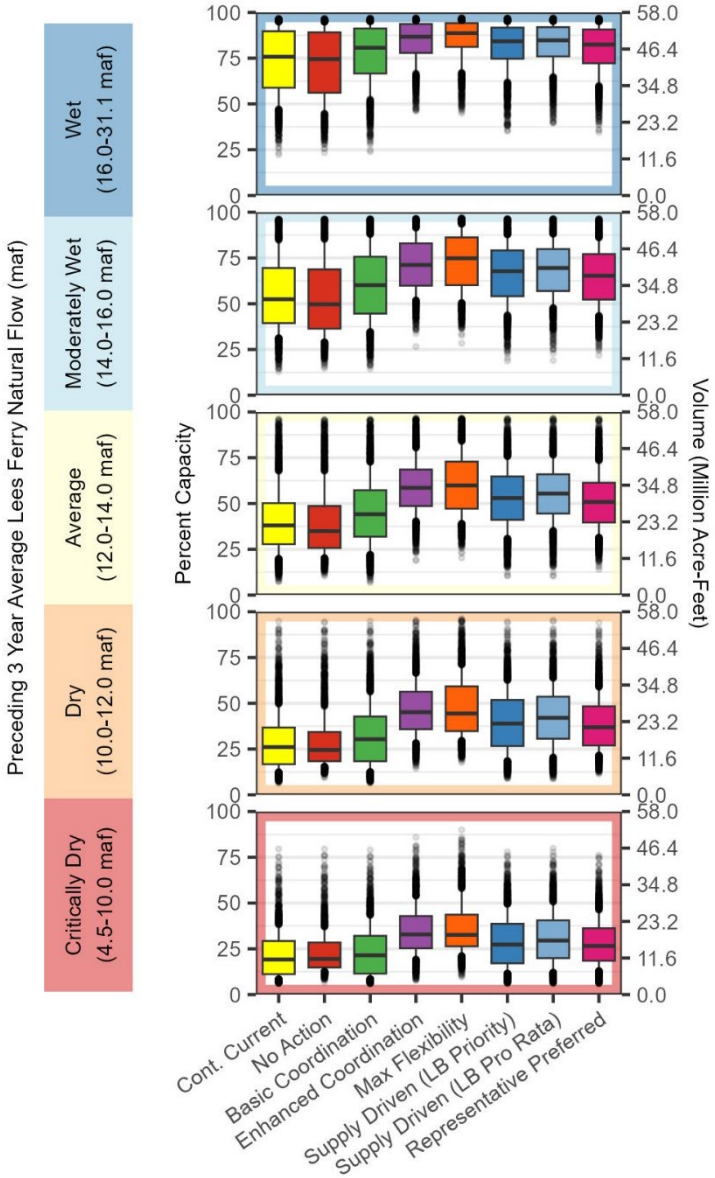
This section compares all alternatives and the CCS Comparative Baseline with respect to EOWY combined storage of Lake Powell, the three CRSP UIUs (Flaming Gorge, Navajo, and Blue Mesa), Lake Mead, Lake Mohave, and Lake Havasu (referred to herein as the seven-reservoir storage). Excluding space allocated for surcharge and Flood Control, the live storage capacity of these seven reservoirs is 58.01 maf, with Lake Powell and Lake Mead accounting for approximately 90 percent of the total system storage capacity.

Figure TA 3-20 presents conditional boxplots of EOWY combined storage for the seven reservoirs, expressed as a percentage of the total storage capacity. See **Table TA 3-13** at the end of this TA for the full statistical summary.

In the Average Flow Category, the Maximum Operational Flexibility Alternative exhibits the greatest median seven-reservoir storage (60 percent), followed closely by Enhanced Coordination (59 percent). The Maximum Operational Flexibility, Enhanced Coordination, and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives all have median EOWY seven-reservoir storage above 50 percent of the total storage capacity. The Enhanced Coordination Alternative exhibits the least variability (interquartile range of 20 percent) while the Maximum Operational Flexibility exhibits the greatest variability (interquartile range of 26 percent). The Basic Coordination

and No Action Alternatives and the CCS Comparative Baseline have the lowest median seven-reservoir storage of 44 percent, 35 percent, and 38 percent, respectively. Likewise, they have the lowest 10th and 25th percentile seven-reservoir storage.

Figure TA 3-20
EOWY Seven-Reservoir Combined Storage



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

In the Critically Dry Flow Category, the order of medians and relationships across the alternatives and the CCS Comparative Baseline are generally similar to those in the Average Flow Category, but with notable reductions to storage volumes. The CCS Comparative Baseline and No Action

Alternative have the lowest median seven-reservoir storage (both with 19 percent), followed by the Basic Coordination Alternative (21 percent).

In the Dry Flow Category, the Representative Preferred Alternative has a median seven-reservoir storage of 37 percent, with 25th and 75th percentiles of 27 and 48 percent. In the Critically Dry Flow Category, the Representative Preferred Alternative has a median of 27 percent combined storage, with 25th and 75th percentiles of 18 and 36 percent.

TA 3.2.3 Issue 3: Reservoir Releases

Issue 3 addresses how operational activities would affect reservoir releases. This was evaluated by comparing the various action alternatives to the No Action Alternative and the CCS Comparative Baseline for the following metrics:

- WY Releases from Glen Canyon Dam
- 10-Year Releases from Glen Canyon Dam
- 10-Year Flows at Lee Ferry Compact Point
- CY Releases from Hoover Dam
- CY Releases from Davis Dam
- CY Releases from Parker Dam

Glen Canyon Dam

This section compares all alternatives and the CCS Comparative Baseline with respect to WY releases from Glen Canyon Dam at Lake Powell. Note that the performance of the LB Priority approach and the LB Pro Rata approach under the Supply Driven Alternative will not differ in Glen Canyon Dam releases because they use the same operation of Lake Powell.

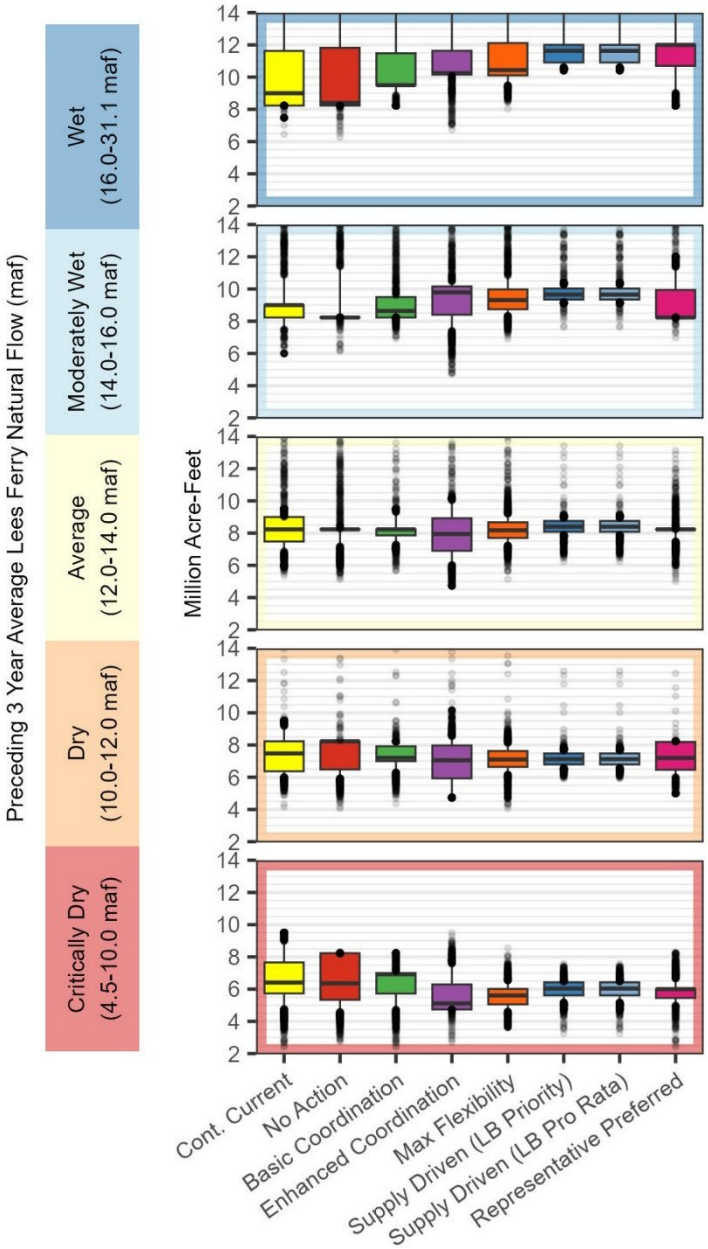
Figure TA 3-21 presents conditional boxplots of WY releases (maf) from Glen Canyon Dam. The y-axis has been truncated to facilitate easier comparison of the alternatives, see **Table TA 3-14** at the end of this TA for the full statistical summary.

In the Average Flow Category, the median annual Glen Canyon Dam releases for all alternatives and the CCS Comparative Baseline are between 7.95 maf (Enhanced Coordination) and 8.41 maf (Supply Driven [both LB Priority and LB Pro Rata approaches]). The Enhanced Coordination Alternative has the most variable release (interquartile range of 2.02 maf), followed by the CCS Comparative Baseline (interquartile range of 1.52 maf). The No Action and Representative Preferred Alternatives have the least variable release (interquartile range of 0 maf).

In the Critically Dry Flow Category, the No Action Alternative (6.36 maf), CCS Comparative Baseline (6.41 maf), and Basic Coordination Alternative (6.92 maf) have the largest median releases while the Enhanced Coordination (5.11 maf) and Maximum Operational Flexibility (5.61 maf) Alternatives have the lowest median releases. The No Action Alternative has the most variable releases (interquartile range of 2.90 maf) due to a large difference between the intended release (8.23 maf) and what is physically capable of being released due to infrastructure limitations below 3,490 feet.

In the Dry Flow Category for annual Glen Canyon Dam releases, the Representative Preferred Alternative has a median annual release of 7.20 maf, with 25th and 75th percentiles of 6.47 and 8.19 maf, respectively. In the Critically Dry Flow Category, the Representative Preferred Alternative has a median annual release of 6.0 maf. The 25th and 75th percentiles are 5.45 and 6.0 maf. Representative Preferred releases under Critically Dry Hydrology are the least variable of all alternatives.

Figure TA 3-21
WY Releases from Glen Canyon Dam[7]

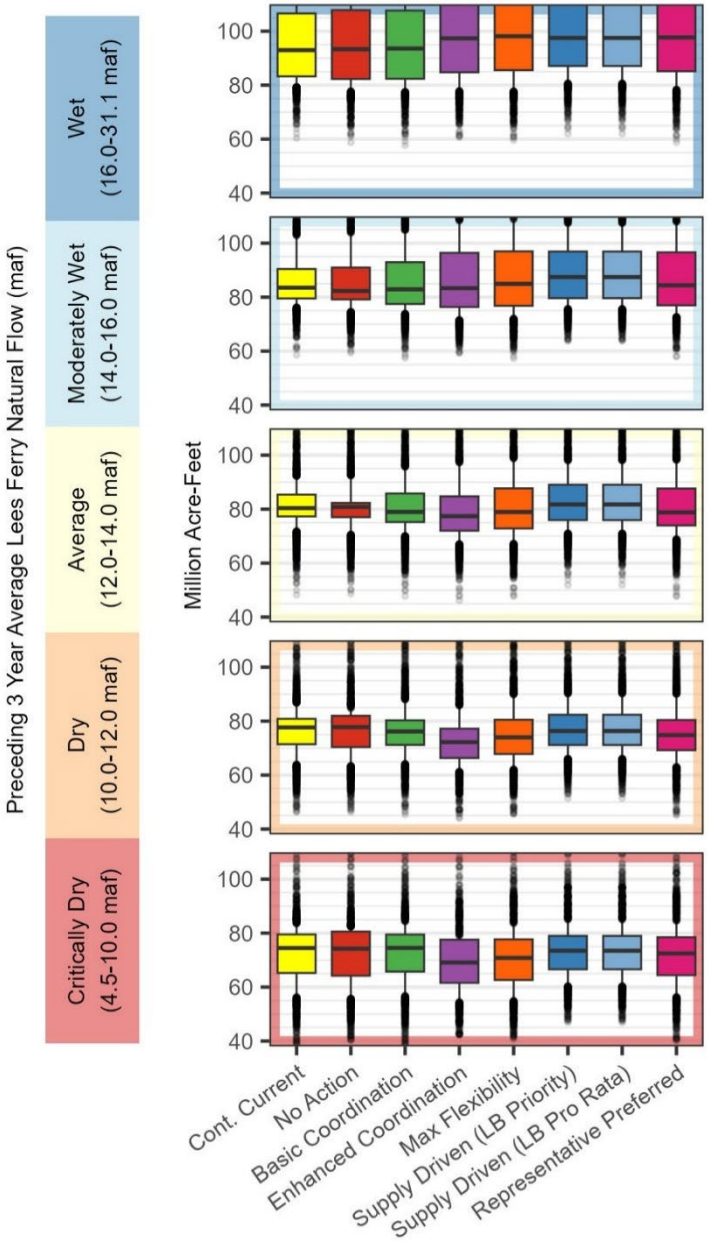


[7] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-14** for the full range of the data.

Glen Canyon Dam 10-Year Releases

Figure TA 3-22 presents conditional boxplots of cumulative 10-year releases from Glen Canyon Dam. The y-axis is truncated to enable easier comparison of alternatives. See **Table TA 3-15** at the end of this TA for the full statistical summary and full range of values.

Figure TA 3-22
10-Year Cumulative Releases from Glen Canyon Dam[8]



[8] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-15** for the full range of the data.

In the Average Flow Category, the median 10-year cumulative release ranges from 77.4 maf (Enhanced Coordination Alternative) to 81.7 maf (Supply Driven Alternative [both LB Priority and LB Pro Rata approaches]). Considering the 25th percentile, the Enhanced Coordination Alternative still exhibits the smallest 10-year release (72.0 maf), but the CCS Comparative Baseline has the greatest 10-year release of 77.3 maf. All action alternatives display significant variability, with the Maximum Operational Flexibility Alternative having the largest interquartile range of 14.8 maf (25th and 75th percentiles of 72.8 and 87.7 maf, respectively). In contrast, the No Action Alternative and CCS Comparative Baseline are the least variable with interquartile ranges of 5.3 and 8.1 maf, respectively.

In the Critically Dry Flow Category, the Basic Coordination Alternative and CCS Comparative Baseline have the highest median release (both 74.5 maf), followed closely by the No Action Alternative (74.2 maf). The Enhanced Coordination Alternative has the lowest median release (69.1 maf). The No Action Alternative has the greatest variability in 10-year releases (interquartile range of 16.4 maf) followed by the Enhanced Coordination (16.0 maf) and Maximum Operational Flexibility Alternatives (15.1 maf). However, for the No Action Alternative, this variability is driven by infrastructure-constrained releases (Lake Powell elevations below 3,490 feet) while it is driven by annual releases that are highly responsive to hydrologic conditions in the Enhanced Coordination and Maximum Operation Flexibility Alternatives.

In the Dry Flow Category for 10-year cumulative releases from Glen Canyon Dam, the Representative Preferred Alternative has a median 10-year release of 74.8 maf, with 25th and 75th percentiles of 69.2 maf and 80.4 maf, respectively. In the Critically Dry Flow Category, the Representative Preferred Alternative has a median 10-year release of 72.4 maf, with 25th and 75th percentiles of 64.4 maf and 78.5 maf, respectively.

Cumulative 10-Year Lee Ferry Flows

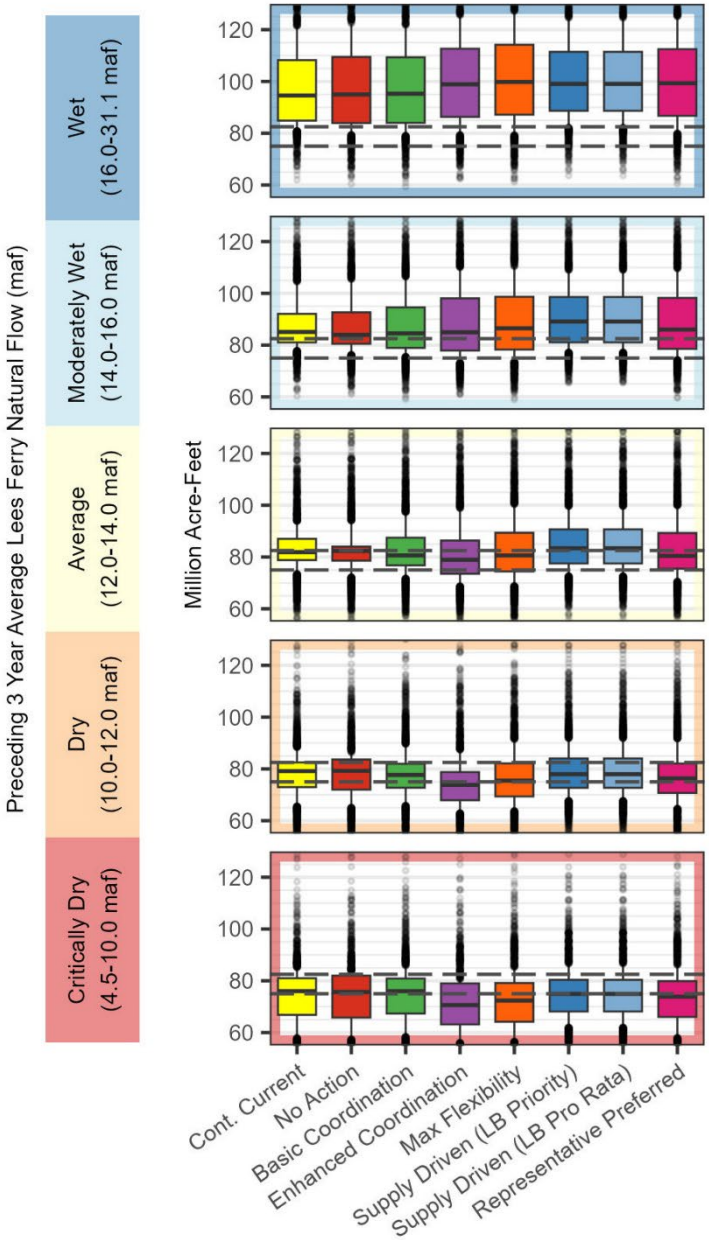
The Lee Ferry is the division point between the Upper Basin and the Lower Basin, as established by the 1922 Colorado River Compact. The Lee Ferry is located in Arizona, approximately 17 miles downstream of Glen Canyon Dam and approximately 1 mile downstream of the confluence with the Paria River. Refer to **Figure TA 3-2** in the Affected Environment Section for a map of the Lee Ferry.

Figure TA 3-23 presents conditional boxplots of cumulative 10-year Lee Ferry flow volumes (maf), with **Table TA 3-16** at the end of this TA providing the full statistical summary. In each flow category, 75.0 maf and 82.5 maf are shown with dashed lines; however, comparison of modeled output to these thresholds is discussed under the description of **Table TA 3-17** and **Table TA 3-18** and **Figure TA 3-24.** To facilitate easier comparison of alternatives, the y-axis is truncated.

In the Average Flow Category, the median Compact Point 10-year volume ranges from 78.9 maf (Enhanced Coordination Alternative) to 83.4 maf (Supply Driven Alternative [both LB Priority and LB Pro Rata approaches]). Considering the 25th percentile, the Enhanced Coordination Alternative also exhibits the smallest Compact Point 10-year volume (73.5 maf), but the CCS Comparative Baseline has the greatest volume of 78.8 maf. All action alternatives display significant variability, with the Maximum Operational Flexibility Alternative having the largest interquartile range of 14.9

maf (25th and 75th percentiles of 74.4 and 89.4 maf, respectively). In contrast, the No Action Alternative and CCS Comparative Baseline are the least variable with interquartile ranges of 5.4 and 8.2 maf, respectively.

Figure TA 3-23
Compact Point 10-Year Volume[9]



In the Critically Dry Flow Category, the CCS Comparative Baseline and Basic Coordination Alternative have the highest median Compact Point 10-year volume (both 76.0 maf), followed

[9] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-16** for the full range of the data.

closely by the No Action Alternative (75.7 maf). The Enhanced Coordination Alternative has the lowest median 10-year Compact Point volume (70.6 maf). The No Action Alternative has the greatest variability in Compact Point 10-year volumes (interquartile range of 16.2 maf) followed by the Enhanced Coordination (15.8 maf) and Maximum Operational Flexibility Alternatives (15.0 maf). However, for the No Action Alternative, this variability is driven by infrastructure-constrained releases (Lake Powell elevations below 3,490 feet) while it is driven by annual releases that are highly responsive to hydrologic conditions in the Enhanced Coordination and Maximum Operation Flexibility Alternatives.

In the Dry Flow Category, the Representative Preferred Alternative has a median Compact Point 10-year volume of 76.4 maf, with 25th and 75th percentiles of 70.7 maf and 82.1 maf, respectively. In the Critically Dry Flow Category, the Representative Preferred Alternative has a median Compact Point 10-year volume of 73.9 maf, with 25th and 75th percentiles of 66.0 maf and 79.9 maf, respectively.

Figure TA 3-24 presents the cumulative 10-year flow volume at the Compact Point relative to two different thresholds using two side-by-side conditional box plot panels. In each panel, the dashed line denotes the zero-difference threshold between the modeled Compact Point 10-year volume and the applicable threshold (75.0 maf in the left panel and 82.5 maf in the right panel). Positive values indicate Compact Point 10-year volumes greater than the threshold. The y-axis is truncated to facilitate easier comparison of the alternatives. Consult **Table TA 3-17** and **Table TA 3-18** for the full range of data.

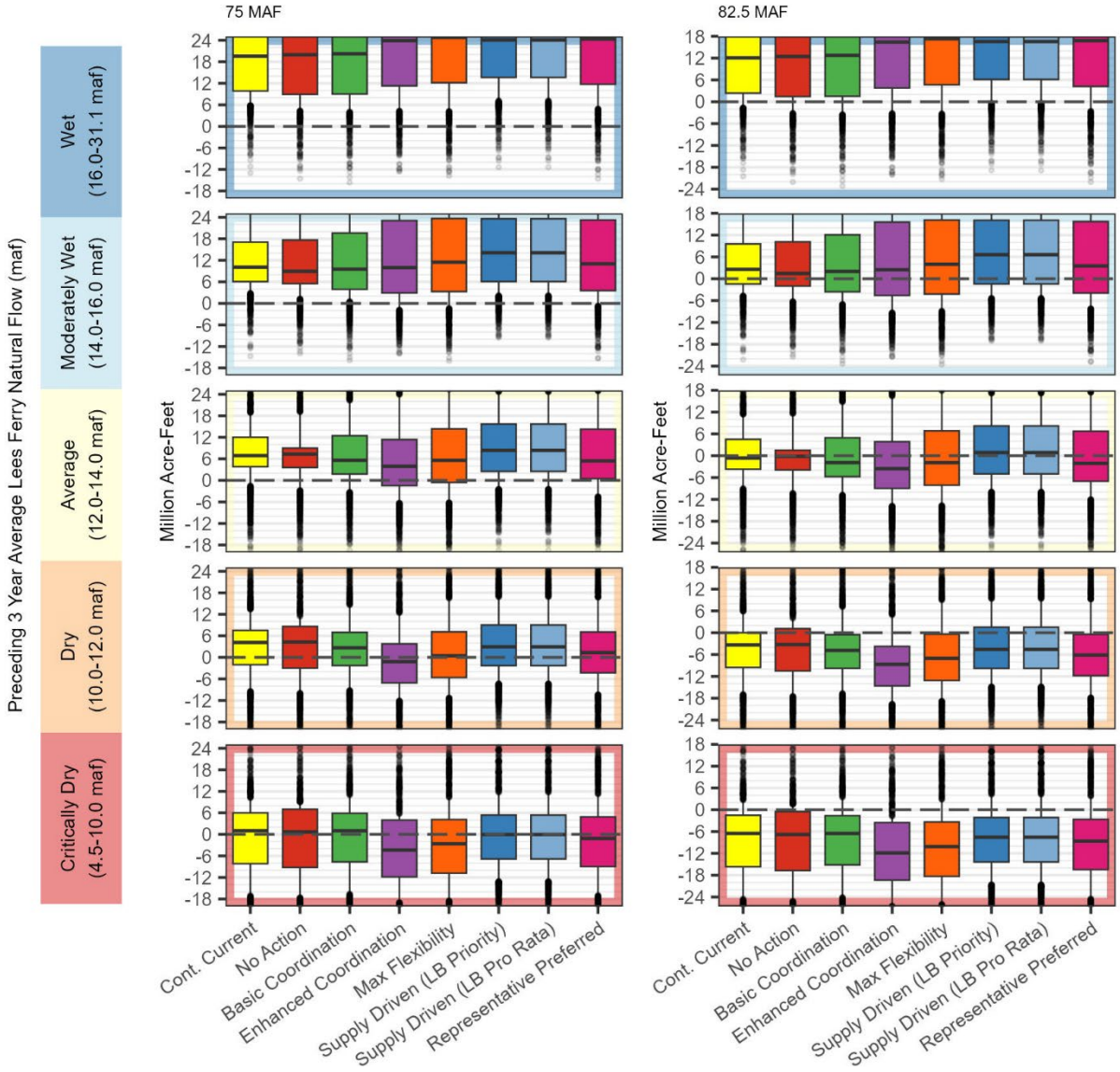
Under Average hydrology, considering the Compact Point 10-year volume **relative to 75.0 maf** (left column), the median values for all alternatives and the CCS Comparative Baseline are greater than zero, ranging from 3.9 maf (Enhanced Coordination Alternative) to 8.4 maf (Supply Driven Alternative [both LB Priority and LB Pro Rata approaches]). Considering the 25th percentile, Enhanced Coordination (-1.5 maf) and Maximum Operational Flexibility (-0.6 maf) are the only alternatives with 10-year volumes less than 75.0 maf.

Under Average hydrology, considering the Compact Point 10-year volume **relative to 82.5 maf** (right column), the only alternative with a median value greater than zero is Supply Driven (both LB Priority and LB Pro Rata approaches) (0.9 maf). After Supply Driven (both LB Priority and LB Pro Rata approaches), the median values for the No Action Alternative and CCS Comparative Baseline are the least negative (i.e. have 10-year volumes closest to 82.5 maf), with values of -0.2 and -0.6 maf, respectively.

In Critically Dry hydrology, considering the Compact Point 10-year volume relative to 75.0 maf, only the CCS Comparative Baseline (1.0 maf), Basic Coordination Alternative (1.0 maf), and No Action Alternative (0.7 maf) have positive median values (i.e. 10-year volumes greater than 75.0 maf). The median for the Supply Driven Alternative (both LB Priority and LB Pro Rata approaches) is slightly negative (-0.06 maf). Relative to 82.5 maf, greater than 75 percent of years are negative (i.e. 10-year volumes less than 82.5 maf) for all alternatives and the CCS Comparative Baseline.

The variability across alternatives and under different hydrologic conditions are the same as discussed in **Figure TA 3-23**.

Figure TA 3-24[10]
Compact Point 10-Year Volume Relative to 75.0 maf and 82.5 maf



In the Dry Flow Category, the Representative Preferred Alternative has a median 10-year volume relative to 75.0 maf of 1.4 maf, indicating that over 50 percent of years under Dry conditions result in 10-year volumes above 75.0 maf. However, less than 25 percent of years exhibit 10-year volumes greater than 82.5 maf (i.e. the 75th percentile relative to 82.5 maf is negative). Under the Critically Dry Flow Category, fewer than 50 percent of years have 10-year volumes greater than 75.0 maf, while slightly more than 10 percent of years result in 10-year volumes greater than 82.5 maf.

[10] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-17** and **Table TA 3-18** for the full range of the data.

Hoover Dam

This section compares all the alternatives and the CCS Comparative Baseline with respect to CY releases from Hoover Dam at Lake Mead.

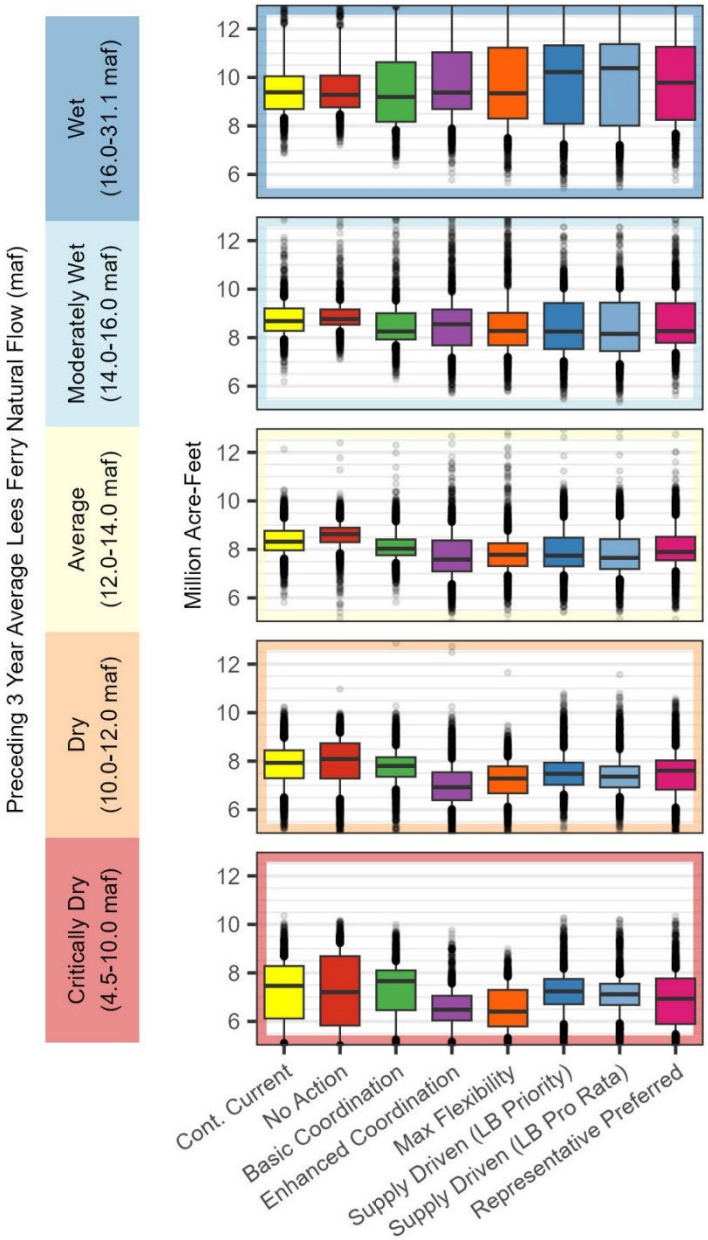
Figure TA 3-25 presents conditional boxplots of CY releases (maf) from Hoover Dam. The range of releases has been truncated to facilitate comparison of the alternatives, see **Table TA 3-19** at the end of this TA for the full range of data.

In the Average Flow Category, the median CY releases from Hoover Dam range from 7.58 maf, under the Enhanced Coordination Alternative, to 8.63 maf, under the No Action Alternative. The median releases for the No Action and Basic Coordination Alternatives and the CCS Comparative Baseline are all above 8.0 maf, while the median releases for other alternatives are all less than 8.0 maf. The No Action and Basic Coordination Alternatives have the least variable releases, with interquartile ranges of 0.60 and 0.65 maf, respectively. The Supply Driven (LB Priority approach), Supply Driven (LB Pro Rata approach), and Enhanced Coordination Alternatives have the greatest variability, with interquartile ranges of 1.18, 1.23 and 1.27 maf, respectively.

In the Critically Dry Flow Category, all alternatives except Enhanced Coordination and Maximum Operational Flexibility Alternatives have median releases between 7.12 maf (Supply Driven [LB Pro Rata approach]) and 7.66 maf (Basic Coordination). Maximum Operational Flexibility and Enhanced Coordination have median releases of 6.40 and 6.48 maf, respectively. All alternatives except Enhanced Coordination and Supply Driven (both LB Priority and LB Pro Rata approaches) have increased variability in Critically Dry conditions compared to Average conditions, with interquartile ranges between 1.51 maf (Maximum Operational Flexibility) and 2.86 maf (No Action Alternative). The Enhanced Coordination (1.02 maf), Supply Driven (LB Priority approach) (1.04 maf), and Supply Driven (LB Pro Rata approach) (0.88 maf) Alternatives have less variable releases (i.e. smaller interquartile ranges).

The Representative Preferred Alternative is roughly in the middle of the other alternatives and CCS Comparative Baseline, in terms of both median releases and variability in releases (except in Critically Dry where it is more variable). In the Dry Flow Category, the median release is 7.61 maf with an interquartile range of 1.20 maf (25th and 75th percentiles of 6.83 and 8.03 maf). In the Critically Dry Flow Category, the median release is 6.94 maf with an interquartile range of 1.88 maf (25th and 75th percentiles of 5.89 and 7.77 maf).

Figure TA 3-25
CY Releases from Hoover Dam[11]



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

[11] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-19** for the full range of the data.

Davis Dam

Releases from Davis Dam, at Lake Mohave, are based on target elevations defined by the existing rule curve (refer to **TA 6**, Water Quality). Inflows into Lake Mohave vary across alternatives, and because elevations are kept to the range determined by the rule curve, releases from Davis Dam subsequently vary across alternatives.

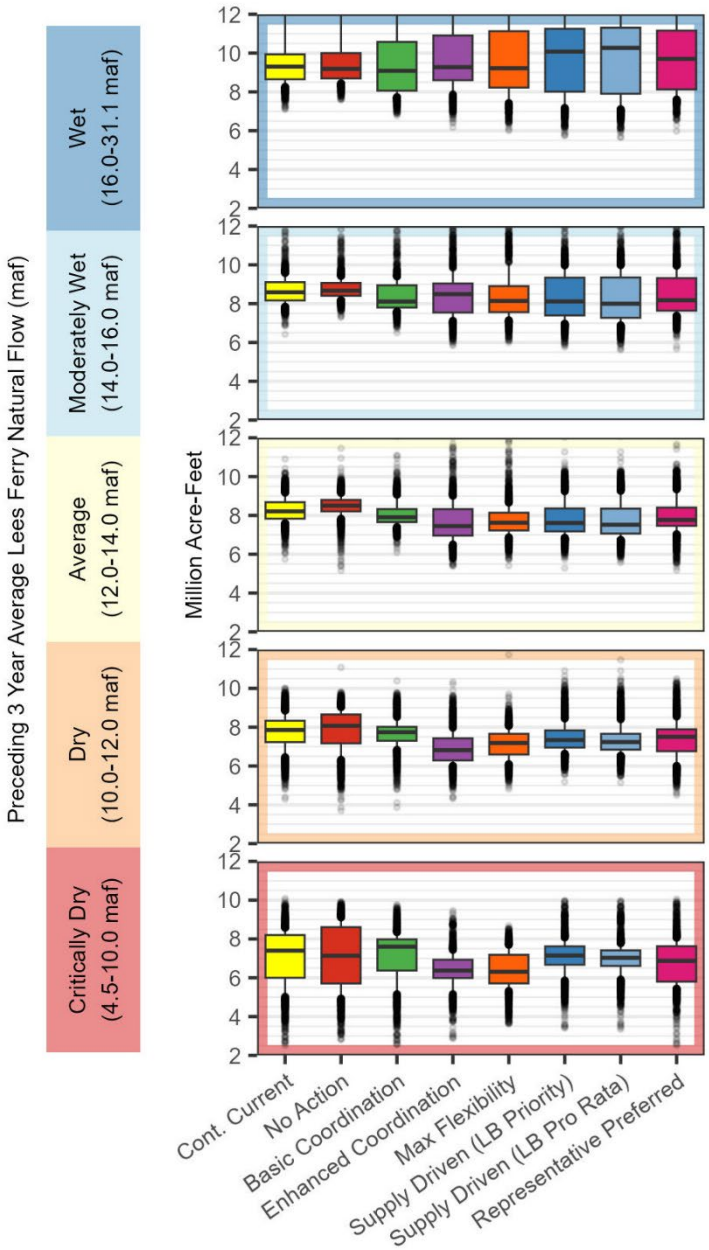
Figure TA 3-26 presents conditional boxplots of CY releases from Davis Dam. The range of releases has been truncated to facilitate comparisons of alternatives, see **Table TA 3-20** at the end of this TA for the full statistical summary and full range of values.

In the Average Flow Category, the median CY releases from Davis Dam range from 7.4 maf (Enhanced Coordination) to 8.5 maf (No Action Alternative). The median release for the CCS Comparative Baseline is 8.2 maf and for the Basic Coordination Alternative is 7.9 maf. Meanwhile, the median releases for the Maximum Operational Flexibility and Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives are closer to the median release under Enhanced Coordination (at 7.6 maf, 7.6 maf, and 7.5 maf, respectively). The No Action and Basic Coordination Alternatives have the least variability (interquartile ranges of 0.6 and 0.7 maf) while the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives have the most (interquartile ranges of 1.4 and 1.3 maf).

In the Critically Dry Flow Category, the median CY releases from Davis Dam range from 6.3 maf (Maximum Operational Flexibility Alternative) to 7.6 maf (Basic Coordination Alternative). The median for the Enhanced Coordination Alternative (6.4 maf) is similar to the Maximum Operational Flexibility Alternative, although the Maximum Operational Flexibility Alternative exhibits greater variability. The Supply Driven (both LB Priority and LB Pro Rata approaches) and the Representative Preferred Alternatives have median releases greater than the Maximum Operational Flexibility and Enhanced Coordination Alternatives but less than the Basic Coordination Alternative and the CCS Comparative Baseline. The Supply Driven (LB Pro Rata approach), Enhanced Coordination, and Supply Driven (LB Priority approach) Alternatives exhibit the least variability (interquartile ranges of 0.8, 0.9, and 0.9 maf) while the CCS Comparative Baseline and No Action Alternative exhibit the greatest variability (interquartile ranges of 2.2 and 2.9 maf).

In the Dry Flow Category, the Representative Preferred Alternative has a median release of 7.5 maf, which is roughly in the middle compared to the other alternatives. However, it has the third greatest variability (interquartile range of 1.1 maf), behind only the No Action and Basic Coordination Alternatives. In the Critically Dry Flow Category, the median release is 6.9 maf and the interquartile range is 1.8 maf, both of which are roughly in the middle compared to other alternatives.

Figure TA 3-26
CY Releases from Davis Dam[12]



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

[12] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-20** for the full range of the data.

Parker Dam

Releases from Parker Dam, at Lake Havasu, are based on target elevations defined by the existing rule curve (refer to **TA 6**, Water Quality). Inflows into Lake Havasu vary across alternatives, and because elevations are kept to the range determined by the rule curve, releases from Parker Dam subsequently vary across alternatives.

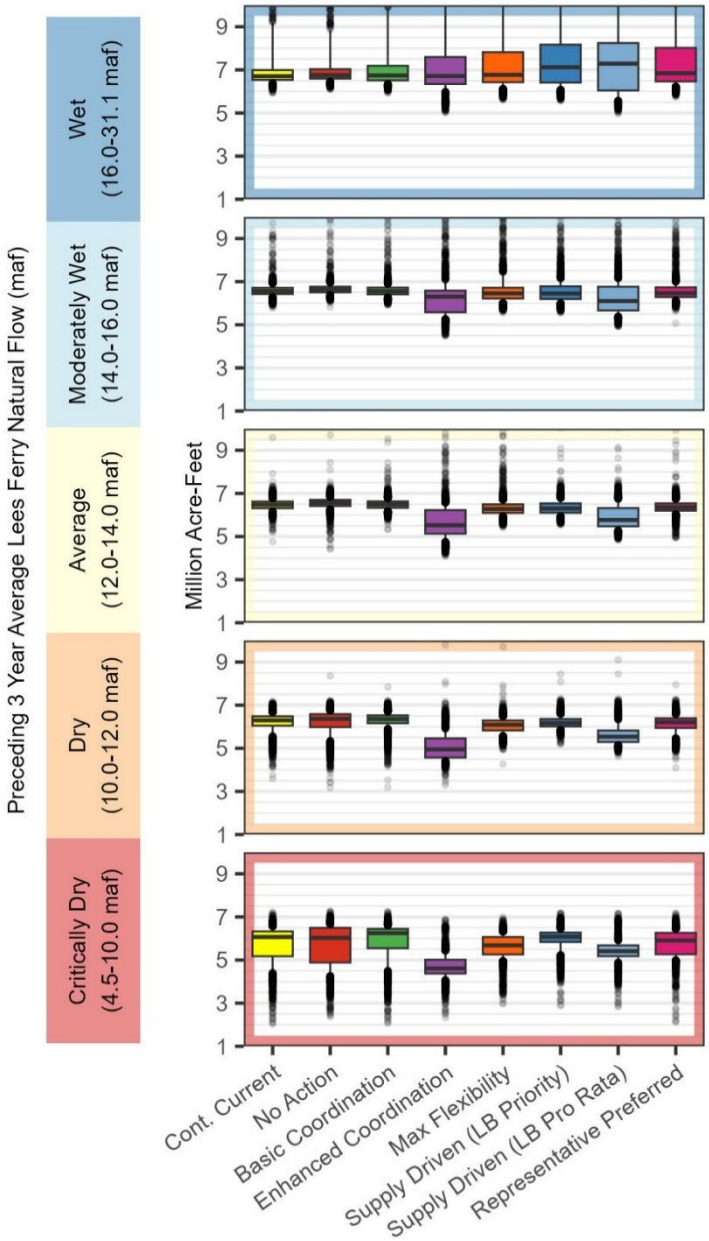
Figure TA 3-27 presents conditional boxplots of CY releases from Parker Dam. The range of releases is truncated to facilitate comparisons between the alternatives, see **Table TA 3-21** at the end of this TA for the full statistical summary and full range of values.

In the Average Flow Category, all alternatives except the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives have median releases between 6.3 and 6.6 maf. The Enhanced Coordination (5.5 maf) and Supply Driven (LB Pro Rata approach) (5.8 maf) Alternatives have notably lower median releases due to pro rata-based distribution of shortages. The Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives also have the greatest variability (interquartile ranges of 1.1 and 0.8 maf, respectively), whereas the other alternatives have interquartile ranges between 0.3 and 0.4 maf.

As conditions become drier, median releases decrease for all alternatives and variability increases for all alternatives except the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives. In the Critically Dry Flow Category, the Enhanced Coordination (4.6 maf), Supply Driven (LB Pro Rata approach) (5.4 maf), and Maximum Operational Flexibility (5.7 maf) Alternatives have the lowest median releases. The remaining alternatives and the CCS Comparative Baseline have higher and similar releases between 6.0 and 6.3 maf. When comparing the Critically Dry to Average Flow Category, most alternatives have greater variability in releases except for the Enhanced Coordination (interquartile range decreases from 1.1 maf to 0.6 maf), Supply Driven (LB Pro Rata approach) (decreases from 0.8 to 0.5 maf), and Supply Driven (LB Priority approach) Alternatives (remains 0.4 maf).

The Representative Preferred Alternative exhibits median releases and release variability similar to most alternatives. In the Dry Flow Category, the median release is 6.2 maf with 25th and 75th percentiles of 5.9 and 6.4 maf (interquartile range of 0.5 maf). Under the Critically Dry Flow Category, the median release is 5.9 maf with 25th and 75th percentiles of 5.3 and 6.3 maf (interquartile range of 1.0 maf).

Figure TA 3-27
CY Releases from Parker Dam[13]



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

[13] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-21** for the full range of the data.

TA 3.2.4 Issue 4: River Flows

Issue 4 addresses how operational activities would affect river flows. This was evaluated by comparing the various action alternatives to the No Action Alternative and the CCS Comparative Baseline for the following metrics:

- Annual Colorado River flows below Glen Canyon Dam
- Annual Colorado River flows below Hoover Dam
- Annual Colorado River flows below Davis Dam
- Annual Colorado River flows below Parker Dam
- Annual Colorado River flows at Imperial Dam
- Annual Colorado River flow below Imperial Dam
- Annual Colorado River flow below Morelos Diversion Dam

The conclusions in this section are drawn from three-year average natural flow model outputs and are framed using five flow categories. The conditional box plots show the distribution of river flows (y-axis) over the full analysis period relative to each alternative (x-axis).

Reach 1: Glen Canyon Dam to Lake Mead

This reach of the river (between Glen Canyon Dam and Lake Mead) extends for 292 miles through narrow canyons, including GCNP. River flows in this reach primarily consist of controlled releases from Glen Canyon Dam at Lake Powell. Refer to Issue 3 for the analysis of WY releases and the 10-year cumulative releases from Glen Canyon Dam for the No Action Alternative, CCS Comparative Baseline, and action alternatives. While the results of CRSS analysis are on an annual basis, monthly releases from Lake Powell at Glen Canyon Dam meet the 2016 LTEMP ROD (Reclamation 2016) minimum flows. Reclamation has the option to conduct high flow experiment releases from Glen Canyon Dam under certain conditions to reduce sediment deposition, which usually occurs in durations ranging from 60 hours to 10 days. Refer to **TA 5**, Geomorphology and Sediment, and **TA 8**, Biological Resources – Fish and Other Aquatic Species, for the analysis of high flow experiment flows from Glen Canyon Dam.

This reach also includes contributions from the Paria River and Little Colorado River, two perennial tributaries that discharge to the Colorado River between Glen Canyon Dam and Lake Mead. Based on historical USGS gage data, inflows from the Paria River and Little Colorado River make up approximately three percent of the total flow in this reach of the Colorado River (USGS 2025a). From 1906 to 2005, the annual inflow of the Paria River averaged 21.0 kafy and the Little Colorado River inflow averaged 180.0 kafy. Since 2007, the annual inflow from the Paria River averaged 17.0 kafy, and the Little Colorado River inflow averaged 274.0 kafy. Inflows from the Paria River and Little Colorado River were modeled in CRSS as the same across alternatives.

Relating back to the Issue 3 analysis for Glen Canyon Dam, in the Average Flow Category, the median WY releases from Glen Canyon Dam are: 8.41 maf under the Supply Driven Alternative (both LB Priority and LB Pro Rata approaches), 8.23 maf under the CCS Comparative Baseline and the No Action and Basic Coordination Alternatives, 8.17 maf under the Maximum Operational Flexibility Alternative, 7.95 maf under the Enhanced Coordination Alternative, and 8.23 maf under

the Representative Preferred Alternative. The historic combined inflows from the Paria River and the Little Colorado River (291.0 kaf combined) are approximately 3.5 percent to 3.7 percent of these modeled Average Flow Category median Glen Canyon Dam releases.

Reach 2: Hoover Dam to Lake Mohave

This reach of the river (starting from the Hoover Dam at Lake Mead) is 67 miles long and flows through Pyramid Canyon, El Dorado Canyon, and Black Canyon. Lake Mohave is on the downstream end of the reach, and it acts hydraulically like a tailwater to Hoover Dam. River flows in this reach primarily consist of releases from Hoover Dam with small contribution from tributary inflows. According to the 2007 Final EIS, tributary inflows, mostly from side washes, comprise less than 1 percent of the total annual flow (Reclamation 2007a). CRSS modeling of flows in this reach do not account for tributary inflows and reflect only releases from Hoover Dam.

Below is brief summary of the modeling results presented in Issue 3 based on CY releases from Hoover Dam. For modeling results and an in-depth discussion, refer to **Table TA 3-19** and **Figure TA 3-25**.

In the Average Flow Category, the median annual flow volumes for the No Action Alternative, Basic Coordination Alternative, and the CCS Comparative Baseline range from 8.03 to 8.63 maf. The remaining alternatives range from 7.58 maf (Enhanced Coordination) to 7.89 maf (Representative Preferred). In the Critically Dry Flow Category, median values decrease, with the smallest values being 6.40 maf (Maximum Operational Flexibility) and 6.48 maf (Enhanced Coordination) and the largest values being 7.47 maf (CCS Comparative Baseline) and 7.66 maf (Basic Coordination). The Representative Preferred Alternative generally results in annual volumes in the middle compared to other alternatives and the CCS Comparative Baseline.

Reach 3: Davis Dam to Lake Havasu

This reach of the Colorado River (starting from Davis Dam at Lake Mohave) is 84 miles long and forms Lake Havasu. River flows in this reach are mostly comprised of releases from Davis Dam and tributary inflow from the Bill Williams River.

Inflows from the Bill Williams River discharge directly into Lake Havasu and are regulated by the USACE operations of Alamo Dam. From 1906 to 2007, the annual inflow averaged 102,000 af. From 2008 to 2022 the annual inflow averaged 105,000 af (USGS 2025b).

Releases from Davis Dam are the variable that would differ between alternatives, so they have been used for comparison. Below, a brief summary of CY releases from Davis Dam are provided. For modeling results and in-depth discussion, refer to **Table TA 3-20** and **Figure TA 3-26**.

In the Average Flow Category, the Basic Coordination Alternative, CCS Comparative Baseline, and No Action Alternative have the largest annual volumes of 7.9, 8.2, and 8.5 maf. The remaining alternatives range from 7.4 maf (Enhanced Coordination) to 7.8 maf (Representative Preferred). In the Critically Dry Flow Category, median values decrease, with the smallest values being 6.3 maf (Maximum Operational Flexibility) and 6.4 maf (Enhanced Coordination) and the largest values being 7.4 maf (CCS Comparative Baseline) and 7.6 maf (Basic Coordination). The Representative

Preferred Alternative generally results in annual volumes in the middle compared to other alternatives and the CCS Comparative Baseline.

Reach 4: Parker Dam to Cibola Gage

This reach of the river (starting from Parker Dam at Lake Havasu) is 105 miles long and goes to Reclamation's Cibola Gage. Flows in this reach primarily consist of releases from Parker Dam. Two major diversion dams are located in this reach of the river: Headgate Rock Dam and Palo Verde Diversion Dam. The impoundments of these dams are used to facilitate the diversion of water for the Colorado River Indian Tribes and Palo Verde Irrigation District.

The analysis of flows for this reach is based on CY release volumes from Parker Dam. A brief summary is provided below. For modeling results and in-depth discussion, refer to Issue 3, **Table TA 3-21** and **Figure TA 3-27**.

In the Average Flow Category, all alternatives except Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives have median releases between 6.3 and 6.6 maf. The Enhanced Coordination (5.5 maf) and Supply Driven (LB Pro Rata approach) (5.8 maf) Alternatives have notably lower median releases due to pro rata-based distribution of shortages. As conditions become drier, median releases decrease for all alternatives. In the Critically Dry Flow Category, the Enhanced Coordination (4.6 maf), Supply Driven (LB Pro Rata approach) (5.4 maf), and Maximum Operational Flexibility (5.7 maf) Alternatives have the lowest median releases. The remaining alternatives and the CCS Comparative Baseline have higher and similar releases between 5.9 and 6.3 maf. The Representative Preferred Alternative has annual volumes similar to other alternatives besides the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives, which are notably lower.

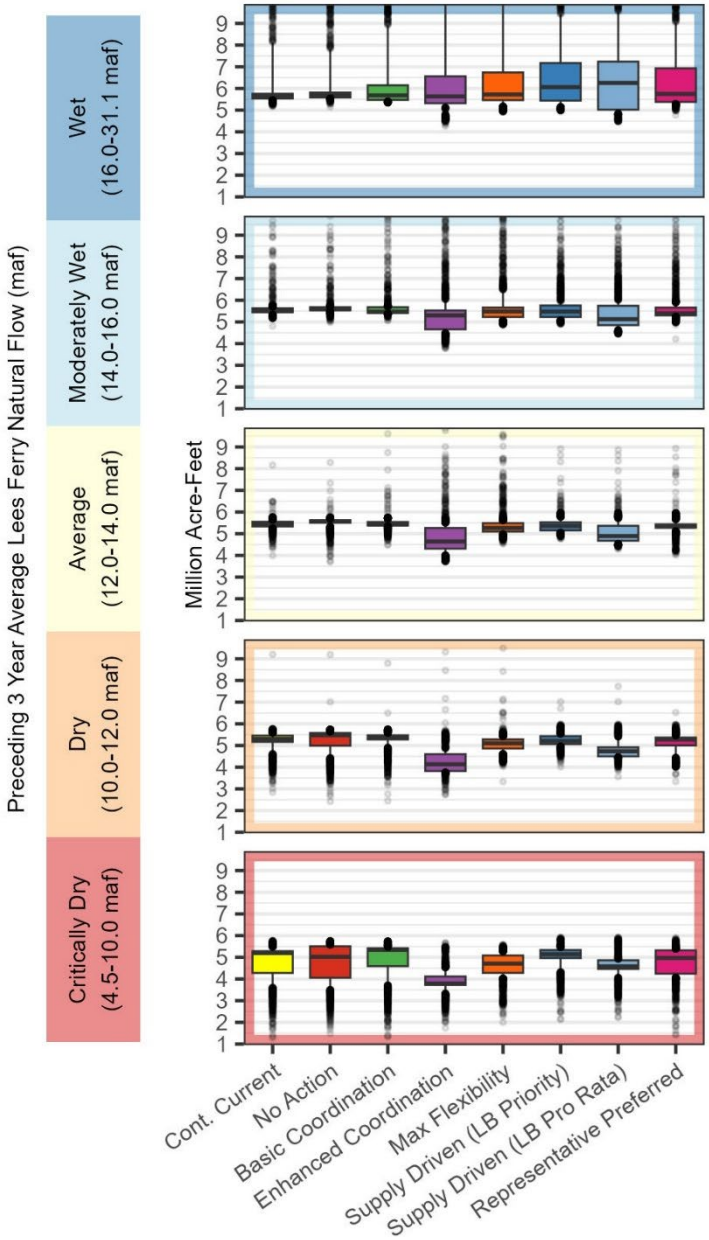
Reach 5: Cibola Gage to Imperial Dam

This reach of the river (starting from the Cibola Gage) is 38 miles long and is bounded on the downstream end by Imperial Dam at Imperial Reservoir. Flows in this reach consist primarily of releases from Parker Dam but are impacted by diversions and return flows. The Imperial Dam impoundment in this reach operates at a nearly constant elevation to meet water delivery requirements.

Figure TA 3-28 presents conditional boxplots of annual flow volume at Imperial Dam. The range of volumes is truncated at the high end to facilitate comparisons between alternatives, see **Table TA 3-22** at the end of this TA for the full statistical summary and full range of values.

In the Average Flow Category, most alternatives and the CCS Comparative Baseline have a median volume between 5.3 and 5.6 maf. The exceptions are the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives, which have smaller median volumes of 4.6 and 4.9 maf, respectively. The Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives are also distinct in that they have greater variability (interquartile ranges of 1.0 maf and 0.7 maf) compared to other alternatives and the CCS Comparative Baseline (interquartile ranges between 0.1 and 0.4 maf). These differences are due to the pro rata-based shortage distributions in the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives.

Figure TA 3-28
Annual Flow Volume at Imperial Dam[14]



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

As hydrology becomes drier, all alternatives and the CCS Comparative Baseline show smaller annual flow volumes. In the Critically Dry Flow Category, most alternatives and the CCS Comparative Baseline have a median volume between 5.0 and 5.3 maf. However, the Enhanced Coordination (3.8

[14] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-22** for the full range of the data.

maf), Supply Driven (LB Pro Rata approach) (4.6 maf), and Maximum Operational Flexibility (4.7 maf) Alternatives have noticeably smaller annual volumes. The CCS Comparative Baseline, No Action Alternative, and Basic Coordination Alternative show greater variability (i.e. larger interquartile ranges) in the Critically Dry Flow Category compared to the Average Flow Category, likely due to dead pool-related delivery reductions (see **Figures TA 4-1** and **TA 4-2** in **TA 4**, Water Deliveries). The Maximum Operational Flexibility and Representative Preferred Alternatives also show greater variability, but likely due to increased shortages (not dead pool-related delivery reductions - see **Figures TA 4-1** and **TA 4-2** in **TA 4**, Water Deliveries). Variability decreases for the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives and remains about the same for the Supply Driven Alternative (LB Priority approach).

The Representative Preferred Alternative exhibits the following outcomes with respect to the Dry Flow Category: a median value of 5.3 maf (tied with CCS Comparative Baseline and third largest behind No Action and Basic Coordination Alternatives) and an interquartile range of 0.4 maf (third largest variability after the Enhanced Coordination and No Action Alternatives). In the Critically Dry Flow Category, the Representative Preferred Alternative exhibits the following outcomes: a median value of 5.0 maf (in the middle of the range of medians) and an interquartile range of 1.1 maf (second largest variability after the No Action Alternative).

Reach 6: Imperial Dam to NIB

This reach of the river (starting from the Imperial Dam) is 26 miles long and is bounded on the downstream end by NIB between the U.S. and Mexico. Flows in this reach primarily consist of releases from Imperial Dam to make delivery requirements. Flows in this reach also include water leaked from the AAC's sluiceway gates and return flow from Imperial Dam diversions.

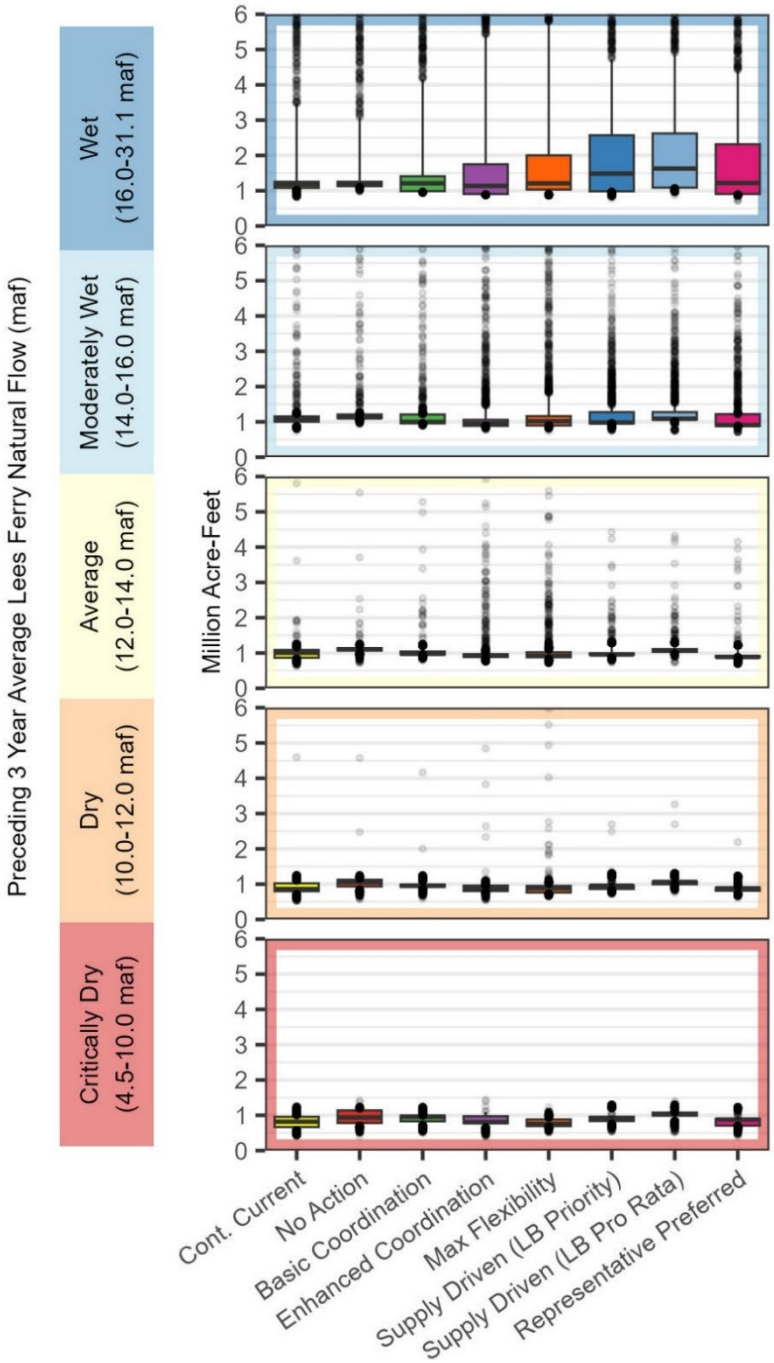
Figure TA 3-29 presents conditional boxplots of annual flow volume below Imperial Dam. The range of volumes is truncated at the high end to facilitate comparisons between alternatives, see **Table TA 3-23** at the end of this TA for the full statistical summary and full range of values.

In the Average Flow Category, the median annual flow volumes below Imperial Dam range from 0.9 maf (Maximum Operational Flexibility and Enhanced Coordination Alternatives) to 1.1 maf (No Action and Supply Driven [LB Pro Rata] Alternatives, and CCS Comparative Baseline). The CCS Comparative Baseline and all action alternatives have low variability in the Average Flow Category, with interquartile ranges between 34 and 221 kaf. Although rare, less than 10 percent of years have large volumes with maximums between 8.5 and 15.6 maf due to Flood Control operations.

In the Critically Dry Flow Category, the median annual flow volumes range from 0.8 maf (CCS Comparative Baseline, Enhanced Coordination Alternative, and Maximum Operational Flexibility Alternatives), to 1.0 maf (Supply Driven Alternative [LB Pro Rata approach] and Basic Coordination Alternatives). Variability in terms of interquartile range and outliers is low.

The Representative Preferred Alternative exhibits the following outcomes with respect to the Dry Flow Category: the median volume is 0.9 maf and the interquartile range is 88 kaf. In the Critically Dry Flow Category, the median volume is 0.9 maf and the interquartile range is 192 kaf. Overall, the Representative Preferred Alternative has annual volumes on the low end of all alternatives.

Figure TA 3-29
Annual Flow Volume Below Imperial Dam[15]



Note: Supply Driven (LB Priority approach) and Supply Driven (LB Pro Rata approach) results differ primarily because of how the two shortage-distribution approaches interact with the modeled assumptions governing the storage and delivery of conserved water (see **Appendix B**, Modeling Assumptions: Lake Powell and Lake Mead Storage and Delivery of Conserved Water).

[15] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-23** for the full range of the data.

Reach 7: NIB in the Limitrophe to SIB

This reach of the river (starting from the NIB) is split into two sub reaches. Approximately 1.1 miles downstream from the NIB is Morelos Diversion Dam where, under normal operations, the entirety of the remaining Colorado River is diverted by Mexico for water supply into the Reforma Canal.

Downstream of Morelos Diversion Dam, the reach continues to the SIB and the Colorado River Delta. Flows through this reach, referred to as the limitrophe, consist of water in excess of Mexico's scheduled delivery. Flows in excess could be due to Flood Control operations at Hoover Dam, seepage from Morelos Diversion Dam, irrigation return flows, groundwater inflow, and any water released for environmental purposes in the Colorado River Delta.

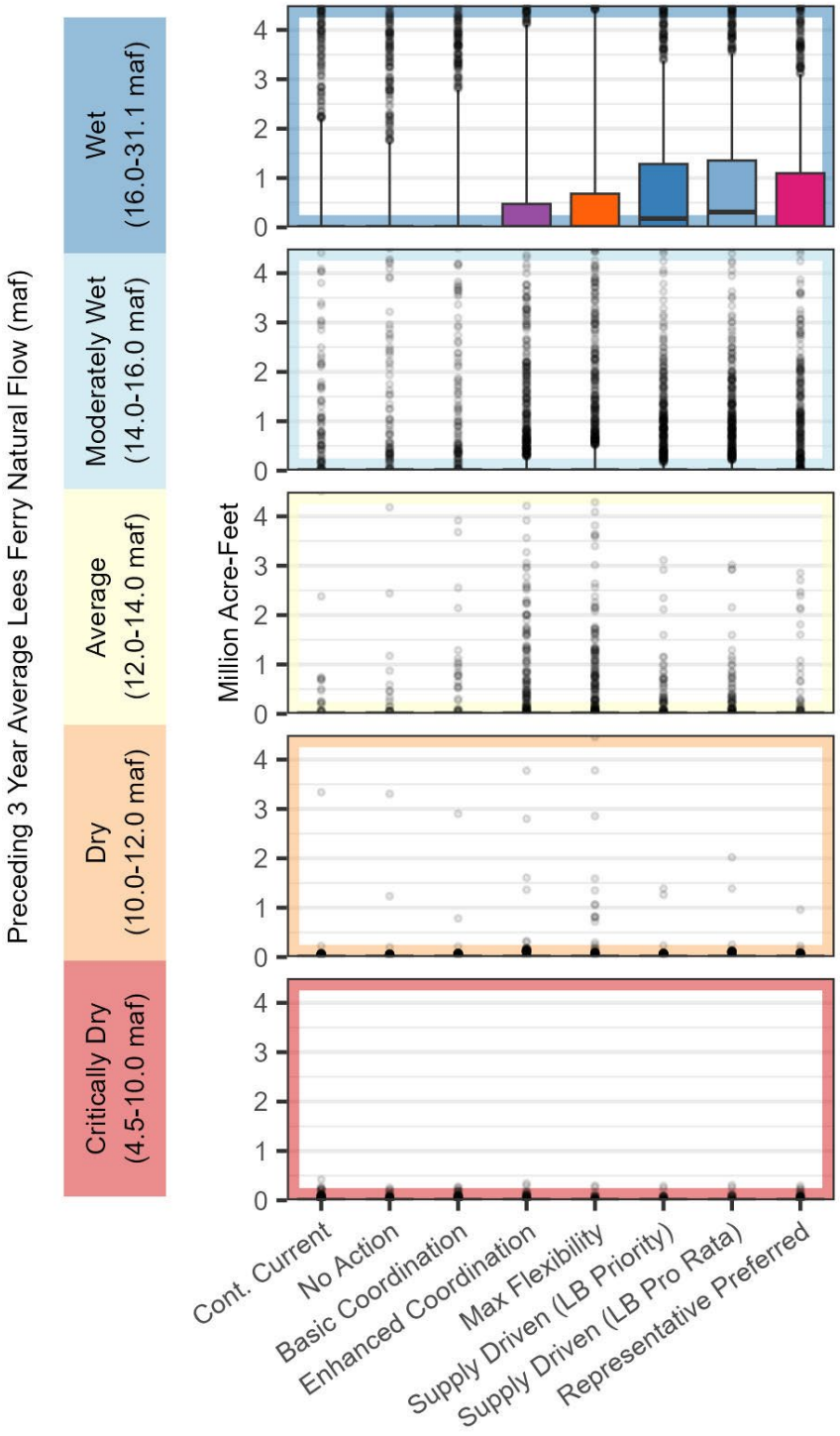
Figure TA 3-30 presents conditional boxplots of annual flow volume below Morelos Diversion Dam. The range of volumes is truncated to facilitate comparisons between alternatives, see **Table TA 3-24** at the end of this TA for the full statistical summary and full range of values.

In the Wet Flow Category, flows in the Colorado River below Morelos Diversion Dam occur in 50 percent of years for the Supply Driven Alternative (both LB Priority and Pro Rata approaches), greater than 25 percent of years for the Enhanced Coordination, Maximum Operational Flexibility and Representative Preferred Alternatives, and fewer than 25 percent of years for other alternatives and the CCS Comparative Baseline (i.e., the 75th percentile is 0).

As natural flow decreases, flows in the Colorado River below Morelos Diversion Dam become even less frequent. In the Average, Dry, and Critically Dry Flow Categories, flows occur in 10 percent or fewer years for all alternatives and the CCS Comparative Baseline (i.e. the 90th percentile is zero).

Although infrequent, there is the possibility of large volume flows in the limitrophe (e.g. greater than 1.0 maf in one calendar year) in all but the Critically Dry Flow Category. These are the result of exceptionally high flows that occur in some of the hydrologic futures considered in the modeling analysis.

Figure TA 3-30
Annual Flow Volume Below Morelos Diversion Dam[16]



[16] The plotting range has been truncated to facilitate comparison of the alternatives. Consult **Table TA 3-24** for the full range of the data.

TA 3.2.5 Issue 5: Groundwater

Issue 5 addresses how operational activities for the various alternatives would affect groundwater adjacent to reservoirs and within specific reaches along the Colorado River. This was evaluated by comparing the various action alternatives to the No Action Alternative and the CCS Comparative Baseline for the following metrics:

- Qualitative discussion of possible groundwater impacts based on relative changes to Colorado River flows for each reach, and relative changes to reservoir elevations where applicable.
- Hydraulic connectivity between groundwater and the reservoirs and river reaches of the Colorado River vary depending on a number of factors, including physical geotechnical characteristics, vegetative groundcover, whether irrigation is occurring nearby, and distance from the river.

Regional scale changes to groundwater are complex and hard to quantify without extensive data records and groundwater models. Current data on groundwater at a regional scale is limited in scope and historical duration.

There are no legal requirements to not deplete groundwater for nearby wells, although decreasing reservoir elevations may contribute to decreased groundwater elevations depending on hydraulic connectivity. Secondary impacts on groundwater are not considered in this analysis (e.g., if actions under the various alternatives would result in more groundwater pumping occurring in order to supplement decreased supply).

Reach 1: Lake Powell to Lake Mead

Fluctuations in elevations at Lake Powell may be reflected in groundwater elevations adjacent to the reservoir, depending on the hydraulic connectivity between the reservoir and nearby groundwater wells. Relating back to the Issue 1 analysis, the water surface elevations at Lake Powell vary by alternative with the Maximum Operational Flexibility Alternative and the Enhanced Coordination Alternative being the most robust at keeping elevations above 3,500 feet in 100 percent of months over the full modeling period (86 percent and 74 percent, respectively). Since these two alternatives are the most robust for reservoir elevations, groundwater elevations adjacent to Lake Powell are anticipated to be slightly higher under these alternatives compared to the others. The Representative Preferred Alternative is the third most robust (40 percent) followed by the CCS Comparative Baseline and Supply Driven Alternative (both LB Priority and LB Pro Rata approaches) (all 18 percent), and the Basic Coordination Alternative (13 percent). The No Action Alternative is the least robust at keeping Lake Powell elevations above 3,500 feet and is therefore anticipated to result in lower groundwater elevations adjacent to the reservoir.

Reach 1 of the Colorado River extends from downstream of Glen Canyon Dam, through the GCNP, to Lake Mead. The Grand Canyon restricts hydraulic connection to groundwater to sandbars. Due to physical geotechnical characteristics, changes to groundwater levels in this reach are not anticipated to be affected by the various alternatives.

Black Canyon, which is dammed by Hoover Dam, is made of bedrock that limits the connection to groundwater with a few small sandbars. As such, groundwater basins adjacent to Lake Mead are generally small in size and are bounded by zones of non-water bearing rock. Changes in water surface elevations at Lake Mead are not anticipated to be affected by the various alternatives.

Reach 2: Hoover Dam to Davis Dam

Reach 2 of the Colorado River extends from downstream of Hoover Dam to Lake Mohave (formed by Davis Dam) and runs through a bedrock canyon that limits the connection to groundwater. Due to physical geotechnical characteristics of the bedrock canyon, changes to groundwater levels in this reach are not anticipated to be affected by the various alternatives.

Groundwater elevations adjacent to Lake Mohave are not anticipated to be affected by the various alternatives because the release rule curve that Lake Mohave operates under is the same for all alternatives in this analysis. The rule curve keeps water surface elevations of Lake Mohave within a tight range and Reclamation will continue to operate releases from Davis Dam in this manner.

Reach 3: Davis Dam to Parker Dam

Reach 3 of the Colorado River extends from downstream of Davis Dam to Lake Havasu (formed by Parker Dam) and flows through two different groundwater basins. The upper portion of this reach is within the Mohave Valley groundwater basin, which is alluvial fill, and fluctuations in river flows through this section may affect groundwater in the alluvial basin.

Relating back to the Issue 4 analysis, the river flows in this reach are mostly comprised of releases from Davis Dam and tributary inflow from the Bill Williams River. Releases from Davis Dam vary by alternative, with the Basic Coordination Alternative having the highest flows in the reach under the Critically Dry Flow Category. Therefore, groundwater elevations through the Mohave Valley groundwater basin are anticipated to be higher under this alternative during dry conditions, compared to the others. Following this connection between river flows and adjacent groundwater elevations, the CCS Comparative Baseline is anticipated to have the second highest groundwater elevations in the Critically Dry Flow Category, closely followed by the No Action Alternative, Supply Driven Alternative (both LB Priority and LB Pro Rata approaches), and the Representative Preferred Alternative. The Enhanced Coordination and the Maximum Operational Flexibility Alternatives are anticipated to result in lower groundwater elevations in dry conditions compared to the other alternatives.

The lower portion of this reach is within the Chemehuevi Valley and is dominated by Lake Havasu. Similar to Lake Mohave, the groundwater elevations adjacent to Lake Havasu are not anticipated to be affected by the various alternatives because of the strict release rule curve is the same for all alternatives within this analysis. The rule curve keeps water surface elevations of Lake Havasu within a tight range and Reclamation will continue to operate releases from Parker Dam in this manner.

Reach 4: Parker Dam to Cibola Gage

Reach 4 of the Colorado River extends from downstream of Parker Dam to the USGS gage station known as Cibola Gage. This reach flows through one large alluvial fill groundwater basin and fluctuations in river flows through this section may affect groundwater in this alluvial basin.

Relating back to the Issue 4 analysis, the river flows in this reach are mostly comprised of releases from Parker Dam which vary by alternative. In the Critically Dry Flow Category, the Basic Coordination Alternatives has the highest flows in the reach, therefore, groundwater elevations through this reach of the river are anticipated to be higher under this alternative compared to others. The Supply Driven Alternative (LB Priority approach) is anticipated to have the next highest groundwater elevations in the Critically Dry Flow Category, followed by the CCS Comparative Baseline, and the No Action, Representative Preferred, and Maximum Operational Flexibility Alternatives. The Supply Driven Alternative (LB Pro Rata approach) is anticipated to have the second lowest groundwater elevations in the Critically Dry Flow Category and the Enhanced Coordination Alternative is anticipated to have the lowest groundwater elevations.

Reach 5: Cibola Gage to Imperial Dam

Reach 5 of the Colorado River extends from the USGS gage station known as Cibola Gage down to Imperial Dam and runs through a narrow alluvial fill valley. Fluctuations in river flows through this section may affect groundwater.

Flows in this reach primarily consist of releases from Parker Dam and mirror trends in reach 4. As such, groundwater elevations in this reach of the river also mirror trends for relative groundwater elevations in Reach 4. In the Critically Dry Flow Category, The Basic Coordination Alternative is anticipated to have the highest groundwater elevations compared to the other alternatives. The CCS Comparative Baseline is anticipated to have the second highest groundwater elevations during in the Critically Dry Flow Category, closely followed by the Supply Driven (LB Priority approach), No Action, Representative Preferred, and Maximum Operational Flexibility Alternatives. The Supply Driven Alternative (LB Pro Rata approach) is anticipated to have the second lowest groundwater elevations in the Critically Dry Flow Category and the Enhanced Coordination Alternative is anticipated to have the lowest groundwater elevations.

Reach 6: Imperial Dam to NIB

Reach 6 of the Colorado River extends from downstream of Imperial Dam to the NIB and bypasses most of the river channel as it runs through a series of lined canals and sluiceways. Therefore, the proposed alternatives are not anticipated to affect groundwater basins adjacent to this reach.

Reach 7: NIB in the Limitrophe to SIB

Reach 7, referred to as the limitrophe, of the Colorado River extends from the NIB to the SIB and consists of the deep Colorado River Delta groundwater basin. Infrequent flows in this reach may occur due to releases at Morelos Diversion Dam under exceptionally wet hydrologic conditions.

The upstream portion of this reach is considered a gaining reach because high groundwater elevations from nearby irrigated fields results in flow to the surface. The proposed alternatives would not affect irrigation to nearby fields, therefore, there are no anticipated impacts on the groundwater in this section of the reach.

The downstream portion of this reach is considered a losing reach because groundwater is recharged from the river. Groundwater elevations in this section of the reach have historically declined and are likely to continue to decline under dry conditions.

TA 3.2.6 Summary Comparison of Alternatives

Issue 1: Reservoir Elevations

Issue 1 evaluates how operational activities under the CCS Comparative Baseline, No Action Alternative, and action alternatives would affect reservoir elevations at Lake Powell and Lake Mead. The analysis compares Lake Powell EOWY and WY minimum elevations, Lake Mead EOCY and CY minimum elevations, and the effects of Upper Basin and Lower Basin conservation assumptions on reservoir storage. Modeling shows fewer performance deviations under wetter flow categories, while differences among alternatives increase under dry and critically dry conditions because operations at lower elevations vary widely across alternatives.

Performance patterns vary by reservoir, alternative, flow category, and metric. At Lake Powell, differences among alternatives become more pronounced under drier hydrologic conditions, with some alternatives maintaining higher elevations and greater robustness above key thresholds, while others shift closer to or below those thresholds. At Lake Mead, the action alternatives perform better than the No Action Alternative for maintaining elevations above key thresholds, although results vary across alternatives and flow categories. Conservation activity increases median elevations for several action alternatives, but effects vary by reservoir, alternative, and flow category. Lake Mohave and Lake Havasu elevations are not affected because existing rule curves maintain target elevations within operational bounds.

Under the Representative Preferred Alternative, modeled results show reduced low-elevation outcomes compared to more vulnerable alternatives, but vulnerability remains under drier future hydrologic conditions. In the Dry and Critically Dry Flow Categories with conservation activity on, median EOWY elevations at Lake Powell are 3,554 feet and 3,523 feet, respectively, and median EOCY elevations at Lake Mead are 1,041 feet and 1,001 feet, respectively. Lake Powell robustness results for the key thresholds indicate that the Representative Preferred Alternative meets preferred minimum performance levels in about 40 to 50 percent of modeled futures over the full modeling period and about 52 to 58 percent of futures during 2027-2039. For Lake Mead, robustness results indicate that the alternative meets preferred minimum performance levels in about 57 to 63 percent of modeled futures over the full modeling period and about 62 to 72 percent of futures during 2027-2039. Vulnerability analyses indicate that, absent additional action, the Representative Preferred Alternative would be reasonably likely to be vulnerable in the next 10 years to elevations below key Lake Powell and Lake Mead thresholds under the 10-year average annual flow conditions identified in the modeling.

Issue 2: System Storage

Issue 2 evaluates how operational activities under the action alternatives would affect EOWY system storage compared to the No Action Alternative and CCS Comparative Baseline. The analysis considers combined storage at Lake Powell and Lake Mead, the CRSP reservoirs, and the seven-reservoir system. Across the alternatives, storage outcomes generally decline as hydrologic conditions become drier, with the Enhanced Coordination and Maximum Operational Flexibility Alternatives often maintaining higher median storage than the No Action Alternative, Basic Coordination Alternative, and CCS Comparative Baseline. For Lake Powell and Lake Mead, alternatives with higher combined storage generally reduce the frequency of modeled years falling

below the lowest observed historical EOWY combined storage value. For CRSP reservoirs, differences are driven primarily by Lake Powell operations because storage at the CRSP UIU reservoirs varies minimally across alternatives. For the seven-reservoir system, alternatives capable of implementing larger Lower Basin shortages tend to result in greater seven-reservoir storage.

Overall, the results show differences among alternatives in their ability to maintain system storage under drier hydrologic conditions. The CCS Comparative Baseline and the No Action and Basic Coordination Alternatives generally show lower median storage than the Enhanced Coordination and Maximum Operational Flexibility Alternatives, and for Lake Powell and Lake Mead they also show a greater frequency of modeled years below lowest observed historical EOWY combined storage value. Under the Representative Preferred Alternative, modeled storage is lower under drier conditions: in the Dry Flow Category, median combined storage is 32 percent for Lake Powell and Lake Mead, 37 percent for CRSP reservoirs, and 37 percent for the seven-reservoir system. In the Critically Dry Flow Category, median storage declines to 21 percent for Lake Powell and Lake Mead, 27 percent for CRSP reservoirs, and 27 percent for the seven-reservoir system. For Lake Powell and Lake Mead specifically, more than 25 percent of modeled years in the Dry Flow Category and nearly 75 percent of modeled years in the Critically Dry Flow Category fall below the lowest observed historical EOWY combined storage value.

Issue 3: Reservoir Releases

Issue 3 evaluates how operational activities under the action alternatives would affect reservoir releases compared to the No Action Alternative and CCS Comparative Baseline, focusing on annual water year releases from Glen Canyon Dam, cumulative 10-year Glen Canyon Dam releases and Lee Ferry flows, and calendar year releases from Hoover, Davis, and Parker Dams. Across alternatives, modeled releases vary by hydrologic condition and by how operations respond to hydrologic and reservoir conditions, with drier conditions generally associated with lower median releases and, for many alternatives and locations, greater variability.

The Enhanced Coordination and Maximum Operational Flexibility Alternatives generally show greater responsiveness to hydrologic conditions at Glen Canyon Dam and the Lee Ferry, while the No Action Alternative shows high variability under critically dry conditions due to infrastructure-constrained releases when Lake Powell falls below about 3,490 feet. At Hoover Dam, releases reflect modeled Lake Mead operations and conserved-water storage and delivery assumptions. At Davis and Parker Dams, releases also reflect inflows and target elevations defined by existing rule curves. Differences between the Supply Driven Alternative (LB Priority approach) and the Supply Driven Alternative (LB Pro Rata approach) at Lower Basin dams arise from how each shortage-distribution approach interacts with modeled conserved-water storage and delivery assumptions.

Under the Representative Preferred Alternative, Glen Canyon Dam releases are comparatively less variable under critically dry conditions, while modeled releases at Hoover, Davis, and Parker Dams are generally within the range of the other alternatives, with some variation by dam and hydrologic condition. Median annual Glen Canyon Dam releases decline from 7.20 maf in the Dry Flow Category to 6.0 maf in the Critically Dry Flow Category, reflecting reduced supply while remaining the least variable among alternatives under critically dry hydrology. At Lee Ferry, the Representative Preferred Alternative has median 10-year volumes of 76.4 maf under Dry conditions and 73.9 maf

under Critically Dry conditions. Under Dry conditions, more than half of modeled 10-year periods exceed 75.0 maf, but fewer than 25 percent exceed 82.5 maf. Under Critically Dry conditions, fewer than half of modeled 10-year periods exceed 75.0 maf, and slightly more than 10 percent exceed 82.5 maf. Downstream, the Representative Preferred Alternative releases at Hoover, Davis, and Parker Dams generally decrease as hydrologic conditions become drier. These releases are generally within the middle of the modeled alternatives or similar to most alternatives, with the main differences related to variability. Hoover releases are more variable under Critically Dry conditions, and Davis Dam releases show relatively higher variability under Dry conditions.

Issue 4: River Flows

Issue 4 evaluates how operational activities under the action alternatives would affect Colorado River flows compared to the No Action Alternative and CCS Comparative Baseline. The analysis considers annual flow volumes below Hoover Dam, below Davis Dam, below Parker Dam, at Imperial Dam, below Imperial Dam, and below Morelos Diversion Dam using three-year average natural flow model outputs across five flow categories. Across these reaches, modeled river flows generally decrease, or become less frequent below Morelos Diversion Dam, as hydrologic conditions become drier.

In the reaches from Glen Canyon Dam through Parker Dam, modeled comparisons generally focus on dam releases because those releases are the primary source of flow or the operational variable that differs among alternatives. Differences among alternatives are particularly apparent in drier hydrologic conditions and in reaches downstream of Parker Dam, where shortage distribution, conserved water assumptions, diversions, flows, and delivery requirements affect annual flow volumes and variability. Below Morelos Diversion Dam, flows are infrequent under all alternatives except during some wetter hydrologic conditions. In the Average, Dry, and Critically Dry Flow Categories, flows occur in 10 percent or fewer years for all alternatives and the CCS Comparative Baseline.

Under the Representative Preferred Alternative, annual flow volumes are generally in the middle of the range of alternatives and the CCS Comparative Baseline below Hoover Dam and Davis Dam. Below Parker Dam, annual volumes are similar to most alternatives, except for the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives, which are notably lower. Farther downstream, the Representative Preferred Alternative reflects the effects of diversions, return flows, delivery requirements, and increased shortages under drier conditions. At Imperial Dam, median annual flow under the Representative Preferred Alternative is 5.3 maf in the Dry Flow Category and 5.0 maf in the Critically Dry Flow Category. Below Imperial Dam, median annual flow is 0.9 maf in both the Dry and Critically Dry Flow Categories, which is on the low end of the alternatives. Below Morelos Diversion Dam, flows remain infrequent in the Average, Dry, and Critically Dry Flow Categories, occurring in 10 percent or fewer modeled years across all alternatives and the CCS Comparative Baseline.

Issue 5: Groundwater Elevations

Issue 5 evaluates how operational activities under the action alternatives could affect groundwater adjacent to reservoirs and along specific reaches of the Colorado River compared to the No Action Alternative and CCS Comparative Baseline. The analysis is qualitative because groundwater

responses are complex, available regional data are limited, and hydraulic connectivity varies by location. Groundwater effects are expected to be limited in many areas because some reaches are constrained by bedrock, lined canals, or reservoir operations that do not meaningfully vary across alternatives. Potential effects are most likely near Lake Powell, where reservoir elevations may influence adjacent groundwater, and in alluvial portions of the river where flow changes may affect groundwater elevations.

Overall, potential groundwater effects vary by reach and are most closely tied to Lake Powell elevations and relative river flows through connected groundwater basins. Alternatives that maintain higher Lake Powell elevations or higher flows in hydraulically connected alluvial reaches would generally be expected to support higher nearby groundwater elevations. Under the Representative Preferred Alternative, groundwater elevations near Lake Powell are anticipated to be lower than under the Maximum Operational Flexibility and Enhanced Coordination Alternatives but higher than under the CCS Comparative Baseline, No Action Alternative, Basic Coordination Alternative, and the Supply Driven Alternative (both LB Priority and LB Pro Rata approaches). Across the river reaches, the Representative Preferred Alternative is expected to have little or no groundwater effect where hydraulic connectivity is limited or operations are similar across alternatives. Where flow-related groundwater effects are possible, it is generally not identified as producing either the highest or lowest anticipated groundwater elevations.

Statistical Summary Tables

Table TA 3-3
Minimum Water Year Elevation (Feet) at Lake Powell

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
CCS Comparative Baseline	16.0-31.1	3,686	3,680	3,676	3,667	3,643	3,604	3,499
CCS Comparative Baseline	14.0-16.0	3,686	3,675	3,659	3,609	3,560	3,534	3,462
CCS Comparative Baseline	12.0-14.0	3,683	3,649	3,589	3,549	3,508	3,492	3,414
CCS Comparative Baseline	10.0-12.0	3,667	3,573	3,535	3,500	3,478	3,456	3,398
CCS Comparative Baseline	4.5-10.0	3,625	3,510	3,499	3,471	3,426	3,408	3,396
No Action	16.0-31.1	3,686	3,680	3,677	3,671	3,658	3,619	3,503
No Action	14.0-16.0	3,687	3,677	3,668	3,630	3,571	3,534	3,433
No Action	12.0-14.0	3,685	3,660	3,622	3,549	3,490	3,465	3,411
No Action	10.0-12.0	3,669	3,609	3,523	3,471	3,449	3,432	3,398
No Action	4.5-10.0	3,630	3,514	3,479	3,436	3,415	3,407	3,396
Basic Coordination	16.0-31.1	3,685	3,678	3,674	3,665	3,648	3,620	3,534
Basic Coordination	14.0-16.0	3,683	3,664	3,645	3,618	3,582	3,559	3,476
Basic Coordination	12.0-14.0	3,677	3,626	3,598	3,561	3,535	3,510	3,413
Basic Coordination	10.0-12.0	3,640	3,574	3,541	3,513	3,476	3,448	3,404
Basic Coordination	4.5-10.0	3,595	3,511	3,494	3,457	3,422	3,407	3,396
Enhanced Coordination	16.0-31.1	3,685	3,678	3,675	3,667	3,652	3,635	3,585
Enhanced Coordination	14.0-16.0	3,683	3,662	3,647	3,635	3,621	3,605	3,524
Enhanced Coordination	12.0-14.0	3,674	3,638	3,627	3,613	3,592	3,568	3,483
Enhanced Coordination	10.0-12.0	3,660	3,621	3,606	3,577	3,548	3,522	3,464
Enhanced Coordination	4.5-10.0	3,642	3,595	3,561	3,520	3,505	3,480	3,397
Max. Operational Flexibility	16.0-31.1	3,685	3,678	3,675	3,669	3,656	3,643	3,591
Max. Operational Flexibility	14.0-16.0	3,683	3,667	3,654	3,638	3,621	3,608	3,528
Max. Operational Flexibility	12.0-14.0	3,681	3,637	3,622	3,605	3,587	3,567	3,508
Max. Operational Flexibility	10.0-12.0	3,649	3,606	3,584	3,562	3,543	3,526	3,500
Max. Operational Flexibility	4.5-10.0	3,616	3,560	3,536	3,512	3,510	3,502	3,414
Supply Driven (LB Priority)	16.0-31.1	3,683	3,674	3,665	3,643	3,616	3,591	3,501
Supply Driven (LB Priority)	14.0-16.0	3,682	3,641	3,619	3,589	3,559	3,530	3,471
Supply Driven (LB Priority)	12.0-14.0	3,661	3,603	3,577	3,545	3,511	3,491	3,441
Supply Driven (LB Priority)	10.0-12.0	3,636	3,561	3,534	3,502	3,484	3,472	3,430
Supply Driven (LB Priority)	4.5-10.0	3,602	3,509	3,497	3,471	3,448	3,425	3,398
Supply Driven (LB Pro Rata)	16.0-31.1	3,683	3,674	3,665	3,643	3,616	3,591	3,501
Supply Driven (LB Pro Rata)	14.0-16.0	3,682	3,641	3,619	3,589	3,559	3,530	3,471
Supply Driven (LB Pro Rata)	12.0-14.0	3,661	3,603	3,577	3,545	3,511	3,491	3,441
Supply Driven (LB Pro Rata)	10.0-12.0	3,636	3,561	3,534	3,502	3,484	3,472	3,430
Supply Driven (LB Pro Rata)	4.5-10.0	3,602	3,509	3,497	3,471	3,448	3,425	3,398

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
Representative Preferred	16.0-31.1	3,683	3,674	3,665	3,648	3,630	3,617	3,562
Representative Preferred	14.0-16.0	3,681	3,641	3,630	3,614	3,595	3,579	3,497
Representative Preferred	12.0-14.0	3,658	3,615	3,597	3,574	3,550	3,528	3,476
Representative Preferred	10.0-12.0	3,624	3,569	3,549	3,525	3,506	3,495	3,450
Representative Preferred	4.5-10.0	3,567	3,514	3,502	3,492	3,472	3,432	3,397

NOTE: Elevations colored blue are above the spill avoidance elevation of 3,680 feet, listed in **Table TA 3-2.**
Elevations colored red are below the minimum power pool elevation of 3,490 feet, listed in **Table TA 3-2**.

Table TA 3-4
EOWY Elevation (Feet) at Lake Powell

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
CCS Comparative Baseline	16.0-31.1	3,696	3,692	3,690	3,679	3,657	3,621	3,499
CCS Comparative Baseline	14.0-16.0	3,697	3,690	3,676	3,635	3,580	3,549	3,462
CCS Comparative Baseline	12.0-14.0	3,695	3,670	3,624	3,574	3,527	3,500	3,414
CCS Comparative Baseline	10.0-12.0	3,694	3,616	3,565	3,517	3,498	3,468	3,404
CCS Comparative Baseline	4.5-10.0	3,689	3,560	3,525	3,499	3,457	3,424	3,398
No Action	16.0-31.1	3,696	3,693	3,690	3,684	3,670	3,637	3,503
No Action	14.0-16.0	3,696	3,691	3,684	3,654	3,595	3,551	3,433
No Action	12.0-14.0	3,697	3,681	3,643	3,585	3,517	3,478	3,411
No Action	10.0-12.0	3,695	3,629	3,571	3,498	3,473	3,447	3,407
No Action	4.5-10.0	3,688	3,571	3,517	3,478	3,443	3,421	3,400
Basic Coordination	16.0-31.1	3,695	3,692	3,689	3,678	3,658	3,632	3,534
Basic Coordination	14.0-16.0	3,696	3,688	3,668	3,638	3,600	3,570	3,476
Basic Coordination	12.0-14.0	3,696	3,658	3,625	3,588	3,551	3,520	3,413
Basic Coordination	10.0-12.0	3,695	3,613	3,579	3,538	3,497	3,466	3,404
Basic Coordination	4.5-10.0	3,676	3,574	3,535	3,487	3,452	3,422	3,398
Enhanced Coordination	16.0-31.1	3,696	3,692	3,690	3,679	3,661	3,642	3,585
Enhanced Coordination	14.0-16.0	3,696	3,689	3,671	3,648	3,629	3,613	3,528
Enhanced Coordination	12.0-14.0	3,696	3,669	3,651	3,629	3,604	3,575	3,483
Enhanced Coordination	10.0-12.0	3,694	3,650	3,627	3,597	3,561	3,533	3,464
Enhanced Coordination	4.5-10.0	3,690	3,622	3,596	3,557	3,524	3,496	3,399
Max. Operational Flexibility	16.0-31.1	3,697	3,692	3,691	3,682	3,664	3,649	3,591
Max. Operational Flexibility	14.0-16.0	3,696	3,691	3,679	3,653	3,632	3,614	3,528
Max. Operational Flexibility	12.0-14.0	3,696	3,671	3,650	3,624	3,598	3,575	3,508
Max. Operational Flexibility	10.0-12.0	3,695	3,641	3,618	3,584	3,558	3,537	3,500
Max. Operational Flexibility	4.5-10.0	3,692	3,615	3,582	3,546	3,520	3,508	3,431

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
Supply Driven (LB Priority)	16.0-31.1	3,698	3,690	3,683	3,657	3,627	3,597	3,501
Supply Driven (LB Priority)	14.0-16.0	3,697	3,673	3,646	3,611	3,571	3,537	3,471
Supply Driven (LB Priority)	12.0-14.0	3,696	3,642	3,609	3,573	3,528	3,496	3,441
Supply Driven (LB Priority)	10.0-12.0	3,690	3,610	3,576	3,533	3,495	3,483	3,430
Supply Driven (LB Priority)	4.5-10.0	3,681	3,584	3,547	3,502	3,470	3,445	3,398
Supply Driven (LB Pro Rata)	16.0-31.1	3,698	3,690	3,683	3,657	3,627	3,597	3,501
Supply Driven (LB Pro Rata)	14.0-16.0	3,697	3,673	3,646	3,611	3,571	3,537	3,471
Supply Driven (LB Pro Rata)	12.0-14.0	3,696	3,642	3,609	3,573	3,528	3,496	3,441
Supply Driven (LB Pro Rata)	10.0-12.0	3,690	3,610	3,576	3,533	3,495	3,483	3,430
Supply Driven (LB Pro Rata)	4.5-10.0	3,681	3,584	3,547	3,502	3,470	3,445	3,398
Representative Preferred	16.0-31.1	3,696	3,690	3,683	3,661	3,639	3,620	3,553
Representative Preferred	14.0-16.0	3,696	3,678	3,656	3,629	3,606	3,585	3,507
Representative Preferred	12.0-14.0	3,699	3,653	3,627	3,595	3,563	3,539	3,476
Representative Preferred	10.0-12.0	3,689	3,616	3,588	3,554	3,529	3,508	3,454
Representative Preferred	4.5-10.0	3,680	3,592	3,555	3,523	3,498	3,468	3,398

NOTE: Elevations colored blue are above the spill avoidance elevation of 3,680 feet, listed in **Table TA 3-2**.
Elevations colored red are below the minimum power pool elevation of 3,490 feet, listed in **Table TA 3-2**.

Table TA 3-6
End of Calendar Year Elevations (Feet) at Lake Mead

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
CCS Comparative Baseline	16.0-31.1	1,219	1,215	1,201	1,151	1,077	1,054	980
CCS Comparative Baseline	14.0-16.0	1,219	1,185	1,118	1,072	1,042	1,025	914
CCS Comparative Baseline	12.0-14.0	1,217	1,122	1,074	1,038	1,019	980	898
CCS Comparative Baseline	10.0-12.0	1,215	1,075	1,039	1,012	946	906	898
CCS Comparative Baseline	4.5-10.0	1,184	1,051	1,024	962	903	900	897
No Action	16.0-31.1	1,218	1,215	1,198	1,139	1,029	975	947
No Action	14.0-16.0	1,218	1,187	1,110	1,016	969	958	912
No Action	12.0-14.0	1,217	1,119	1,027	978	958	939	898
No Action	10.0-12.0	1,215	1,052	1,003	959	919	901	897
No Action	4.5-10.0	1,186	1,034	995	931	901	900	897
Basic Coordination	16.0-31.1	1,220	1,215	1,207	1,182	1,123	1,062	964
Basic Coordination	14.0-16.0	1,219	1,204	1,166	1,121	1,049	1,009	936
Basic Coordination	12.0-14.0	1,219	1,171	1,127	1,063	1,012	958	898
Basic Coordination	10.0-12.0	1,215	1,132	1,087	1,017	946	919	897
Basic Coordination	4.5-10.0	1,201	1,106	1,032	981	912	900	897

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
Enhanced Coordination	16.0-31.1	1,220	1,217	1,215	1,207	1,173	1,131	1,046
Enhanced Coordination	14.0-16.0	1,220	1,217	1,205	1,150	1,115	1,086	983
Enhanced Coordination	12.0-14.0	1,220	1,199	1,143	1,109	1,073	1,046	923
Enhanced Coordination	10.0-12.0	1,220	1,135	1,102	1,061	1,025	986	898
Enhanced Coordination	4.5-10.0	1,196	1,098	1,046	1,008	961	904	897
Max. Operational Flexibility	16.0-31.1	1,220	1,218	1,216	1,211	1,188	1,126	1,040
Max. Operational Flexibility	14.0-16.0	1,229	1,217	1,212	1,176	1,109	1,063	985
Max. Operational Flexibility	12.0-14.0	1,229	1,212	1,183	1,126	1,056	1,024	929
Max. Operational Flexibility	10.0-12.0	1,220	1,188	1,144	1,054	1,013	991	901
Max. Operational Flexibility	4.5-10.0	1,220	1,153	1,061	1,013	979	928	897
Supply Driven (LB Priority)	16.0-31.1	1,220	1,219	1,218	1,215	1,197	1,143	1,007
Supply Driven (LB Priority)	14.0-16.0	1,220	1,218	1,211	1,188	1,135	1,079	977
Supply Driven (LB Priority)	12.0-14.0	1,220	1,203	1,184	1,150	1,070	1,027	920
Supply Driven (LB Priority)	10.0-12.0	1,220	1,176	1,153	1,067	1,004	948	899
Supply Driven (LB Priority)	4.5-10.0	1,194	1,144	1,076	1,011	933	905	897
Supply Driven (LB Pro Rata)	16.0-31.1	1,220	1,219	1,218	1,216	1,204	1,161	1,009
Supply Driven (LB Pro Rata)	14.0-16.0	1,220	1,218	1,213	1,195	1,154	1,106	984
Supply Driven (LB Pro Rata)	12.0-14.0	1,220	1,204	1,190	1,161	1,099	1,054	914
Supply Driven (LB Pro Rata)	10.0-12.0	1,219	1,181	1,163	1,096	1,031	971	898
Supply Driven (LB Pro Rata)	4.5-10.0	1,194	1,150	1,094	1,027	971	905	897
Representative Preferred	16.0-31.1	1,220	1,218	1,217	1,209	1,168	1,115	1,027
Representative Preferred	14.0-16.0	1,220	1,215	1,191	1,147	1,091	1,054	989
Representative Preferred	12.0-14.0	1,220	1,183	1,148	1,104	1,047	1,022	953
Representative Preferred	10.0-12.0	1,219	1,150	1,113	1,041	1,005	984	907
Representative Preferred	4.5-10.0	1,207	1,115	1,041	1,001	970	932	897

NOTE: Elevations colored blue are above the spillway elevation of 1,221 feet, listed in the previous table. Elevations colored red are below the minimum power pool elevation of 950 feet, listed in **Table TA 3-5**.

Table TA 3-7
Minimum Calendar Year Elevation (Feet) at Lake Mead

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
CCS Comparative Baseline	16.0-31.1	1,217	1,210	1,196	1,130	1,067	1,046	980
CCS Comparative Baseline	14.0-16.0	1,216	1,180	1,102	1,063	1,035	1,017	910
CCS Comparative Baseline	12.0-14.0	1,206	1,113	1,066	1,030	1,007	962	898
CCS Comparative Baseline	10.0-12.0	1,195	1,070	1,028	998	924	901	897
CCS Comparative Baseline	4.5-10.0	1,184	1,040	1,011	932	900	898	897
No Action	16.0-31.1	1,217	1,209	1,194	1,116	1,015	966	936
No Action	14.0-16.0	1,215	1,180	1,093	1,006	959	949	912
No Action	12.0-14.0	1,204	1,107	1,020	967	949	932	898
No Action	10.0-12.0	1,193	1,043	993	944	907	900	897
No Action	4.5-10.0	1,186	1,029	988	905	900	899	897
Basic Coordination	16.0-31.1	1,218	1,211	1,203	1,171	1,101	1,047	946
Basic Coordination	14.0-16.0	1,219	1,199	1,160	1,112	1,038	996	930
Basic Coordination	12.0-14.0	1,219	1,167	1,122	1,054	1,003	948	897
Basic Coordination	10.0-12.0	1,214	1,128	1,081	1,010	937	909	897
Basic Coordination	4.5-10.0	1,201	1,104	1,027	976	901	899	896
Enhanced Coordination	16.0-31.1	1,219	1,214	1,211	1,204	1,157	1,115	994
Enhanced Coordination	14.0-16.0	1,220	1,215	1,200	1,142	1,104	1,071	970
Enhanced Coordination	12.0-14.0	1,220	1,194	1,134	1,102	1,059	1,030	902
Enhanced Coordination	10.0-12.0	1,218	1,126	1,094	1,046	1,008	966	897
Enhanced Coordination	4.5-10.0	1,196	1,088	1,036	1,002	951	899	896
Max. Operational Flexibility	16.0-31.1	1,219	1,216	1,214	1,207	1,169	1,101	991
Max. Operational Flexibility	14.0-16.0	1,229	1,215	1,208	1,169	1,095	1,050	971
Max. Operational Flexibility	12.0-14.0	1,222	1,209	1,179	1,117	1,045	1,015	929
Max. Operational Flexibility	10.0-12.0	1,218	1,185	1,141	1,043	1,004	980	897
Max. Operational Flexibility	4.5-10.0	1,210	1,152	1,054	1,005	969	912	896
Supply Driven (LB Priority)	16.0-31.1	1,220	1,218	1,217	1,213	1,177	1,109	966
Supply Driven (LB Priority)	14.0-16.0	1,220	1,216	1,209	1,180	1,118	1,058	943
Supply Driven (LB Priority)	12.0-14.0	1,219	1,201	1,181	1,143	1,057	1,013	913
Supply Driven (LB Priority)	10.0-12.0	1,217	1,174	1,150	1,057	995	934	899
Supply Driven (LB Priority)	4.5-10.0	1,194	1,143	1,074	1,008	925	900	896
Supply Driven (LB Pro Rata)	16.0-31.1	1,220	1,218	1,217	1,214	1,186	1,130	961
Supply Driven (LB Pro Rata)	14.0-16.0	1,220	1,216	1,210	1,188	1,139	1,082	947
Supply Driven (LB Pro Rata)	12.0-14.0	1,219	1,202	1,187	1,155	1,085	1,038	914
Supply Driven (LB Pro Rata)	10.0-12.0	1,217	1,179	1,160	1,089	1,021	956	898
Supply Driven (LB Pro Rata)	4.5-10.0	1,194	1,149	1,093	1,024	963	900	897

Alternative	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
Representative Preferred	16.0-31.1	1,220	1,218	1,216	1,199	1,145	1,091	1,001
Representative Preferred	14.0-16.0	1,220	1,213	1,185	1,139	1,077	1,042	975
Representative Preferred	12.0-14.0	1,219	1,180	1,144	1,097	1,036	1,012	945
Representative Preferred	10.0-12.0	1,212	1,146	1,108	1,030	995	974	898
Representative Preferred	4.5-10.0	1,207	1,111	1,033	990	957	914	896

NOTE: Elevations colored blue are above the spillway elevation of 1,221 feet, listed in **Table TA 3-5**. Elevations colored red are below the minimum power pool elevation of 950 feet, listed in **Table TA 3-5**.

Table TA 3-9
Impacts of Modeling Assumptions for Conservation Activity on End of Water Year Elevations (Feet) at Lake Powell

Alternative	Activity	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
CCS Comparative Baseline	On	16.0-31.1	3,696	3,692	3,690	3,679	3,657	3,621	3,499
CCS Comparative Baseline	Off	16.0-31.1	3,696	3,692	3,690	3,679	3,659	3,623	3,499
CCS Comparative Baseline	On	14.0-16.0	3,697	3,690	3,676	3,635	3,580	3,549	3,462
CCS Comparative Baseline	Off	14.0-16.0	3,697	3,690	3,676	3,636	3,583	3,551	3,464
CCS Comparative Baseline	On	12.0-14.0	3,695	3,670	3,624	3,574	3,527	3,500	3,414
CCS Comparative Baseline	Off	12.0-14.0	3,695	3,670	3,626	3,576	3,531	3,500	3,414
CCS Comparative Baseline	On	10.0-12.0	3,694	3,616	3,565	3,517	3,498	3,468	3,404
CCS Comparative Baseline	Off	10.0-12.0	3,694	3,619	3,568	3,521	3,498	3,470	3,404
CCS Comparative Baseline	On	4.5-10.0	3,689	3,560	3,525	3,499	3,457	3,424	3,398
CCS Comparative Baseline	Off	4.5-10.0	3,689	3,561	3,527	3,499	3,458	3,424	3,398
No Action	On	16.0-31.1	3,696	3,693	3,690	3,684	3,670	3,637	3,503
No Action	Off	16.0-31.1	3,696	3,693	3,690	3,684	3,671	3,637	3,503
No Action	On	14.0-16.0	3,696	3,691	3,684	3,654	3,595	3,551	3,433
No Action	Off	14.0-16.0	3,696	3,691	3,684	3,654	3,595	3,551	3,433
No Action	On	12.0-14.0	3,697	3,681	3,643	3,585	3,517	3,478	3,411
No Action	Off	12.0-14.0	3,697	3,681	3,643	3,585	3,517	3,478	3,411

Alternative	Activity	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
No Action	On	10.0-12.0	3,695	3,629	3,571	3,498	3,473	3,447	3,407
No Action	Off	10.0-12.0	3,695	3,629	3,571	3,498	3,473	3,447	3,407
No Action	On	4.5-10.0	3,688	3,571	3,517	3,478	3,443	3,421	3,400
No Action	Off	4.5-10.0	3,688	3,571	3,517	3,478	3,443	3,421	3,400
Basic Coordination	On	16.0-31.1	3,695	3,692	3,689	3,678	3,658	3,632	3,534
Basic Coordination	Off	16.0-31.1	3,695	3,692	3,689	3,678	3,659	3,632	3,534
Basic Coordination	On	14.0-16.0	3,696	3,688	3,668	3,638	3,600	3,570	3,476
Basic Coordination	Off	14.0-16.0	3,696	3,688	3,669	3,638	3,600	3,570	3,476
Basic Coordination	On	12.0-14.0	3,696	3,658	3,625	3,588	3,551	3,520	3,413
Basic Coordination	Off	12.0-14.0	3,696	3,658	3,625	3,588	3,551	3,520	3,413
Basic Coordination	On	10.0-12.0	3,695	3,613	3,579	3,538	3,497	3,466	3,404
Basic Coordination	Off	10.0-12.0	3,695	3,613	3,579	3,538	3,497	3,466	3,404
Basic Coordination	On	4.5-10.0	3,676	3,574	3,535	3,487	3,452	3,422	3,398
Basic Coordination	Off	4.5-10.0	3,676	3,574	3,535	3,487	3,452	3,422	3,398
Enhanced Coordination	On	16.0-31.1	3,696	3,692	3,690	3,679	3,661	3,642	3,585
Enhanced Coordination	Off	16.0-31.1	3,695	3,692	3,689	3,676	3,657	3,638	3,586
Enhanced Coordination	On	14.0-16.0	3,696	3,689	3,671	3,648	3,629	3,613	3,528
Enhanced Coordination	Off	14.0-16.0	3,695	3,686	3,666	3,643	3,626	3,610	3,534
Enhanced Coordination	On	12.0-14.0	3,696	3,669	3,651	3,629	3,604	3,575	3,483
Enhanced Coordination	Off	12.0-14.0	3,695	3,664	3,645	3,623	3,600	3,575	3,484
Enhanced Coordination	On	10.0-12.0	3,694	3,650	3,627	3,597	3,561	3,533	3,464
Enhanced Coordination	Off	10.0-12.0	3,692	3,644	3,621	3,593	3,561	3,531	3,464
Enhanced Coordination	On	4.5-10.0	3,690	3,622	3,596	3,557	3,524	3,496	3,399
Enhanced Coordination	Off	4.5-10.0	3,687	3,617	3,592	3,556	3,524	3,495	3,399

Alternative	Activity	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
Max. Operational Flexibility	On	16.0-31.1	3,697	3,692	3,691	3,682	3,664	3,649	3,591
Max. Operational Flexibility	Off	16.0-31.1	3,696	3,692	3,690	3,680	3,661	3,647	3,596
Max. Operational Flexibility	On	14.0-16.0	3,696	3,691	3,679	3,653	3,632	3,614	3,528
Max. Operational Flexibility	Off	14.0-16.0	3,696	3,689	3,675	3,650	3,630	3,612	3,540
Max. Operational Flexibility	On	12.0-14.0	3,696	3,671	3,650	3,624	3,598	3,575	3,508
Max. Operational Flexibility	Off	12.0-14.0	3,695	3,668	3,646	3,621	3,595	3,575	3,508
Max. Operational Flexibility	On	10.0-12.0	3,695	3,641	3,618	3,584	3,558	3,537	3,500
Max. Operational Flexibility	Off	10.0-12.0	3,695	3,637	3,615	3,581	3,556	3,536	3,502
Max. Operational Flexibility	On	4.5-10.0	3,692	3,615	3,582	3,546	3,520	3,508	3,431
Max. Operational Flexibility	Off	4.5-10.0	3,689	3,611	3,578	3,543	3,519	3,507	3,431
Supply Driven (LB Priority)	On	16.0-31.1	3,698	3,690	3,683	3,657	3,627	3,597	3,501
Supply Driven (LB Priority)	Off	16.0-31.1	3,698	3,690	3,679	3,651	3,619	3,588	3,492
Supply Driven (LB Priority)	On	14.0-16.0	3,697	3,673	3,646	3,611	3,571	3,537	3,471
Supply Driven (LB Priority)	Off	14.0-16.0	3,696	3,666	3,638	3,602	3,560	3,524	3,471
Supply Driven (LB Priority)	On	12.0-14.0	3,696	3,642	3,609	3,573	3,528	3,496	3,441
Supply Driven (LB Priority)	Off	12.0-14.0	3,695	3,635	3,601	3,565	3,520	3,493	3,439
Supply Driven (LB Priority)	On	10.0-12.0	3,690	3,610	3,576	3,533	3,495	3,483	3,430
Supply Driven (LB Priority)	Off	10.0-12.0	3,688	3,604	3,571	3,528	3,493	3,481	3,431
Supply Driven (LB Priority)	On	4.5-10.0	3,681	3,584	3,547	3,502	3,470	3,445	3,398
Supply Driven (LB Priority)	Off	4.5-10.0	3,679	3,580	3,543	3,498	3,469	3,445	3,398
Supply Driven (LB Pro Rata)	On	16.0-31.1	3,698	3,690	3,683	3,657	3,627	3,597	3,501
Supply Driven (LB Pro Rata)	Off	16.0-31.1	3,698	3,690	3,679	3,651	3,619	3,588	3,492
Supply Driven (LB Pro Rata)	On	14.0-16.0	3,697	3,673	3,646	3,611	3,571	3,537	3,471
Supply Driven (LB Pro Rata)	Off	14.0-16.0	3,696	3,666	3,638	3,602	3,560	3,524	3,471

Alternative	Activity	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
Supply Driven (LB Pro Rata)	On	12.0-14.0	3,696	3,642	3,609	3,573	3,528	3,496	3,441
Supply Driven (LB Pro Rata)	Off	12.0-14.0	3,695	3,635	3,601	3,565	3,520	3,493	3,439
Supply Driven (LB Pro Rata)	On	10.0-12.0	3,690	3,610	3,576	3,533	3,495	3,483	3,430
Supply Driven (LB Pro Rata)	Off	10.0-12.0	3,688	3,604	3,571	3,528	3,493	3,481	3,431
Supply Driven (LB Pro Rata)	On	4.5-10.0	3,681	3,584	3,547	3,502	3,470	3,445	3,398
Supply Driven (LB Pro Rata)	Off	4.5-10.0	3,679	3,580	3,543	3,498	3,469	3,445	3,398
Representative Preferred	On	16.0-31.1	3,696	3,690	3,683	3,661	3,639	3,620	3,553
Representative Preferred	Off	16.0-31.1	3,696	3,689	3,681	3,658	3,637	3,619	3,546
Representative Preferred	On	14.0-16.0	3,696	3,678	3,656	3,629	3,606	3,585	3,507
Representative Preferred	Off	14.0-16.0	3,696	3,676	3,654	3,627	3,603	3,581	3,505
Representative Preferred	On	12.0-14.0	3,699	3,653	3,627	3,595	3,563	3,539	3,474
Representative Preferred	Off	12.0-14.0	3,697	3,650	3,624	3,591	3,561	3,537	3,454
Representative Preferred	On	10.0-12.0	3,689	3,616	3,588	3,554	3,529	3,508	3,454
Representative Preferred	Off	10.0-12.0	3,688	3,613	3,585	3,552	3,528	3,507	3,454
Representative Preferred	On	4.5-10.0	3,680	3,592	3,555	3,523	3,498	3,468	3,398
Representative Preferred	Off	4.5-10.0	3,679	3,590	3,553	3,522	3,498	3,468	3,398

NOTE: Elevations colored blue are above the spill avoidance elevation of 3,680 feet, listed in **Table TA 3-2**.
Elevations colored red are below the minimum power pool elevation of 3,490 feet, listed in **Table TA 3-2**.

Table TA 3-10
Impacts of Modeling Assumptions for Conservation Activity on End of Calendar Year Elevations (Feet) at Lake Mead

Alternative	Activity	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
CCS Comparative Baseline	On	16.0-31.1	1,219	1,215	1,201	1,151	1,077	1,054	980
CCS Comparative Baseline	Off	16.0-31.1	1,219	1,215	1,199	1,155	1,080	1,057	981
CCS Comparative Baseline	On	14.0-16.0	1,219	1,185	1,118	1,072	1,042	1,025	914
CCS Comparative Baseline	Off	14.0-16.0	1,218	1,183	1,120	1,074	1,046	1,028	915
CCS Comparative Baseline	On	12.0-14.0	1,217	1,122	1,074	1,038	1,019	980	898
CCS Comparative Baseline	Off	12.0-14.0	1,217	1,121	1,075	1,041	1,022	984	898
CCS Comparative Baseline	On	10.0-12.0	1,215	1,075	1,039	1,012	946	906	898
CCS Comparative Baseline	Off	10.0-12.0	1,215	1,077	1,042	1,019	952	907	898

Alternative	Activity	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
CCS Comparative Baseline	On	4.5-10.0	1,184	1,051	1,024	962	903	900	897
CCS Comparative Baseline	Off	4.5-10.0	1,177	1,053	1,027	970	903	900	897
No Action	On	16.0-31.1	1,218	1,215	1,198	1,139	1,029	975	947
No Action	Off	16.0-31.1	1,219	1,215	1,199	1,147	1,038	976	945
No Action	On	14.0-16.0	1,218	1,187	1,110	1,016	969	958	912
No Action	Off	14.0-16.0	1,218	1,188	1,115	1,025	969	958	912
No Action	On	12.0-14.0	1,217	1,119	1,027	978	958	939	898
No Action	Off	12.0-14.0	1,217	1,124	1,036	981	959	939	897
No Action	On	10.0-12.0	1,215	1,052	1,003	959	919	901	897
No Action	Off	10.0-12.0	1,215	1,058	1,011	960	918	901	897
No Action	On	4.5-10.0	1,186	1,034	995	931	901	900	897
No Action	Off	4.5-10.0	1,185	1,040	1,003	933	901	900	897
Basic Coordination	On	16.0-31.1	1,220	1,215	1,207	1,182	1,123	1,062	964
Basic Coordination	Off	16.0-31.1	1,220	1,215	1,207	1,186	1,133	1,072	962
Basic Coordination	On	14.0-16.0	1,219	1,204	1,166	1,121	1,049	1,009	936
Basic Coordination	Off	14.0-16.0	1,219	1,204	1,171	1,125	1,062	1,012	935
Basic Coordination	On	12.0-14.0	1,219	1,171	1,127	1,063	1,012	958	898
Basic Coordination	Off	12.0-14.0	1,219	1,174	1,131	1,077	1,019	959	899
Basic Coordination	On	10.0-12.0	1,215	1,132	1,087	1,017	946	919	897
Basic Coordination	Off	10.0-12.0	1,215	1,135	1,095	1,027	946	918	897
Basic Coordination	On	4.5-10.0	1,201	1,106	1,032	981	912	900	897
Basic Coordination	Off	4.5-10.0	1,201	1,110	1,040	991	912	900	896
Enhanced Coordination	On	16.0-31.1	1,220	1,217	1,215	1,207	1,173	1,131	1,046
Enhanced Coordination	Off	16.0-31.1	1,220	1,216	1,213	1,198	1,149	1,119	1,033
Enhanced Coordination	On	14.0-16.0	1,220	1,217	1,205	1,150	1,115	1,086	983
Enhanced Coordination	Off	14.0-16.0	1,220	1,213	1,177	1,132	1,109	1,085	999
Enhanced Coordination	On	12.0-14.0	1,220	1,199	1,143	1,109	1,073	1,046	923
Enhanced Coordination	Off	12.0-14.0	1,220	1,171	1,125	1,102	1,073	1,045	912
Enhanced Coordination	On	10.0-12.0	1,220	1,135	1,102	1,061	1,025	986	898
Enhanced Coordination	Off	10.0-12.0	1,217	1,119	1,092	1,060	1,025	978	896
Enhanced Coordination	On	4.5-10.0	1,196	1,098	1,046	1,008	961	904	897
Enhanced Coordination	Off	4.5-10.0	1,179	1,085	1,045	1,013	955	902	897
Max. Operational Flexibility	On	16.0-31.1	1,220	1,218	1,216	1,211	1,188	1,126	1,040
Max. Operational Flexibility	Off	16.0-31.1	1,220	1,217	1,215	1,198	1,144	1,098	1,003
Max. Operational Flexibility	On	14.0-16.0	1,229	1,217	1,212	1,176	1,109	1,063	985
Max. Operational Flexibility	Off	14.0-16.0	1,220	1,212	1,179	1,124	1,083	1,050	955
Max. Operational Flexibility	On	12.0-14.0	1,229	1,212	1,183	1,126	1,056	1,024	929
Max. Operational Flexibility	Off	12.0-14.0	1,219	1,180	1,129	1,091	1,048	1,018	905
Max. Operational Flexibility	On	10.0-12.0	1,220	1,188	1,144	1,054	1,013	991	901
Max. Operational Flexibility	Off	10.0-12.0	1,217	1,136	1,099	1,049	1,008	969	898
Max. Operational Flexibility	On	4.5-10.0	1,220	1,153	1,061	1,013	979	928	897
Max. Operational Flexibility	Off	4.5-10.0	1,197	1,106	1,054	1,013	966	915	897

Alternative	Activity	Flow Category	Max (feet)	90% (feet)	75% (feet)	50% (feet)	25% (feet)	10% (feet)	Min (feet)
Supply Driven (LB Priority)	On	16.0-31.1	1,220	1,219	1,218	1,215	1,197	1,143	1,007
Supply Driven (LB Priority)	Off	16.0-31.1	1,220	1,218	1,216	1,198	1,166	1,128	1,010
Supply Driven (LB Priority)	On	14.0-16.0	1,220	1,218	1,211	1,188	1,135	1,079	977
Supply Driven (LB Priority)	Off	14.0-16.0	1,220	1,213	1,185	1,151	1,114	1,071	976
Supply Driven (LB Priority)	On	12.0-14.0	1,220	1,203	1,184	1,150	1,070	1,027	920
Supply Driven (LB Priority)	Off	12.0-14.0	1,219	1,177	1,144	1,115	1,056	1,019	919
Supply Driven (LB Priority)	On	10.0-12.0	1,220	1,176	1,153	1,067	1,004	948	899
Supply Driven (LB Priority)	Off	10.0-12.0	1,215	1,133	1,110	1,044	992	945	899
Supply Driven (LB Priority)	On	4.5-10.0	1,194	1,144	1,076	1,011	933	905	897
Supply Driven (LB Priority)	Off	4.5-10.0	1,186	1,098	1,039	995	926	904	897
Supply Driven (LB Pro Rata)	On	16.0-31.1	1,220	1,219	1,218	1,216	1,204	1,161	1,009
Supply Driven (LB Pro Rata)	Off	16.0-31.1	1,220	1,218	1,216	1,198	1,166	1,127	1,006
Supply Driven (LB Pro Rata)	On	14.0-16.0	1,220	1,218	1,213	1,195	1,154	1,106	984
Supply Driven (LB Pro Rata)	Off	14.0-16.0	1,220	1,213	1,185	1,151	1,114	1,071	980
Supply Driven (LB Pro Rata)	On	12.0-14.0	1,220	1,204	1,190	1,161	1,099	1,054	914
Supply Driven (LB Pro Rata)	Off	12.0-14.0	1,219	1,177	1,143	1,115	1,056	1,018	913
Supply Driven (LB Pro Rata)	On	10.0-12.0	1,219	1,181	1,163	1,096	1,031	971	898
Supply Driven (LB Pro Rata)	Off	10.0-12.0	1,215	1,133	1,110	1,043	991	941	897
Supply Driven (LB Pro Rata)	On	4.5-10.0	1,194	1,150	1,094	1,027	971	905	897
Supply Driven (LB Pro Rata)	Off	4.5-10.0	1,186	1,097	1,038	995	922	902	897
Representative Preferred	On	16.0-31.1	1,220	1,218	1,217	1,209	1,168	1,115	1,027
Representative Preferred	Off	16.0-31.1	1,220	1,218	1,216	1,197	1,153	1,101	1,023
Representative Preferred	On	14.0-16.0	1,220	1,215	1,191	1,147	1,091	1,054	989
Representative Preferred	Off	14.0-16.0	1,220	1,208	1,175	1,131	1,075	1,044	995
Representative Preferred	On	12.0-14.0	1,220	1,183	1,148	1,104	1,047	1,022	953
Representative Preferred	Off	12.0-14.0	1,219	1,167	1,130	1,086	1,037	1,018	947
Representative Preferred	On	10.0-12.0	1,219	1,150	1,113	1,041	1,005	984	907
Representative Preferred	Off	10.0-12.0	1,215	1,132	1,096	1,029	1,002	981	906
Representative Preferred	On	4.5-10.0	1,207	1,115	1,041	1,001	970	932	897
Representative Preferred	Off	4.5-10.0	1,197	1,099	1,027	995	965	924	897

NOTE: Elevations colored blue are above the spillway elevation of 1,221 feet, listed in **Table TA 3-5**.
Elevations colored red are below the minimum power pool elevation of 950 feet, listed in **Table TA 3-5**.

Table TA 3-11
EOWY Powell and Mead Combined Storage (% Full)

Alternative	Flow Category	Max (% Full)	90% (% Full)	75% (% Full)	50% (% Full)	25% (% Full)	10% (% Full)	Min (% Full)
CCS Comparative Baseline	16.0-31.1	98.2	96.4	90.7	74.3	54.9	42.3	15.8
CCS Comparative Baseline	14.0-16.0	98.1	84.6	66.9	47.4	33.6	26.5	8.2
CCS Comparative Baseline	12.0-14.0	97.7	65.0	44.9	31.6	22.9	15.4	2.4
CCS Comparative Baseline	10.0-12.0	95.7	43.5	30.4	20.9	11.9	7.1	1.6
CCS Comparative Baseline	4.5-10.0	78.1	31.8	22.6	13.3	5.7	3.0	1.5
No Action	16.0-31.1	98.3	96.1	89.9	72.5	51.3	38.4	13.0
No Action	14.0-16.0	98.1	85.2	66.2	43.7	28.4	19.9	4.9
No Action	12.0-14.0	97.4	64.7	42.4	26.6	15.9	9.9	2.2
No Action	10.0-12.0	95.5	42.4	25.9	14.5	7.8	4.8	1.9
No Action	4.5-10.0	78.0	29.4	19.4	9.0	4.4	2.8	1.6
Basic Coordination	16.0-31.1	98.5	96.5	92.4	80.5	63.7	48.4	17.5
Basic Coordination	14.0-16.0	98.4	88.1	74.2	56.1	38.5	28.8	9.9
Basic Coordination	12.0-14.0	97.5	70.2	53.1	38.4	25.7	17.6	2.5
Basic Coordination	10.0-12.0	95.8	51.7	37.6	24.9	13.4	7.4	1.9
Basic Coordination	4.5-10.0	77.5	38.4	26.1	15.5	5.9	3.1	1.4
Enhanced Coordination	16.0-31.1	98.5	97.0	95.2	87.2	77.0	63.9	40.3
Enhanced Coordination	14.0-16.0	98.6	92.2	82.7	68.9	56.1	46.9	18.5
Enhanced Coordination	12.0-14.0	98.1	79.6	65.8	54.5	42.9	33.7	10.2
Enhanced Coordination	10.0-12.0	96.0	63.6	51.7	38.8	28.3	19.9	5.6
Enhanced Coordination	4.5-10.0	85.5	49.5	36.3	25.1	16.9	10.2	1.6
Max. Operational Flexibility	16.0-31.1	98.5	97.2	95.7	89.5	81.1	64.7	38.3
Max. Operational Flexibility	14.0-16.0	99.8	94.8	86.6	73.6	56.2	45.2	20.7
Max. Operational Flexibility	12.0-14.0	98.4	84.0	71.1	55.8	41.1	32.1	11.9
Max. Operational Flexibility	10.0-12.0	98.5	68.8	55.0	38.0	26.9	21.2	9.1
Max. Operational Flexibility	4.5-10.0	90.3	54.2	37.3	24.8	18.0	12.3	3.2
Supply Driven (LB Priority)	16.0-31.1	98.5	96.7	92.8	84.3	73.6	59.0	31.0
Supply Driven (LB Priority)	14.0-16.0	98.3	88.0	78.5	65.8	50.3	38.5	14.5
Supply Driven (LB Priority)	12.0-14.0	98.1	74.3	61.9	49.3	35.2	24.7	5.7
Supply Driven (LB Priority)	10.0-12.0	95.6	59.2	47.9	33.3	20.3	12.6	4.0
Supply Driven (LB Priority)	4.5-10.0	76.4	45.3	32.8	20.6	10.6	5.8	1.5
Supply Driven (LB Pro Rata)	16.0-31.1	99.4	96.7	93.1	85.0	74.9	62.7	35.3
Supply Driven (LB Pro Rata)	14.0-16.0	98.7	88.4	79.4	67.7	53.8	42.9	14.8
Supply Driven (LB Pro Rata)	12.0-14.0	98.1	75.3	63.6	51.9	39.6	29.5	5.7
Supply Driven (LB Pro Rata)	10.0-12.0	96.6	60.7	50.0	37.0	24.4	14.9	4.0
Supply Driven (LB Pro Rata)	4.5-10.0	78.7	46.8	35.2	23.3	13.8	6.4	1.4

Alternative	Flow Category	Max (% Full)	90% (% Full)	75% (% Full)	50% (% Full)	25% (% Full)	10% (% Full)	Min (% Full)
Representative Preferred	16.0-31.1	98.5	96.5	91.6	82.4	70.5	56.7	27.3
Representative Preferred	14.0-16.0	98.6	86	75.8	62.4	47.6	37.9	18.3
Representative Preferred	12.0-14.0	97.8	71.5	57.9	45.9	33.6	26.2	10.1
Representative Preferred	10.0-12.0	94.8	54.8	43.5	31.5	22.3	17.4	6.9
Representative Preferred	4.5-10.0	74.5	41.5	30.7	20.8	14.1	8.3	1.4

Table TA 3-12
EOWY CRSP Combined Storage (% Full)

Alternative	Flow Category	Max (% Full)	90% (% Full)	75% (% Full)	50% (% Full)	25% (% Full)	10% (% Full)	Min (% Full)
CCS Comparative Baseline	16.0-31.1	94.9	92.4	91.2	85.3	74.9	59.2	21.8
CCS Comparative Baseline	14.0-16.0	94.7	91.4	84.2	65.8	45.6	33.2	11.4
CCS Comparative Baseline	12.0-14.0	94.7	81.1	61.8	44.2	28.4	20.1	6.0
CCS Comparative Baseline	10.0-12.0	93.1	58.4	41.3	26.7	19.2	14.7	4.9
CCS Comparative Baseline	4.5-10.5	91.6	40.9	30.5	21.0	13.2	8.6	4.1
No Action	16.0-31.1	95.1	92.8	91.8	88.2	81.0	66.3	31.6
No Action	14.0-16.0	95.2	92.2	88.3	73.9	52.5	40.8	18.6
No Action	12.0-14.0	95.5	86.7	69.2	49.6	33.9	26.9	12.7
No Action	10.0-12.0	94.8	63.9	45.9	31.0	25.8	21.6	10.7
No Action	4.5-10.5	91.3	45.6	33.7	25.8	20.4	16.8	5.0
Basic Coordination	16.0-31.1	95.4	92.4	91.1	84.9	74.9	63.1	31.0
Basic Coordination	14.0-16.0	94.6	90.8	80.1	67.0	52.6	42.5	13.5
Basic Coordination	12.0-14.0	94.6	75.4	62.2	48.3	35.8	25.7	5.2
Basic Coordination	10.0-12.0	93.1	57.5	45.0	31.7	20.5	14.3	4.8
Basic Coordination	4.5-10.5	86.5	44.2	32.9	21.1	12.6	8.6	4.1
Enhanced Coordination	16.0-31.1	94.9	92.7	91.7	85.4	76.5	68.5	48.5
Enhanced Coordination	14.0-16.0	95.1	91.1	82.0	71.7	63.4	57.4	33.2
Enhanced Coordination	12.0-14.0	95.5	81.1	73.0	63.5	54.1	46.2	22.2
Enhanced Coordination	10.0-12.0	93.8	72.7	63.1	52.3	42.4	35.4	18.4
Enhanced Coordination	4.5-10.5	92.1	61.2	52.1	40.6	32.8	27.1	7.2
Max. Operational Flexibility	16.0-31.1	95.3	92.8	91.8	87.0	78.0	70.8	50.4
Max. Operational Flexibility	14.0-16.0	95.2	91.9	85.9	73.9	64.7	57.8	32.8
Max. Operational Flexibility	12.0-14.0	94.8	82.3	72.6	61.8	52.5	46.0	27.6
Max. Operational Flexibility	10.0-12.0	93.9	69.1	60.2	48.6	41.5	35.9	21.3
Max. Operational Flexibility	4.5-10.5	93.2	59.2	48.0	38.5	32.1	28.5	11.1

Alternative	Flow Category	Max (% Full)	90% (% Full)	75% (% Full)	50% (% Full)	25% (% Full)	10% (% Full)	Min (% Full)
Supply Driven (LB Priority)	16.0-31.1	95.2	91.9	87.7	74.7	63.0	51.3	26.1
Supply Driven (LB Priority)	14.0-16.0	94.1	82.7	70.5	57.1	43.6	35.2	17.0
Supply Driven (LB Priority)	12.0-14.0	94.3	69.2	56.4	44.7	32.9	26.0	9.9
Supply Driven (LB Priority)	10.0-12.0	92.5	56.8	45.4	33.6	24.7	19.4	7.9
Supply Driven (LB Priority)	4.5-10.5	87.5	47.0	36.7	25.8	18.0	12.7	4.3
Supply Driven (LB Pro Rata)	16.0-31.1	95.2	91.9	87.7	74.7	63.0	51.3	26.1
Supply Driven (LB Pro Rata)	14.0-16.0	94.1	82.7	70.5	57.1	43.6	35.2	17.0
Supply Driven (LB Pro Rata)	12.0-14.0	94.3	69.2	56.4	44.7	32.9	26.0	9.9
Supply Driven (LB Pro Rata)	10.0-12.0	92.5	56.8	45.4	33.6	24.7	19.4	7.9
Supply Driven (LB Pro Rata)	4.5-10.5	87.5	47.0	36.7	25.8	18.0	12.7	4.3
Representative Preferred	16.0-31.1	95.0	91.8	87.6	76.9	66.9	59.5	39.3
Representative Preferred	14.0-16.0	94.3	85.4	75.2	63.8	54.3	47.1	18.7
Representative Preferred	12.0-14.0	94.6	73.7	62.8	50.7	40.5	32.3	13.9
Representative Preferred	10.0-12.0	92.9	58.5	48.9	37.2	28.3	21.8	11.0
Representative Preferred	4.5-10.5	88.2	48.7	37.7	27.4	19.2	14.2	4.3

Table TA 3-13
EOWY Seven-Reservoir Combined Storage (% Full)

Alternative	Flow Category	Max (% Full)	90% (% Full)	75% (% Full)	50% (% Full)	25% (% Full)	10% (% Full)	Min (% Full)
CCS Comparative Baseline	16.0-31.1	96.8	94.9	89.7	75.8	58.8	47.3	22.4
CCS Comparative Baseline	14.0-16.0	96.6	84.6	69.5	52.5	39.4	31.4	12.9
CCS Comparative Baseline	12.0-14.0	96.2	67.6	50.2	38.0	27.8	20.0	7.4
CCS Comparative Baseline	10.0-12.0	94.8	49.5	36.7	26.1	16.7	12.4	6.4
CCS Comparative Baseline	4.5-10.0	79.5	38.1	29.3	19.2	11.2	8.5	6.3
No Action	16.0-31.1	96.8	94.8	89.2	74.5	56.1	45.0	23.4
No Action	14.0-16.0	96.6	85.0	68.8	49.7	36.4	29.2	14.7
No Action	12.0-14.0	96.0	67.6	48.6	34.9	25.7	20.3	10.4
No Action	10.0-12.0	94.6	48.3	34.4	24.5	18.4	15.5	9.5
No Action	4.5-10.0	79.5	36.9	28.5	19.5	14.8	12.7	6.7
Basic Coordination	16.0-31.1	96.9	95.1	91.2	80.7	66.7	52.7	23.9
Basic Coordination	14.0-16.0	96.7	87.6	75.7	60.2	44.6	34.9	14.4
Basic Coordination	12.0-14.0	96.0	72.4	57.3	44.2	31.9	22.4	6.8
Basic Coordination	10.0-12.0	94.8	55.9	42.8	30.4	18.4	12.6	6.6
Basic Coordination	4.5-10.0	79.0	43.2	32.1	21.4	11.5	8.6	6.0
Enhanced Coordination	16.0-31.1	96.9	95.5	93.7	86.7	77.9	66.8	46.1
Enhanced Coordination	14.0-16.0	96.8	91.3	83.0	71.2	59.9	52.1	26.6
Enhanced Coordination	12.0-14.0	96.9	80.2	68.5	58.6	48.6	40.6	18.8
Enhanced Coordination	10.0-12.0	95.4	66.4	56.3	45.1	35.8	28.4	14.4
Enhanced Coordination	4.5-10.0	85.9	53.8	42.9	32.9	25.3	19.4	7.6

Alternative	Flow Category	Max (% Full)	90% (% Full)	75% (% Full)	50% (% Full)	25% (% Full)	10% (% Full)	Min (% Full)
Max. Operational Flexibility	16.0-31.1	96.9	95.6	94.2	88.7	81.2	67.3	44.9
Max. Operational Flexibility	14.0-16.0	97.4	93.4	86.2	74.9	60.1	50.6	28.4
Max. Operational Flexibility	12.0-14.0	96.8	84.0	72.9	59.8	47.2	39.1	20.3
Max. Operational Flexibility	10.0-12.0	96.3	70.9	59.3	44.4	34.8	29.7	17.7
Max. Operational Flexibility	4.5-10.0	90.0	57.9	43.7	32.6	26.4	21.1	9.6
Supply Driven (LB Priority)	16.0-31.1	96.9	95.2	91.7	84.2	74.7	62.1	35.2
Supply Driven (LB Priority)	14.0-16.0	96.6	87.6	79.1	67.8	54.1	43.9	18.8
Supply Driven (LB Priority)	12.0-14.0	96.6	75.6	64.8	52.9	41.1	31.0	10.6
Supply Driven (LB Priority)	10.0-12.0	94.7	62.3	51.8	38.9	26.6	18.7	8.9
Supply Driven (LB Priority)	4.5-10.0	77.9	49.2	38.7	27.3	17.1	11.7	6.2
Supply Driven (LB Pro Rata)	16.0-31.1	96.9	95.2	91.9	84.7	76.0	65.0	39.6
Supply Driven (LB Pro Rata)	14.0-16.0	96.6	87.9	79.9	69.5	57.0	47.9	19.0
Supply Driven (LB Pro Rata)	12.0-14.0	96.7	76.4	66.0	55.4	44.5	35.3	10.4
Supply Driven (LB Pro Rata)	10.0-12.0	95.3	63.6	53.6	42.0	30.6	20.7	8.7
Supply Driven (LB Pro Rata)	4.5-10.0	79.9	50.6	40.6	29.5	19.9	12.3	6.1
Representative Preferred	16.0-31.1	96.9	95.1	90.7	82.5	72.2	60.2	34.5
Representative Preferred	14.0-16.0	96.6	85.9	77.1	65.3	52.3	43.5	21.9
Representative Preferred	12.0-14.0	96.5	73.3	61.3	50.8	39.6	31.6	14
Representative Preferred	10.0-12.0	94.0	58.8	48.4	36.9	27.0	21.6	11.4
Representative Preferred	4.5-10.0	76.1	46.2	36.2	26.5	18.5	13.0	6.1

Table TA 3-14
WY Releases from Glen Canyon Dam (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	38.09	14.79	11.63	9.00	8.23	8.23	6.45
CCS Comparative Baseline	14.0-16.0	24.28	10.81	9.00	9.00	8.23	7.48	6.00
CCS Comparative Baseline	12.0-14.0	28.14	9.00	9.00	8.23	7.48	6.89	5.36
CCS Comparative Baseline	10.0-12.0	17.22	9.16	8.23	7.48	6.37	6.00	4.15
CCS Comparative Baseline	4.5-10.0	9.50	9.00	7.66	6.41	5.73	4.79	2.42
No Action	16.0-31.1	38.13	15.25	11.82	8.40	8.23	8.23	6.27
No Action	14.0-16.0	24.50	11.35	8.23	8.23	8.23	8.23	6.15
No Action	12.0-14.0	28.49	8.23	8.23	8.23	8.23	7.20	5.11
No Action	10.0-12.0	18.89	8.23	8.23	8.23	6.49	5.93	4.06
No Action	4.5-10.0	8.32	8.23	8.23	6.36	5.33	4.58	2.76
Basic Coordination	16.0-31.1	38.09	14.97	11.48	9.50	9.50	8.93	8.23
Basic Coordination	14.0-16.0	22.88	9.58	9.50	8.64	8.23	8.23	6.92
Basic Coordination	12.0-14.0	26.99	9.29	8.23	8.23	7.86	7.30	5.68
Basic Coordination	10.0-12.0	17.59	8.23	7.92	7.20	7.00	6.31	4.37
Basic Coordination	4.5-10.0	8.23	7.10	7.00	6.92	5.72	4.73	2.42

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Enhanced Coordination	16.0-31.1	38.44	15.42	11.63	10.24	10.16	10.09	6.74
Enhanced Coordination	14.0-16.0	27.13	10.46	10.16	9.79	8.40	7.41	4.74
Enhanced Coordination	12.0-14.0	29.33	10.04	8.92	7.95	6.90	6.02	4.74
Enhanced Coordination	10.0-12.0	19.84	8.55	7.97	7.05	5.93	4.74	4.74
Enhanced Coordination	4.5-10.0	9.49	7.58	6.29	5.11	4.74	4.74	2.70
Max. Operational Flexibility	16.0-31.1	38.59	15.78	12.11	10.44	10.11	9.49	8.05
Max. Operational Flexibility	14.0-16.0	25.97	10.81	9.98	9.31	8.74	8.34	6.89
Max. Operational Flexibility	12.0-14.0	28.85	9.21	8.67	8.17	7.70	7.23	5.14
Max. Operational Flexibility	10.0-12.0	19.31	8.13	7.63	7.10	6.64	6.18	4.07
Max. Operational Flexibility	4.5-10.0	8.55	6.54	6.01	5.61	5.06	4.61	3.62
Supply Driven (LB Priority)	16.0-31.1	38.29	14.14	12.00	11.63	10.91	10.61	10.40
Supply Driven (LB Priority)	14.0-16.0	21.64	10.28	10.03	9.65	9.34	9.19	7.63
Supply Driven (LB Priority)	12.0-14.0	27.98	8.97	8.75	8.41	8.08	7.88	6.22
Supply Driven (LB Priority)	10.0-12.0	18.53	7.67	7.48	7.12	6.80	6.57	5.93
Supply Driven (LB Priority)	4.5-10.0	7.56	6.49	6.42	6.04	5.62	5.18	3.23
Supply Driven (LB Pro Rata)	16.0-31.1	38.29	14.14	12.00	11.63	10.91	10.61	10.40
Supply Driven (LB Pro Rata)	14.0-16.0	21.64	10.28	10.03	9.65	9.34	9.19	7.63
Supply Driven (LB Pro Rata)	12.0-14.0	27.98	8.97	8.75	8.41	8.08	7.88	6.22
Supply Driven (LB Pro Rata)	10.0-12.0	18.53	7.67	7.48	7.12	6.80	6.57	5.93
Supply Driven (LB Pro Rata)	4.5-10.0	7.56	6.49	6.42	6.04	5.62	5.18	3.23
Representative Preferred	16.0-31.1	38.29	14.47	12.00	12.00	10.70	9.05	8.23
Representative Preferred	14.0-16.0	22.85	11.36	9.94	8.23	8.23	8.23	6.97
Representative Preferred	12.0-14.0	28.46	8.23	8.23	8.23	8.23	7.50	5.00
Representative Preferred	10.0-12.0	18.97	8.23	8.19	7.20	6.47	6.00	5.00
Representative Preferred	4.5-10.0	8.23	6.65	6.00	6.00	5.45	5.00	2.42

NOTE: Releases colored blue highlight Glen Canyon Dam's median release of 8.23 maf. Releases colored red are at or below the smallest releases allowable of 4.73 maf in accordance with LTEMP (Reclamation 2016).

Table TA 3-15
10-Year Releases from Glen Canyon Dam

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	174.0	119.6	106.6	93.0	83.3	79.4	60.4
CCS Comparative Baseline	14.0-16.0	154.5	102.8	90.4	83.5	79.5	76.3	58.6
CCS Comparative Baseline	12.0-14.0	145.4	92.2	85.4	80.4	77.3	72.0	48.2
CCS Comparative Baseline	10.0-12.0	134.5	86.7	80.9	77.7	71.4	64.0	46.3
CCS Comparative Baseline	4.5-10.0	132.9	83.5	79.5	74.5	65.2	56.4	38.5
No Action	16.0-31.1	174.6	120.6	107.8	93.3	82.3	77.8	58.8
No Action	14.0-16.0	156.8	103.8	91.0	82.3	79.2	74.6	59.4
No Action	12.0-14.0	145.5	92.3	82.3	80.8	77.0	70.7	48.7
No Action	10.0-12.0	135.3	84.7	82.0	77.8	70.4	63.5	46.3
No Action	4.5-10.0	135.3	82.3	80.6	74.2	64.2	55.8	40.4

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Basic Coordination	16.0-31.1	173.9	120.1	107.7	93.6	82.4	77.6	57.7
Basic Coordination	14.0-16.0	156.3	104.6	93.0	82.9	77.5	74.0	57.5
Basic Coordination	12.0-14.0	148.6	95.5	85.8	79.0	75.2	70.2	47.8
Basic Coordination	10.0-12.0	135.3	87.9	80.3	76.2	71.2	64.2	45.4
Basic Coordination	4.5-10.0	131.8	84.2	79.5	74.5	65.8	56.8	38.4
Enhanced Coordination	16.0-31.1	177.0	123.9	111.0	97.3	84.8	77.9	60.8
Enhanced Coordination	14.0-16.0	160.5	108.3	96.4	83.3	76.4	71.6	59.3
Enhanced Coordination	12.0-14.0	153.7	97.1	84.7	77.4	72.0	67.1	46.2
Enhanced Coordination	10.0-12.0	139.2	85.6	77.2	72.2	66.3	61.4	44.0
Enhanced Coordination	4.5-10.0	135.6	78.9	77.6	69.1	61.6	54.5	42.3
Max. Operational Flexibility	16.0-31.1	178.7	125.1	112.5	98.1	85.6	77.8	59.6
Max. Operational Flexibility	14.0-16.0	161.0	108.8	97.0	84.9	76.8	72.2	57.3
Max. Operational Flexibility	12.0-14.0	152.4	98.6	87.7	78.9	72.8	67.4	47.8
Max. Operational Flexibility	10.0-12.0	138.8	89.8	80.5	74.0	67.8	62.1	45.6
Max. Operational Flexibility	4.5-10.0	133.7	83.5	77.7	70.8	62.6	55.0	40.7
Supply Driven (LB Priority)	16.0-31.1	174.7	122.8	109.8	97.5	87.1	80.8	62.0
Supply Driven (LB Priority)	14.0-16.0	161.0	107.4	96.9	87.4	79.6	75.8	63.8
Supply Driven (LB Priority)	12.0-14.0	152.4	98.0	89.0	81.7	76.0	71.0	51.9
Supply Driven (LB Priority)	10.0-12.0	138.9	90.2	82.4	76.4	71.2	66.1	51.4
Supply Driven (LB Priority)	4.5-10.0	132.7	85.0	79.0	73.5	66.6	60.4	46.8
Supply Driven (LB Pro Rata)	16.0-31.1	174.7	122.8	109.8	97.5	87.1	80.8	62.0
Supply Driven (LB Pro Rata)	14.0-16.0	161.0	107.4	96.9	87.4	79.6	75.8	63.8
Supply Driven (LB Pro Rata)	12.0-14.0	152.4	98.0	89.0	81.7	76.0	71.0	51.9
Supply Driven (LB Pro Rata)	10.0-12.0	138.9	90.2	82.4	76.4	71.2	66.1	51.4
Supply Driven (LB Pro Rata)	4.5-10.0	132.7	85.0	79.0	73.5	66.6	60.4	46.8
Representative Preferred	16.0-31.1	175.7	123.5	110.8	97.7	85.2	78.4	58.8
Representative Preferred	14.0-16.0	160.9	107.8	96.6	84.4	77.0	72.8	58.0
Representative Preferred	12.0-14.0	152.3	98.2	87.6	78.8	74.0	69.0	47.8
Representative Preferred	10.0-12.0	139.6	90.0	80.4	74.8	69.2	63.1	45.1
Representative Preferred	4.5-10.0	133.4	84.5	78.5	72.5	64.4	56.5	40.0

Table TA 3-16
Cumulative 10-Year Lee Ferry Flow Volume (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	175.7	121.3	108.2	94.6	84.9	80.9	62.0
CCS Comparative Baseline	14.0-16.0	156.2	104.4	92.1	85.1	81.1	77.9	60.3
CCS Comparative Baseline	12.0-14.0	147.0	93.8	87.0	81.9	78.8	73.6	49.8
CCS Comparative Baseline	10.0-12.0	136.2	88.3	82.5	79.1	73.0	65.6	47.9
CCS Comparative Baseline	4.5-10.0	134.6	85.1	81.0	76.0	66.8	58.0	40.1

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
No Action	16.0-31.1	176.3	122.2	109.5	95.0	83.9	79.4	60.4
No Action	14.0-16.0	158.5	105.4	92.7	83.9	80.5	76.3	61.1
No Action	12.0-14.0	147.2	94.0	84.0	82.3	78.6	72.3	50.3
No Action	10.0-12.0	137.0	86.4	83.6	79.3	72.0	65.2	47.9
No Action	4.5-10.0	137.0	84.0	82.0	75.7	65.8	57.4	42.0
Basic Coordination	16.0-31.1	175.6	121.8	109.3	95.2	84.0	79.2	59.4
Basic Coordination	14.0-16.0	157.9	106.3	94.6	84.5	78.9	75.6	59.2
Basic Coordination	12.0-14.0	150.3	97.2	87.5	80.6	76.8	71.8	49.4
Basic Coordination	10.0-12.0	136.9	89.6	82.0	77.7	72.7	65.8	47.0
Basic Coordination	4.5-10.0	133.4	85.8	80.9	76.0	67.3	58.5	40.0
Enhanced Coordination	16.0-31.1	178.7	125.6	112.6	98.9	86.3	79.4	62.5
Enhanced Coordination	14.0-16.0	162.2	110.0	98.1	85.0	77.9	73.3	61.0
Enhanced Coordination	12.0-14.0	155.3	98.8	86.4	78.9	73.5	68.7	47.8
Enhanced Coordination	10.0-12.0	140.9	87.3	78.8	73.8	67.9	63.0	45.6
Enhanced Coordination	4.5-10.0	137.3	80.6	79.0	70.6	63.2	56.1	43.9
Max. Operational Flexibility	16.0-31.1	180.4	126.8	114.2	99.8	87.2	79.3	61.2
Max. Operational Flexibility	14.0-16.0	162.6	110.4	98.7	86.5	78.3	73.7	59.0
Max. Operational Flexibility	12.0-14.0	154.1	100.2	89.4	80.6	74.4	68.9	49.4
Max. Operational Flexibility	10.0-12.0	140.4	91.5	82.1	75.5	69.4	63.7	47.2
Max. Operational Flexibility	4.5-10.0	135.4	85.2	79.1	72.4	64.2	56.7	42.3
Supply Driven (LB Priority)	16.0-31.1	176.4	124.4	111.4	99.1	88.6	82.2	63.6
Supply Driven (LB Priority)	14.0-16.0	162.7	109.0	98.6	89.1	81.1	77.3	65.4
Supply Driven (LB Priority)	12.0-14.0	154.1	99.6	90.7	83.4	77.5	72.6	53.5
Supply Driven (LB Priority)	10.0-12.0	140.6	91.8	84.0	78.0	72.7	67.7	53.0
Supply Driven (LB Priority)	4.5-10.0	134.4	86.7	80.4	74.9	68.2	62.0	48.4
Supply Driven (LB Pro Rata)	16.0-31.1	176.4	124.4	111.4	99.1	88.6	82.2	63.6
Supply Driven (LB Pro Rata)	14.0-16.0	162.7	109.0	98.6	89.1	81.1	77.3	65.4
Supply Driven (LB Pro Rata)	12.0-14.0	154.1	99.6	90.7	83.4	77.5	72.6	53.5
Supply Driven (LB Pro Rata)	10.0-12.0	140.6	91.8	84.0	78.0	72.7	67.7	53.0
Supply Driven (LB Pro Rata)	4.5-10.0	134.4	86.7	80.4	74.9	68.2	62.0	48.4
Representative Preferred	16.0-31.1	177.4	125.2	112.5	99.3	86.7	79.9	60.4
Representative Preferred	14.0-16.0	162.6	109.4	98.2	86.0	78.6	74.3	59.7
Representative Preferred	12.0-14.0	154.0	99.9	89.3	80.4	75.5	70.6	49.4
Representative Preferred	10.0-12.0	141.2	91.6	82.1	76.4	70.7	64.7	46.7
Representative Preferred	4.5-10.0	135.1	86.1	79.9	73.9	66.0	58.1	41.6

Table TA 3-17
Compact Point 10-Year Volume Relative to 75.0 maf[17]

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	100.7	46.3	33.2	19.6	9.9	5.9	-13.0
CCS Comparative Baseline	14.0-16.0	81.2	29.4	17.1	10.1	6.1	2.9	-14.7
CCS Comparative Baseline	12.0-14.0	72.0	18.8	12.0	6.9	3.8	-1.4	-25.2
CCS Comparative Baseline	10.0-12.0	61.2	13.3	7.5	4.1	-2.0	-9.4	-27.1
CCS Comparative Baseline	4.5-10.0	59.6	10.1	6.0	1.0	-8.2	-17.0	-34.9
No Action	16.0-31.1	101.3	47.2	34.5	20.0	8.9	4.4	-14.6
No Action	14.0-16.0	83.5	30.4	17.7	8.9	5.5	1.3	-13.9
No Action	12.0-14.0	72.2	19.0	9.0	7.3	3.6	-2.7	-24.7
No Action	10.0-12.0	62.0	11.4	8.6	4.3	-3.0	-9.8	-27.1
No Action	4.5-10.0	62.0	9.0	7.0	0.7	-9.2	-17.6	-33.0
Basic Coordination	16.0-31.1	100.6	46.8	34.3	20.2	9.0	4.2	-15.6
Basic Coordination	14.0-16.0	82.9	31.3	19.6	9.5	3.9	0.6	-15.8
Basic Coordination	12.0-14.0	75.3	22.2	12.5	5.6	1.8	-3.2	-25.6
Basic Coordination	10.0-12.0	61.9	14.6	7.0	2.7	-2.3	-9.2	-28.0
Basic Coordination	4.5-10.0	58.4	10.8	5.9	1.0	-7.7	-16.5	-35.0
Enhanced Coordination	16.0-31.1	103.7	50.6	37.6	23.9	11.3	4.4	-12.5
Enhanced Coordination	14.0-16.0	87.2	35.0	23.1	10.0	2.9	-1.7	-14.0
Enhanced Coordination	12.0-14.0	80.3	23.8	11.4	3.9	-1.5	-6.3	-27.2
Enhanced Coordination	10.0-12.0	65.9	12.3	3.8	-1.2	-7.1	-12.0	-29.4
Enhanced Coordination	4.5-10.0	62.3	5.6	4.0	-4.4	-11.8	-18.9	-31.1
Max. Operational Flexibility	16.0-31.1	105.4	51.8	39.2	24.8	12.2	4.3	-13.8
Max. Operational Flexibility	14.0-16.0	87.6	35.4	23.7	11.5	3.3	-1.3	-16.0
Max. Operational Flexibility	12.0-14.0	79.1	25.2	14.4	5.6	-0.6	-6.1	-25.6
Max. Operational Flexibility	10.0-12.0	65.4	16.5	7.1	0.5	-5.6	-11.3	-27.8
Max. Operational Flexibility	4.5-10.0	60.4	10.2	4.1	-2.6	-10.8	-18.3	-32.7
Supply Driven (LB Priority)	16.0-31.1	101.4	49.4	36.4	24.1	13.6	7.2	-11.4
Supply Driven (LB Priority)	14.0-16.0	87.7	34.0	23.6	14.1	6.1	2.3	-9.6
Supply Driven (LB Priority)	12.0-14.0	79.1	24.6	15.7	8.4	2.5	-2.4	-21.5
Supply Driven (LB Priority)	10.0-12.0	65.6	16.8	9.0	3.0	-2.3	-7.3	-22.0
Supply Driven (LB Priority)	4.5-10.0	59.4	11.7	5.4	-0.1	-6.8	-13.0	-26.6
Supply Driven (LB Pro Rata)	16.0-31.1	101.4	49.4	36.4	24.1	13.6	7.2	-11.4
Supply Driven (LB Pro Rata)	14.0-16.0	87.7	34.0	23.6	14.1	6.1	2.3	-9.6
Supply Driven (LB Pro Rata)	12.0-14.0	79.1	24.6	15.7	8.4	2.5	-2.4	-21.5
Supply Driven (LB Pro Rata)	10.0-12.0	65.6	16.8	9.0	3.0	-2.3	-7.3	-22.0
Supply Driven (LB Pro Rata)	4.5-10.0	59.4	11.7	5.4	-0.1	-6.8	-13.0	-26.6

[17] Positive numbers indicate a volume is above 75.0 maf and negative numbers mean a volume is below 75.0 maf

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Representative Preferred	16.0-31.1	102.4	50.2	37.5	24.3	11.7	4.9	-14.6
Representative Preferred	14.0-16.0	87.6	34.4	23.2	11.0	3.6	-0.7	-15.3
Representative Preferred	12.0-14.0	79.0	24.9	14.3	5.4	0.5	-4.4	-25.6
Representative Preferred	10.0-12.0	66.2	16.6	7.1	1.4	-4.3	-10.3	-28.3
Representative Preferred	4.5-10.0	60.1	11.1	4.9	-1.1	-9.0	-16.9	-33.4

Table TA 3-18
Compact Point 10-Year Volume Relative to 82.5 maf[18]

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	93.2	38.8	25.7	12.1	2.4	-1.6	-20.5
CCS Comparative Baseline	14.0-16.0	73.7	21.9	9.6	2.6	-1.4	-4.6	-22.2
CCS Comparative Baseline	12.0-14.0	64.5	11.3	4.5	-0.6	-3.7	-8.9	-32.7
CCS Comparative Baseline	10.0-12.0	53.7	5.8	0.0	-3.4	-9.5	-16.9	-34.6
CCS Comparative Baseline	4.5-10.0	52.1	2.6	-1.5	-6.5	-15.7	-24.5	-42.4
No Action	16.0-31.1	93.8	39.7	27.0	12.5	1.4	-3.1	-22.1
No Action	14.0-16.0	76.0	22.9	10.2	1.4	-2.0	-6.2	-21.4
No Action	12.0-14.0	64.7	11.5	1.5	-0.2	-3.9	-10.2	-32.2
No Action	10.0-12.0	54.5	3.9	1.1	-3.2	-10.5	-17.3	-34.6
No Action	4.5-10.0	54.5	1.5	-0.5	-6.8	-16.7	-25.1	-40.5
Basic Coordination	16.0-31.1	93.1	39.3	26.8	12.7	1.5	-3.3	-23.1
Basic Coordination	14.0-16.0	75.4	23.8	12.1	2.0	-3.6	-6.9	-23.3
Basic Coordination	12.0-14.0	67.8	14.7	5.0	-1.9	-5.7	-10.7	-33.1
Basic Coordination	10.0-12.0	54.4	7.1	-0.5	-4.8	-9.8	-16.7	-35.5
Basic Coordination	4.5-10.0	50.9	3.3	-1.6	-6.5	-15.2	-24.0	-42.5
Enhanced Coordination	16.0-31.1	96.2	43.1	30.1	16.4	3.8	-3.1	-20.0
Enhanced Coordination	14.0-16.0	79.7	27.5	15.6	2.5	-4.6	-9.2	-21.5
Enhanced Coordination	12.0-14.0	72.8	16.3	3.9	-3.6	-9.0	-13.8	-34.7
Enhanced Coordination	10.0-12.0	58.4	4.8	-3.7	-8.7	-14.6	-19.5	-36.9
Enhanced Coordination	4.5-10.0	54.8	-1.9	-3.5	-11.9	-19.3	-26.4	-38.6
Max. Operational Flexibility	16.0-31.1	97.9	44.3	31.7	17.3	4.7	-3.2	-21.3
Max. Operational Flexibility	14.0-16.0	80.1	27.9	16.2	4.0	-4.2	-8.8	-23.5
Max. Operational Flexibility	12.0-14.0	71.6	17.7	6.9	-1.9	-8.1	-13.6	-33.1
Max. Operational Flexibility	10.0-12.0	57.9	9.0	-0.4	-7.0	-13.1	-18.8	-35.3
Max. Operational Flexibility	4.5-10.0	52.9	2.7	-3.4	-10.1	-18.3	-25.8	-40.2
Supply Driven (LB Priority)	16.0-31.1	93.9	41.9	28.9	16.6	6.1	-0.3	-18.9
Supply Driven (LB Priority)	14.0-16.0	80.2	26.5	16.1	6.6	-1.4	-5.2	-17.1
Supply Driven (LB Priority)	12.0-14.0	71.6	17.1	8.2	0.9	-5.0	-9.9	-29.0
Supply Driven (LB Priority)	10.0-12.0	58.1	9.3	1.5	-4.5	-9.8	-14.8	-29.5
Supply Driven (LB Priority)	4.5-10.0	51.9	4.2	-2.1	-7.6	-14.3	-20.5	-34.1

[18] Positive numbers indicate a volume is above 82.5 maf and negative numbers mean a volume is below 82.5 maf

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Supply Driven (LB Pro Rata)	16.0-31.1	93.9	41.9	28.9	16.6	6.1	-0.3	-18.9
Supply Driven (LB Pro Rata)	14.0-16.0	80.2	26.5	16.1	6.6	-1.4	-5.2	-17.1
Supply Driven (LB Pro Rata)	12.0-14.0	71.6	17.1	8.2	0.9	-5.0	-9.9	-29.0
Supply Driven (LB Pro Rata)	10.0-12.0	58.1	9.3	1.5	-4.5	-9.8	-14.8	-29.5
Supply Driven (LB Pro Rata)	4.5-10.0	51.9	4.2	-2.1	-7.6	-14.3	-20.5	-34.1
Representative Preferred	16.0-31.1	94.9	42.7	30.0	16.8	4.2	-2.6	-22.1
Representative Preferred	14.0-16.0	80.1	26.9	15.7	3.5	-3.9	-8.2	-22.8
Representative Preferred	12.0-14.0	71.5	17.4	6.8	-2.1	-7.0	-11.9	-33.1
Representative Preferred	10.0-12.0	58.7	9.1	-0.4	-6.1	-11.8	-17.8	-35.8
Representative Preferred	4.5-10.0	52.6	3.6	-2.6	-8.6	-16.5	-24.4	-40.9

Table TA 3-19
CY Releases from Hoover Dam (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	37.94	12.15	10.05	9.39	8.70	8.36	6.85
CCS Comparative Baseline	14.0-16.0	22.33	9.67	9.21	8.68	8.28	7.96	6.19
CCS Comparative Baseline	12.0-14.0	21.35	9.29	8.77	8.32	7.96	7.64	5.81
CCS Comparative Baseline	10.0-12.0	13.17	8.94	8.44	7.93	7.30	6.53	4.28
CCS Comparative Baseline	4.5-10.0	10.36	8.67	8.28	7.47	6.12	5.14	2.64
No Action	16.0-31.1	37.85	12.11	10.08	9.28	8.77	8.50	7.20
No Action	14.0-16.0	22.37	9.53	9.17	8.77	8.54	8.27	7.10
No Action	12.0-14.0	22.68	9.26	8.89	8.63	8.30	7.86	5.19
No Action	10.0-12.0	13.27	9.16	8.74	8.09	7.28	6.48	3.75
No Action	4.5-10.0	10.16	9.22	8.69	7.21	5.83	5.04	2.88
Basic Coordination	16.0-31.1	38.04	12.86	10.63	9.19	8.17	7.84	6.37
Basic Coordination	14.0-16.0	21.75	9.51	9.01	8.26	7.92	7.70	6.27
Basic Coordination	12.0-14.0	22.02	9.14	8.41	8.03	7.76	7.45	5.83
Basic Coordination	10.0-12.0	12.87	8.64	8.16	7.80	7.36	6.86	4.20
Basic Coordination	4.5-10.0	9.99	8.47	8.10	7.66	6.46	5.28	2.61
Enhanced Coordination	16.0-31.1	38.33	14.19	11.03	9.38	8.70	7.92	5.77
Enhanced Coordination	14.0-16.0	23.36	9.87	9.16	8.55	7.68	7.20	5.71
Enhanced Coordination	12.0-14.0	24.08	9.12	8.37	7.58	7.09	6.59	4.93
Enhanced Coordination	10.0-12.0	14.35	8.09	7.54	6.93	6.39	6.03	4.32
Enhanced Coordination	4.5-10.0	9.76	7.54	7.06	6.48	6.04	5.20	2.92
Max. Operational Flexibility	16.0-31.1	38.48	14.57	11.23	9.34	8.30	7.53	5.67
Max. Operational Flexibility	14.0-16.0	23.91	10.09	9.02	8.28	7.68	7.21	5.79
Max. Operational Flexibility	12.0-14.0	24.99	8.76	8.26	7.78	7.31	6.95	4.98
Max. Operational Flexibility	10.0-12.0	16.69	8.18	7.79	7.29	6.67	6.15	4.70
Max. Operational Flexibility	4.5-10.0	8.99	7.83	7.30	6.40	5.79	5.34	3.66

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Supply Driven (LB Priority)	16.0-31.1	38.25	13.37	11.32	10.22	8.09	7.27	5.43
Supply Driven (LB Priority)	14.0-16.0	20.06	10.02	9.43	8.25	7.53	7.05	5.46
Supply Driven (LB Priority)	12.0-14.0	17.32	9.32	8.48	7.74	7.30	6.94	4.87
Supply Driven (LB Priority)	10.0-12.0	10.79	8.54	7.94	7.48	7.03	6.64	4.75
Supply Driven (LB Priority)	4.5-10.0	10.27	8.16	7.75	7.24	6.71	5.91	3.53
Supply Driven (LB Pro Rata)	16.0-31.1	38.25	13.47	11.37	10.38	8.01	7.24	5.49
Supply Driven (LB Pro Rata)	14.0-16.0	20.06	10.01	9.44	8.16	7.45	6.93	5.35
Supply Driven (LB Pro Rata)	12.0-14.0	18.68	9.35	8.42	7.65	7.19	6.79	5.14
Supply Driven (LB Pro Rata)	10.0-12.0	11.57	8.46	7.78	7.36	6.92	6.54	4.72
Supply Driven (LB Pro Rata)	4.5-10.0	10.21	7.94	7.55	7.12	6.68	5.95	3.48
Representative Preferred	16.0-31.1	38.25	13.02	11.26	9.78	8.25	7.69	5.76
Representative Preferred	14.0-16.0	22.08	10.07	9.42	8.27	7.79	7.39	5.63
Representative Preferred	12.0-14.0	20.09	9.41	8.52	7.89	7.55	7.11	4.88
Representative Preferred	10.0-12.0	10.59	8.61	8.03	7.61	6.83	6.11	4.13
Representative Preferred	4.5-10.0	10.33	8.16	7.77	6.94	5.89	5.5	2.55

Table TA 3-20
CY Releases from Davis Dam (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	37.6	12.1	9.9	9.3	8.6	8.3	7.1
CCS Comparative Baseline	14.0-16.0	22.5	9.6	9.1	8.6	8.2	7.9	6.4
CCS Comparative Baseline	12.0-14.0	21.9	9.2	8.7	8.2	7.8	7.6	5.7
CCS Comparative Baseline	10.0-12.0	13.3	8.8	8.3	7.9	7.2	6.5	4.3
CCS Comparative Baseline	4.5-10.0	10.1	8.6	8.2	7.4	6.0	5.0	2.5
No Action	16.0-31.1	37.5	12.1	10.0	9.2	8.7	8.4	7.6
No Action	14.0-16.0	22.6	9.4	9.1	8.7	8.4	8.2	7.3
No Action	12.0-14.0	23.2	9.2	8.8	8.5	8.2	7.8	5.2
No Action	10.0-12.0	13.4	9.0	8.7	8.1	7.2	6.3	3.7
No Action	4.5-10.0	9.9	9.1	8.6	7.1	5.7	4.9	2.8
Basic Coordination	16.0-31.1	37.7	12.9	10.6	9.1	8.1	7.7	6.8
Basic Coordination	14.0-16.0	21.8	9.4	8.9	8.1	7.8	7.6	6.5
Basic Coordination	12.0-14.0	22.6	9.1	8.3	7.9	7.7	7.4	6.1
Basic Coordination	10.0-12.0	13.0	8.5	8.0	7.7	7.3	6.8	3.9
Basic Coordination	4.5-10.0	9.8	8.3	8.0	7.6	6.4	5.2	2.6
Enhanced Coordination	16.0-31.1	38.0	14.3	10.9	9.3	8.6	7.9	6.2
Enhanced Coordination	14.0-16.0	23.4	9.8	9.0	8.5	7.5	7.1	5.8
Enhanced Coordination	12.0-14.0	24.6	9.0	8.3	7.4	7.0	6.5	5.4
Enhanced Coordination	10.0-12.0	14.5	8.0	7.4	6.8	6.3	6.0	4.3
Enhanced Coordination	4.5-10.0	9.5	7.4	6.9	6.4	6.0	5.2	2.9

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Max. Operational Flexibility	16.0-31.1	38.2	14.6	11.1	9.2	8.2	7.4	6.0
Max. Operational Flexibility	14.0-16.0	23.8	10.1	8.9	8.1	7.6	7.2	6.0
Max. Operational Flexibility	12.0-14.0	25.5	8.7	8.1	7.6	7.2	6.9	5.4
Max. Operational Flexibility	10.0-12.0	16.8	8.1	7.7	7.2	6.6	6.1	4.8
Max. Operational Flexibility	4.5-10.0	8.7	7.7	7.2	6.3	5.7	5.3	3.6
Supply Driven (LB Priority)	16.0-31.1	37.9	13.5	11.3	10.1	8.0	7.2	5.8
Supply Driven (LB Priority)	14.0-16.0	20.1	9.9	9.3	8.1	7.4	7.0	5.8
Supply Driven (LB Priority)	12.0-14.0	17.6	9.2	8.4	7.6	7.2	6.9	5.3
Supply Driven (LB Priority)	10.0-12.0	10.9	8.4	7.8	7.3	6.9	6.6	5.2
Supply Driven (LB Priority)	4.5-10.0	10.0	8.1	7.6	7.1	6.7	5.9	3.4
Supply Driven (LB Pro Rata)	16.0-31.1	37.9	13.6	11.3	10.3	7.9	7.1	5.7
Supply Driven (LB Pro Rata)	14.0-16.0	20.1	10.0	9.4	8.0	7.3	6.9	5.6
Supply Driven (LB Pro Rata)	12.0-14.0	19.0	9.2	8.4	7.5	7.1	6.8	5.6
Supply Driven (LB Pro Rata)	10.0-12.0	11.5	8.4	7.7	7.2	6.8	6.5	5.1
Supply Driven (LB Pro Rata)	4.5-10.0	10.0	7.8	7.4	7.0	6.6	5.9	3.3
Representative Preferred	16.0-31.1	37.9	13.1	11.2	9.7	8.1	7.6	6.0
Representative Preferred	14.0-16.0	22.2	9.9	9.3	8.2	7.6	7.4	5.7
Representative Preferred	12.0-14.0	20.6	9.3	8.4	7.8	7.5	7.0	5.2
Representative Preferred	10.0-12.0	10.5	8.5	7.9	7.5	6.8	6.0	4.5
Representative Preferred	4.5-10.0	10.1	8.0	7.6	6.9	5.8	5.5	2.5

Table TA 3-21
CY Releases from Parker Dam (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	34.8	9.2	7.0	6.7	6.5	6.4	5.9
CCS Comparative Baseline	14.0-16.0	19.9	6.9	6.7	6.6	6.4	6.3	5.8
CCS Comparative Baseline	12.0-14.0	18.7	6.8	6.6	6.5	6.3	6.2	4.8
CCS Comparative Baseline	10.0-12.0	10.6	6.7	6.5	6.3	6.1	5.6	3.6
CCS Comparative Baseline	4.5-10.0	7.2	6.6	6.3	6.1	5.2	4.4	2.0
No Action	16.0-31.1	34.4	8.8	7.0	6.8	6.6	6.5	6.1
No Action	14.0-16.0	19.6	7.0	6.8	6.6	6.5	6.4	5.8
No Action	12.0-14.0	19.7	6.8	6.7	6.6	6.4	6.3	4.4
No Action	10.0-12.0	10.6	6.8	6.6	6.4	6.0	5.3	3.2
No Action	4.5-10.0	7.3	6.7	6.5	6.0	4.9	4.3	2.4
Basic Coordination	16.0-31.1	34.6	9.8	7.2	6.7	6.5	6.3	5.9
Basic Coordination	14.0-16.0	18.6	6.9	6.7	6.6	6.4	6.3	5.9
Basic Coordination	12.0-14.0	19.1	6.8	6.6	6.5	6.3	6.2	5.3
Basic Coordination	10.0-12.0	10.2	6.7	6.5	6.4	6.2	5.9	3.2
Basic Coordination	4.5-10.0	7.2	6.6	6.4	6.3	5.5	4.5	2.1

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Enhanced Coordination	16.0-31.1	34.9	11.2	7.6	6.7	6.3	6.0	5.0
Enhanced Coordination	14.0-16.0	20.1	7.1	6.6	6.3	5.6	5.3	4.5
Enhanced Coordination	12.0-14.0	21.1	6.6	6.2	5.5	5.1	4.8	4.1
Enhanced Coordination	10.0-12.0	12.0	5.9	5.5	5.0	4.6	4.4	3.3
Enhanced Coordination	4.5-10.0	6.9	5.4	5.0	4.6	4.4	4.1	2.3
Max. Operational Flexibility	16.0-31.1	35.0	11.5	7.8	6.8	6.4	6.1	5.6
Max. Operational Flexibility	14.0-16.0	20.6	7.4	6.7	6.5	6.2	6.0	5.6
Max. Operational Flexibility	12.0-14.0	21.7	6.7	6.5	6.3	6.1	5.9	5.4
Max. Operational Flexibility	10.0-12.0	14.5	6.5	6.3	6.1	5.8	5.6	4.3
Max. Operational Flexibility	4.5-10.0	7.0	6.3	6.1	5.7	5.3	5.0	3.0
Supply Driven (LB Priority)	16.0-31.1	34.8	10.5	8.2	7.1	6.4	6.1	5.6
Supply Driven (LB Priority)	14.0-16.0	16.9	7.1	6.8	6.4	6.2	6.0	5.6
Supply Driven (LB Priority)	12.0-14.0	14.3	6.8	6.5	6.3	6.1	5.9	5.6
Supply Driven (LB Priority)	10.0-12.0	8.4	6.6	6.4	6.2	6.0	5.9	5.2
Supply Driven (LB Priority)	4.5-10.0	7.2	6.5	6.3	6.1	5.8	5.2	2.9
Supply Driven (LB Pro Rata)	16.0-31.1	34.8	10.6	8.2	7.3	6.0	5.6	5.0
Supply Driven (LB Pro Rata)	14.0-16.0	16.9	7.1	6.8	6.1	5.7	5.4	4.9
Supply Driven (LB Pro Rata)	12.0-14.0	15.6	6.7	6.3	5.8	5.5	5.3	4.8
Supply Driven (LB Pro Rata)	10.0-12.0	9.1	6.3	5.8	5.5	5.3	5.2	4.6
Supply Driven (LB Pro Rata)	4.5-10.0	7.2	5.9	5.7	5.4	5.2	4.9	2.8
Representative Preferred	16.0-31.1	34.8	10.0	8.0	6.8	6.5	6.2	5.7
Representative Preferred	14.0-16.0	18.8	7.0	6.7	6.5	6.3	6.1	5.1
Representative Preferred	12.0-14.0	17.4	6.7	6.5	6.4	6.2	6.0	4.9
Representative Preferred	10.0-12.0	7.9	6.6	6.4	6.2	5.9	5.5	4.1
Representative Preferred	4.5-10.0	7.2	6.4	6.3	5.9	5.3	5.0	2.1

Table TA 3-22
Annual Flow Volume at Imperial Dam (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	33.5	8.1	5.8	5.6	5.5	5.5	5.2
CCS Comparative Baseline	14.0-16.0	19.1	5.7	5.6	5.5	5.4	5.3	4.8
CCS Comparative Baseline	12.0-14.0	17.3	5.6	5.6	5.5	5.3	5.3	4.0
CCS Comparative Baseline	10.0-12.0	9.2	5.6	5.5	5.3	5.2	4.6	2.8
CCS Comparative Baseline	4.5-10.0	5.8	5.5	5.3	5.2	4.3	3.6	1.3
No Action	16.0-31.1	33.1	7.8	5.8	5.7	5.6	5.5	5.1
No Action	14.0-16.0	18.7	5.7	5.7	5.6	5.5	5.5	5.0
No Action	12.0-14.0	18.2	5.7	5.6	5.6	5.5	5.3	3.7
No Action	10.0-12.0	9.2	5.6	5.6	5.5	5.0	4.4	2.4
No Action	4.5-10.0	5.8	5.6	5.5	5.0	4.1	3.5	1.5

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
Basic Coordination	16.0-31.1	33.2	8.9	6.1	5.7	5.5	5.4	5.3
Basic Coordination	14.0-16.0	17.2	5.7	5.7	5.5	5.4	5.4	5.1
Basic Coordination	12.0-14.0	17.6	5.7	5.5	5.4	5.4	5.3	4.5
Basic Coordination	10.0-12.0	8.8	5.6	5.5	5.4	5.3	4.9	2.5
Basic Coordination	4.5-10.0	5.7	5.5	5.4	5.3	4.6	3.7	1.3
Enhanced Coordination	16.0-31.1	33.5	10.2	6.6	5.6	5.3	5.1	4.3
Enhanced Coordination	14.0-16.0	18.7	6.0	5.5	5.3	4.7	4.5	3.8
Enhanced Coordination	12.0-14.0	19.6	5.5	5.3	4.6	4.3	4.0	3.7
Enhanced Coordination	10.0-12.0	10.6	4.9	4.6	4.1	3.8	3.8	2.7
Enhanced Coordination	4.5-10.0	5.7	4.5	4.1	3.8	3.7	3.4	1.7
Max. Operational Flexibility	16.0-31.1	33.7	10.5	6.7	5.7	5.5	5.2	4.9
Max. Operational Flexibility	14.0-16.0	19.2	6.5	5.7	5.5	5.2	5.1	4.9
Max. Operational Flexibility	12.0-14.0	20.4	5.6	5.5	5.3	5.1	5.0	4.5
Max. Operational Flexibility	10.0-12.0	13.2	5.4	5.3	5.1	4.9	4.6	3.3
Max. Operational Flexibility	4.5-10.0	5.6	5.3	5.1	4.7	4.3	4.0	2.0
Supply Driven (LB Priority)	16.0-31.1	33.5	9.4	7.2	6.1	5.4	5.2	4.9
Supply Driven (LB Priority)	14.0-16.0	16.0	6.0	5.8	5.5	5.2	5.1	4.9
Supply Driven (LB Priority)	12.0-14.0	13.3	5.8	5.5	5.4	5.2	5.0	4.8
Supply Driven (LB Priority)	10.0-12.0	7.0	5.5	5.4	5.2	5.1	5.0	4.0
Supply Driven (LB Priority)	4.5-10.0	5.9	5.5	5.3	5.1	5.0	4.3	2.1
Supply Driven (LB Pro Rata)	16.0-31.1	33.5	9.5	7.2	6.3	5.0	4.8	4.5
Supply Driven (LB Pro Rata)	14.0-16.0	16.0	6.0	5.7	5.1	4.9	4.6	4.5
Supply Driven (LB Pro Rata)	12.0-14.0	14.5	5.7	5.4	4.9	4.7	4.5	4.3
Supply Driven (LB Pro Rata)	10.0-12.0	7.7	5.4	4.9	4.7	4.5	4.5	3.6
Supply Driven (LB Pro Rata)	4.5-10.0	5.9	4.9	4.9	4.6	4.5	4.1	2.2
Representative Preferred	16.0-31.1	33.5	9.0	6.9	5.7	5.4	5.3	4.8
Representative Preferred	14.0-16.0	17.4	5.9	5.7	5.4	5.3	5.2	4.2
Representative Preferred	12.0-14.0	15.9	5.7	5.4	5.3	5.3	5.1	4.0
Representative Preferred	10.0-12.0	6.5	5.5	5.4	5.3	5.0	4.5	3.3
Representative Preferred	4.5-10.0	5.9	5.4	5.3	5.0	4.2	4.1	1.4

Table TA 3-23
Annual Flow Volume Below Imperial Dam (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	28.7	3.5	1.3	1.2	1.1	1.0	0.8
CCS Comparative Baseline	14.0-16.0	14.3	1.2	1.2	1.1	1.0	0.9	0.7
CCS Comparative Baseline	12.0-14.0	12.6	1.2	1.1	1.0	0.9	0.8	0.6
CCS Comparative Baseline	10.0-12.0	4.6	1.1	1.0	0.9	0.8	0.7	0.5
CCS Comparative Baseline	4.5-10.0	1.2	1.0	1.0	0.8	0.7	0.6	0.4

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
No Action	16.0-31.1	28.2	3.1	1.3	1.2	1.1	1.1	1.0
No Action	14.0-16.0	13.9	1.2	1.2	1.1	1.1	1.1	0.9
No Action	12.0-14.0	13.5	1.2	1.1	1.1	1.1	1.0	0.7
No Action	10.0-12.0	4.6	1.2	1.1	1.1	0.9	0.8	0.6
No Action	4.5-10.0	1.4	1.2	1.1	0.9	0.8	0.7	0.4
Basic Coordination	16.0-31.1	28.4	4.1	1.4	1.2	1.0	1.0	0.9
Basic Coordination	14.0-16.0	12.4	1.2	1.2	1.0	1.0	1.0	0.9
Basic Coordination	12.0-14.0	12.8	1.2	1.0	1.0	1.0	0.9	0.8
Basic Coordination	10.0-12.0	4.2	1.1	1.0	1.0	0.9	0.9	0.6
Basic Coordination	4.5-10.0	1.3	1.0	1.0	1.0	0.8	0.7	0.5
Enhanced Coordination	16.0-31.1	28.7	5.4	1.7	1.1	0.9	0.9	0.9
Enhanced Coordination	14.0-16.0	13.9	1.5	1.1	1.0	0.9	0.9	0.8
Enhanced Coordination	12.0-14.0	14.9	1.0	1.0	0.9	0.9	0.8	0.8
Enhanced Coordination	10.0-12.0	6.1	1.0	1.0	0.9	0.8	0.8	0.6
Enhanced Coordination	4.5-10.0	1.4	1.1	1.0	0.8	0.8	0.7	0.4
Max. Operational Flexibility	16.0-31.1	28.9	5.8	2.0	1.2	1.0	0.9	0.8
Max. Operational Flexibility	14.0-16.0	14.4	1.8	1.2	1.0	0.9	0.9	0.7
Max. Operational Flexibility	12.0-14.0	15.6	1.1	1.0	0.9	0.9	0.8	0.7
Max. Operational Flexibility	10.0-12.0	8.7	1.0	1.0	0.9	0.8	0.7	0.7
Max. Operational Flexibility	4.5-10.0	1.2	0.9	0.9	0.8	0.7	0.7	0.5
Supply Driven (LB Priority)	16.0-31.1	28.6	4.7	2.6	1.5	1.0	1.0	0.8
Supply Driven (LB Priority)	14.0-16.0	11.2	1.4	1.3	1.0	1.0	1.0	0.8
Supply Driven (LB Priority)	12.0-14.0	8.5	1.3	1.0	1.0	1.0	0.9	0.7
Supply Driven (LB Priority)	10.0-12.0	2.7	1.1	1.0	1.0	0.9	0.8	0.7
Supply Driven (LB Priority)	4.5-10.0	1.3	1.0	1.0	0.9	0.8	0.8	0.5
Supply Driven (LB Pro Rata)	16.0-31.1	28.6	4.9	2.6	1.6	1.1	1.1	0.9
Supply Driven (LB Pro Rata)	14.0-16.0	11.2	1.5	1.3	1.1	1.1	1.0	0.7
Supply Driven (LB Pro Rata)	12.0-14.0	9.8	1.3	1.1	1.1	1.0	1.0	0.7
Supply Driven (LB Pro Rata)	10.0-12.0	3.3	1.2	1.1	1.1	1.0	1.0	0.8
Supply Driven (LB Pro Rata)	4.5-10.0	1.4	1.1	1.1	1.0	1.0	0.8	0.5
Representative Preferred	16.0-31.1	28.6	4.4	2.3	1.2	0.9	0.9	0.7
Representative Preferred	14.0-16.0	12.6	1.2	1.2	0.9	0.9	0.9	0.7
Representative Preferred	12.0-14.0	11.4	1.2	0.9	0.9	0.9	0.9	0.7
Representative Preferred	10.0-12.0	2.2	0.9	0.9	0.9	0.8	0.7	0.6
Representative Preferred	4.5-10.0	1.3	1.0	0.9	0.9	0.7	0.7	0.4

Table TA 3-24
Annual Flow Volume Below Morelos Diversion Dam (maf)

Alternative	Flow Category	Max (maf)	90% (maf)	75% (maf)	50% (maf)	25% (maf)	10% (maf)	Min (maf)
CCS Comparative Baseline	16.0-31.1	27.4	2.2	0.0	0.0	0.0	0.0	0.0
CCS Comparative Baseline	14.0-16.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0
CCS Comparative Baseline	12.0-14.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0
CCS Comparative Baseline	10.0-12.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0
CCS Comparative Baseline	4.5-10.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
No Action	16.0-31.1	26.9	1.7	0.0	0.0	0.0	0.0	0.0
No Action	14.0-16.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0
No Action	12.0-14.0	12.2	0.0	0.0	0.0	0.0	0.0	0.0
No Action	10.0-12.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0
No Action	4.5-10.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Basic Coordination	16.0-31.1	27.1	2.8	0.0	0.0	0.0	0.0	0.0
Basic Coordination	14.0-16.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0
Basic Coordination	12.0-14.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0
Basic Coordination	10.0-12.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0
Basic Coordination	4.5-10.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Enhanced Coordination	16.0-31.1	27.4	4.1	0.5	0.0	0.0	0.0	0.0
Enhanced Coordination	14.0-16.0	12.6	0.3	0.0	0.0	0.0	0.0	0.0
Enhanced Coordination	12.0-14.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0
Enhanced Coordination	10.0-12.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0
Enhanced Coordination	4.5-10.0	0.3	0.0	0.0	0.0	0.0	0.0	-0.1
Max. Operational Flexibility	16.0-31.1	27.5	4.4	0.7	0.0	0.0	0.0	0.0
Max. Operational Flexibility	14.0-16.0	13.0	0.5	0.0	0.0	0.0	0.0	0.0
Max. Operational Flexibility	12.0-14.0	14.2	0.0	0.0	0.0	0.0	0.0	0.0
Max. Operational Flexibility	10.0-12.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0
Max. Operational Flexibility	4.5-10.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Priority)	16.0-31.1	27.3	3.4	1.3	0.2	0.0	0.0	0.0
Supply Driven (LB Priority)	14.0-16.0	9.8	0.2	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Priority)	12.0-14.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Priority)	10.0-12.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Priority)	4.5-10.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Pro Rata)	16.0-31.1	27.3	3.5	1.4	0.3	0.0	0.0	0.0
Supply Driven (LB Pro Rata)	14.0-16.0	9.8	0.2	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Pro Rata)	12.0-14.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Pro Rata)	10.0-12.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Supply Driven (LB Pro Rata)	4.5-10.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Representative Preferred	16.0-31.1	27.3	3.1	1.1	0.0	0.0	0.0	0.0
Representative Preferred	14.0-16.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0
Representative Preferred	12.0-14.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0
Representative Preferred	10.0-12.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Representative Preferred	4.5-10.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0

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