Technical Appendix 16

Socioeconomics

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Acronyms and Abbreviations

Acronym or Abbreviation	Full Phrase
2007 Final EIS	2007 Interim Guidelines Final Environmental Impact Statement
Basin	Colorado River Basin
CAP	Central Arizona Project
CCS	Continued Current Strategies
cfs	cubic feet per second
DMDU	decision making under deep uncertainty
EIS	environmental impact statement
GCNP	Grand Canyon National Park
GDP	gross domestic product
kaf	thousand acre-feet
LB Priority	Lower Basin Priority
LB Pro Rata	Lower Basin Pro Rata
maf	million acre-feet
NPS	National Park Service
NRA	National Recreation Area
NWR	National Wildlife Refuge
Reclamation	Bureau of Reclamation
SEIS	supplemental environmental impact statement
U.S.	United States

TA 16. Socioeconomics

TA 16.1 Affected Environment

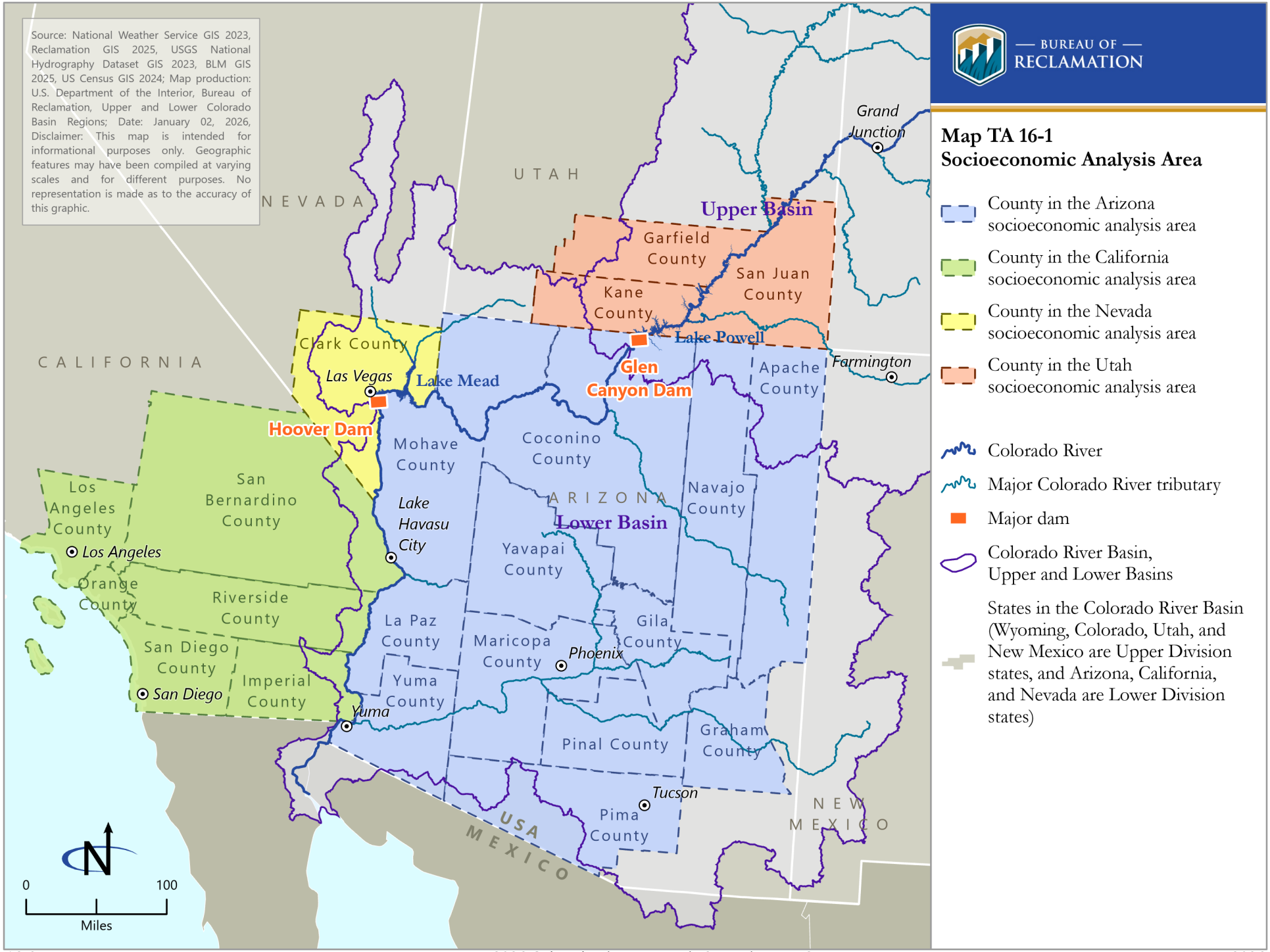
TA 16.1.1 Socioeconomic Analysis Area

The analysis area for the socioeconomic analysis includes counties in Arizona, California, Nevada, and Utah (see **Map TA 16-1** for a map of the socioeconomic analysis area). In Section **TA 16.2.1**, Methodology, in the *Impact Analysis Area* subsection under the *Agriculture, Recreation,* and *Ecosystem Services and Nonmarket Values* subsections, the socioeconomic analysis area is further described as it relates to each issue statement that was analyzed in this technical appendix. The analysis on impacts on economic and social conditions due to changes agricultural production included Arizona, California, and Nevada. The analysis on economic impacts from changes in recreational use included Arizona, California, Nevada, and Utah. The impact analysis on ecosystem services and nonmarket values included Arizona, California, Nevada, and Utah. The counties and communities that are included in the socioeconomic analysis area is described further below, by state.

The Arizona analysis area consists of Apache, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Yavapai and Yuma Counties. These include counties that are directly adjacent to Lake Powell, Lake Mead, or the mainstream Colorado River, counties in which impacts from Colorado River shortages would likely occur, and counties where tribal reservations affected by Colorado River or Central Arizona Project (CAP) shortages are located.[1] The counties in which measurable mainstream Colorado River or CAP shortages could potentially occur to tribal and non-tribal irrigation entitlement holders, resulting in reductions in agricultural production, are La Paz, Maricopa, Mohave, Pinal, Pima, and Yuma Counties.

Apache, Coconino, Gila, Graham, Navajo, and Yavapai Counties would not experience a water shortage to irrigation entitlement holders attributable to the alternatives; however, they are included in the analysis area because of the ties these counties have to recreation-related economic activity on the Colorado River as well as ties to Indian water rights settlements involving CAP water and non-CAP Colorado River water delivered through the CAP. Please refer to **Table 18-3**, CAP Water Entitlements, in Section **TA 18.1.2**, Water Entitlements, Water Deliveries, and Storage and Conservation Options, **TA-18**, Indian Trust Assets for details on tribes with CAP contracts.

[1] See Section 1.5.1, Geographic Scope of Scope of the Proposed Federal Action and Affected Regions and Interests, of the Draft EIS, for more information on the geographic scope that would be affected by the alternatives analyzed.


Source: National Weather Service GIS 2023, Reclamation GIS 2025, USGS National Hydrography Dataset GIS 2023, BLM GIS 2025, US Census GIS 2024; Map production: U.S. Department of the Interior, Bureau of Reclamation, Upper and Lower Colorado Basin Regions; Date: January 02, 2026, Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.
BUREAU OF RECLAMATION
Map TA 16-1
Socioeconomic Analysis Area
County in the Arizona socioeconomic analysis area
County in the California socioeconomic analysis area
County in the Nevada socioeconomic analysis area
County in the Utah socioeconomic analysis area
Colorado River
Major Colorado River tributary
Major dam
Colorado River Basin, Upper and Lower Basins
States in the Colorado River Basin (Wyoming, Colorado, Utah, and New Mexico are Upper Division states, and Arizona, California, and Nevada are Lower Division states)
NEVADA
UTAH
CALIFORNIA
ARIZONA
NEW MEXICO
USA
MEXICO
Upper Basin
Lower Basin
Grand Junction
Garfield County
Kane County
San Juan County
Lake Powell
Glen Canyon Dam
Farmington
Apache County
Clark County
Las Vegas
Lake Mead
Hoover Dam
Mohave County
Coconino County
Navajo County
Lake Havasu City
Yavapai County
Los Angeles County
Los Angeles
San Bernardino County
Orange County
Riverside County
San Diego County
San Diego
Imperial County
La Paz County
Maricopa County
Phoenix
Gila County
Yuma County
Yuma
Pinal County
Graham County
Tucson
Pima County
N
0
100
Miles

The California analysis area consists of Imperial, Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties. These counties were selected because they are either directly adjacent to the Colorado River, or they are within the Metropolitan Water District of Southern California service area. Although Ventura County is also in the Metropolitan Water District of Southern California service area, it does not receive any water from the Colorado River; therefore, it is not included in the analysis area.

The Nevada analysis area consists of Clark County. The analysis area was limited to Clark County because it is adjacent to Lake Mead and encompasses the Southern Nevada Water Authority's service area and other individual water providers. Shortages in Nevada would be limited to Southern Nevada Water Authority's service area.

The Utah analysis area consists of Garfield, Kane, and San Juan Counties. Utah will not experience shortages under any alternative, so Utah was not included in the analysis area for the agriculture economic impact analysis in this technical appendix. However, changes in storage at Lake Powell could result in changes in recreation-related expenditures made in these Utah analysis area counties, so the following sections include baseline data for Utah, as it relates to economic and social conditions due to changes in recreation.

TA 16.1.2 Baseline Economic Conditions

This section provides an overview of baseline economic conditions related to Colorado River water use with the potential to be affected by water shortages. Baseline data used to inform this section was collected from the United States (U.S.) Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, the U.S. Census Bureau, as well as current, relevant literature. This data is county-level data on employment, labor income, unemployment rates, poverty, and market value of agricultural production in analysis areas. The county-level data does not distinguish between water source(s)—which may include sources other than, or blended with, mainstream Colorado River and CAP—that were used in support of the economic conditions presented.

Arizona

Employment and Personal Income

Table TA 16-1 and **Table TA 16-2**, below, provide an overview for employment by sector for the counties in the analysis area in Arizona in 2010 and 2022, respectively. Full- and part-time employment in Arizona totaled almost 4.3 million jobs in 2022, an increase of approximately 1.1 million jobs from 2010 levels. Farm employment totaled almost 28,000 jobs in 2022 and accounted for 0.6 percent of the total employment in the state; this is a small reduction from the number of jobs and percentage of the total employment in 2010, at almost 29,000 jobs and 0.9 percent of the total employment.

Table TA 16-1
Arizona Employment by Industry (2010)

Employment	Apache County	Coconino County	Gila County	Graham County	La Paz County	Maricopa County	Mohave County	Navajo County	Pima County	Pinal County	Yavapai Couty	Yuma County	Arizona
Total employment	29,145	76,339	20,545	11,169	7,120	2,128,893	64,093	39,742	476,916	81,029	87,126	79,896	3,181,563
Wage and salary employment	20,108	60,171	14,547	8,771	5,632	1,674,446	47,017	27,588	373,423	55,378	56,921	66,962	2,473,077
Proprietors' employment	9,037	16,168	5,998	2,398	1,488	454,447	17,076	12,154	103,493	25,651	30,205	12,934	708,486
Farm employment (number and percentage of total employment)	5,097	2,014	223	670	254	6,325	529	3,665	1,177	2,147	937	3,152	28,609
	17.5%	2.6%	1.1%	6.0%	3.6%	0.3%	0.8%	9.2%	0.2%	2.6%	1.1%	3.9%	0.9%
Non-farm employment (number and percentage of total employment)	24,048	74,325	20,322	10,499	6,866	2,122,568	63,564	36,077	475,739	78,882	86,189	76,744	3,152,954
	82.5%	97.4%	98.9%	94.0%	96.4%	99.7%	99.2%	90.8%	99.8%	97.4%	98.9%	96.1%	99.1%
Employment by Industry (Number and Percentage of Total Employment)													
Forestry, fishing, and related	238	229	116	(D)	(D)	2,537	(D)	235	391	616	308	9,444	15,507
	0.8%	0.3%	0.6%	(D)	(D)	0.1%	(D)	0.6%	0.1%	0.8%	0.4%	11.8%	0.5%
Mining, quarrying, and oil and gas extraction	59	220	1,082	(D)	(D)	6,348	592	575	3,241	1,540	1,690	121	17,968
	0.2%	0.3%	5.3%	(D)	(D)	0.3%	0.9%	1.4%	0.7%	1.9%	1.9%	0.2%	0.6%
Utilities	(D)	107	66	72	(D)	8,193	311	57	2,115	294	131	179	12,518
	(D)	0.1%	0.3%	0.6%	(D)	0.4%	0.5%	0.1%	0.4%	0.4%	0.2%	0.2%	0.4%
Construction	1,046	3,144	1,228	(D)	181	109,587	4,051	1,845	22,088	3,380	5,708	3,556	159,505
	3.6%	4.1%	6.0%	(D)	2.5%	5.1%	6.3%	4.6%	4.6%	4.2%	6.6%	4.5%	5.0%
Manufacturing	605	4,084	1,074	265	162	112,507	3,144	735	25,858	3,535	3,422	1,961	158,823
	2.1%	5.3%	5.2%	2.4%	2.3%	5.3%	4.9%	1.8%	5.4%	4.4%	3.9%	2.5%	5.0%
Wholesale trade	(D)	973	249	141	87	87,971	1,076	543	9,731	1,338	2,394	1,437	108,772
	(D)	1.3%	1.2%	1.3%	1.2%	4.1%	1.7%	1.4%	2.0%	1.7%	2.7%	1.8%	3.4%
Retail trade	1,709	8,514	2,349	1,538	1,239	236,685	9,859	4,357	48,909	9,071	11,185	8,411	353,032
	5.9%	11.2%	11.4%	13.8%	17.4%	11.1%	15.4%	11.0%	10.3%	11.2%	12.8%	10.5%	11.1%

Employment	Apache County	Coconino County	Gila County	Graham County	La Paz County	Maricopa County	Mohave County	Navajo County	Pima County	Pinal County	Yavapai Couty	Yuma County	Arizona
Transportation and warehousing	385	1,971	423	158	(D)	64,320	1,774	1,081	9,157	1,887	1,698	1,794	87,237
	1.3%	2.6%	2.1%	1.4%	(D)	3.0%	2.8%	2.7%	1.9%	2.3%	1.9%	2.2%	2.7%
Information	120	595	218	124	29	34,552	1,036	1,249	5,866	785	1,080	662	47,208
	0.4%	0.8%	1.1%	1.1%	0.4%	1.6%	1.6%	3.1%	1.2%	1.0%	1.2%	0.8%	1.5%
Finance and insurance	(D)	1,622	493	266	120	156,658	2,043	867	22,093	2,941	3,390	1,685	194,156
	(D)	2.1%	2.4%	2.4%	1.7%	7.4%	3.2%	2.2%	4.6%	3.6%	3.9%	2.1%	6.1%
Real estate rental and leasing	595	3,236	1,081	330	297	140,169	4,206	1,592	25,055	4,431	6,785	2,555	193,014
	2.0%	4.2%	5.3%	3.0%	4.2%	6.6%	6.6%	4.0%	5.3%	5.5%	7.8%	3.2%	6.1%
Professional, scientific, and technical services	352	3,020	(D)	912	122	147,900	2,301	1,012	32,335	3,575	4,758	2,515	205,097
	1.2%	4.0%	(D)	8.2%	1.7%	6.9%	3.6%	2.5%	6.8%	4.4%	5.5%	3.1%	6.4%
Management of companies and enterprises	38	129	(D)	(D)	32	25,180	(D)	248	3,173	93	138	100	29,569
	0.1%	0.2%	(D)	(D)	0.4%	1.2%	(D)	0.6%	0.7%	0.1%	0.2%	0.1%	0.9%
Administrative, support, and waste management	375	2,138	882	(D)	322	188,443	3,888	1,059	33,965	6,454	3,850	5,498	250,885
	1.3%	2.8%	4.3%	(D)	4.5%	8.9%	6.1%	2.7%	7.1%	8.0%	4.4%	6.9%	7.9%
Educational services	632	951	164	(D)	(D)	51,118	742	979	7,510	1,143	2,536	575	67,392
	2.2%	1.2%	0.8%	(D)	(D)	2.4%	1.2%	2.5%	1.6%	1.4%	2.9%	0.7%	2.1%
Health care and social assistance	2,357	8,752	2,181	1,360	(D)	221,074	8,456	3,564	62,367	6,034	10,131	7,725	340,074
	8.1%	11.5%	10.6%	12.2%	(D)	10.4%	13.2%	9.0%	13.1%	7.4%	11.6%	9.7%	10.7%
Arts, entertainment, and recreation	220	2,687	359	(D)	(D)	45,043	1,013	634	10,802	1,598	2,841	570	66,935
	0.8%	3.5%	1.7%	(D)	(D)	2.1%	1.6%	1.6%	2.3%	2.0%	3.3%	0.7%	2.1%
Accommodation and food services	1,239	11,031	1,487	(D)	(D)	153,423	5,820	3,285	35,864	4,434	6,752	5,531	235,695
	4.3%	14.5%	7.2%	(D)	(D)	7.2%	9.1%	8.3%	7.5%	5.5%	7.7%	6.9%	7.4%
Other services	713	3,254	957	646	326	104,806	4,303	1,848	25,669	4,963	5,835	3,494	160,513
	2.4%	4.3%	4.7%	5.8%	4.6%	4.9%	6.7%	4.6%	5.4%	6.1%	6.7%	4.4%	5.0%
Government and government enterprises	12,581	17,668	5,172	2,763	2,334	226,054	8,661	10,312	89,550	20,770	11,557	18,931	449,054
	43.2%	23.1%	25.2%	24.7%	32.8%	10.6%	13.5%	25.9%	18.8%	25.6%	13.3%	23.7%	14.1%

Source: BEA 2024a

D = not shown to avoid disclosure of confidential information; estimates are included in higher-level totals.

Table TA 16-2
Arizona Employment by Industry (2022)

Employment	Apache County	Coconino County	Gila County	Graham County	La Paz County	Maricopa County	Mohave County	Navajo County	Pima County	Pinal County	Yavapai County	Yuma County	Arizona
Total employment	26,932	88,910	21,663	14,234	8,161	3,038,704	81,675	43,690	557,893	116,876	112,493	95,822	4,287,595
Wage and salary employment	17,385	67,640	15,362	10,741	6,402	2,307,069	57,889	29,232	415,635	71,285	71,986	76,858	3,206,670
Proprietors' employment	9,547	21,270	6,301	3,493	1,759	731,635	23,786	14,458	142,258	45,591	40,507	18,964	1,080,925
Farm employment (number and percentage of total employment)	5,164	2,088	179	405	434	5,775	479	3,819	1,042	2,051	1,190	3,110	27,735
	19.2%	2.3%	0.8%	2.8%	5.3%	0.2%	0.6%	8.7%	0.2%	1.8%	1.1%	3.2%	0.6%
Non-farm employment (number and percentage of total employment)	21,768	86,822	21,484	13,829	7,727	3,032,929	81,196	39,871	556,851	114,825	111,303	92,712	4,259,860
	80.8%	97.7%	99.2%	97.2%	94.7%	99.8%	99.4%	91.3%	99.8%	98.2%	98.9%	96.8%	99.4%
Employment by Industry (Number and Percentage of Total Employment)													
Forestry, fishing, and related	(D)	254	125	(D)	(D)	2,678	(D)	(D)	494	569	369	(D)	14,280
	(D)	0.3%	0.6%	(D)	(D)	0.1%	(D)	(D)	0.1%	0.5%	0.3%	(D)	0.3%
Mining, quarrying, and oil and gas extraction	(D)	178	1,029	(D)	88	5,733	469	(D)	3,762	1,313	1,711	(D)	20,295
	(D)	0.2%	4.8%	(D)	1.1%	0.2%	0.6%	(D)	0.7%	1.1%	1.5%	(D)	0.5%
Utilities	(D)	196	70	(D)	11	8,357	418	119	2,064	365	220	157	12,818
	(D)	0.2%	0.3%	(D)	0.1%	0.3%	0.5%	0.3%	0.4%	0.3%	0.2%	0.2%	0.3%
Construction	1,278	4,086	1,374	699	219	197,947	6,958	2,718	29,426	6,691	9,184	5,253	270,022
	4.7%	4.6%	6.3%	4.9%	2.7%	6.5%	8.5%	6.2%	5.3%	5.7%	8.2%	5.5%	6.3%
Manufacturing	249	3,852	1,303	265	293	148,956	3,561	533	30,132	5,641	4,725	3,483	204,725
	0.9%	4.3%	6.0%	1.9%	3.6%	4.9%	4.4%	1.2%	5.4%	4.8%	4.2%	3.6%	4.8%
Wholesale trade	403	1,412	190	(D)	131	102,023	1,827	573	9,631	2,265	2,460	2,108	126,540
	1.5%	1.6%	0.9%	(D)	1.6%	3.4%	2.2%	1.3%	1.7%	1.9%	2.2%	2.2%	3.0%
Retail trade	1,244	8,866	2,398	1,984	1,739	289,783	12,436	4,775	52,938	14,351	13,759	10,107	422,975
	4.6%	10.0%	11.1%	13.9%	21.3%	9.5%	15.2%	10.9%	9.5%	12.3%	12.2%	10.5%	9.9%
Transportation and warehousing	(D)	2,709	486	(D)	179	181,284	3,254	1,592	31,151	7,177	3,292	3,558	240,127
	(D)	3.0%	2.2%	(D)	2.2%	6.0%	4.0%	3.6%	5.6%	6.1%	2.9%	3.7%	5.6%

Employment	Apache County	Coconino County	Gila County	Graham County	La Paz County	Maricopa County	Mohave County	Navajo County	Pima County	Pinal County	Yavapai County	Yuma County	Arizona
Information	114	791	184	76	98	52,979	769	364	7,813	1,138	1,077	531	66,692
	0.4%	0.9%	0.8%	0.5%	1.2%	1.7%	0.9%	0.8%	1.4%	1.0%	1.0%	0.6%	1.6%
Finance and insurance	(D)	2,295	727	513	181	256,443	3,078	1,167	28,136	5,261	5,394	4,265	309,879
	(D)	2.6%	3.4%	3.6%	2.2%	8.4%	3.8%	2.7%	5.0%	4.5%	4.8%	4.5%	7.2%
Real estate rental and leasing	745	4,777	1,271	(D)	346	200,999	5,693	2,007	32,866	7,083	9,524	3,721	272,829
	2.8%	5.4%	5.9%	(D)	4.2%	6.6%	7.0%	4.6%	5.9%	6.1%	8.5%	3.9%	6.4%
Professional, scientific, and technical services	(D)	4,012	892	405	(D)	222,987	3,643	1,350	35,199	5,573	6,610	3,652	289,301
	(D)	4.5%	4.1%	2.8%	(D)	7.3%	4.5%	3.1%	6.3%	4.8%	5.9%	3.8%	6.7%
Management of companies and enterprises	(D)	597	63	(D)	(D)	47,528	295	196	2,996	557	477	408	53,464
	(D)	0.7%	0.3%	(D)	(D)	1.6%	0.4%	0.4%	0.5%	0.5%	0.4%	0.4%	1.2%
Administrative, support, and waste management	477	2,948	733	(D)	194	250,356	4,424	1,518	37,995	8,178	5,989	6,384	322,974
	1.8%	3.3%	3.4%	(D)	2.4%	8.2%	5.4%	3.5%	6.8%	7.0%	5.3%	6.7%	7.5%
Educational services	445	1,280	187	(D)	(D)	70,915	887	824	10,175	2,422	2,950	744	92,109
	1.7%	1.4%	0.9%	(D)	(D)	2.3%	1.1%	1.9%	1.8%	2.1%	2.6%	0.8%	2.1%
Health care and social assistance	2,791	9,792	1,731	1,469	(D)	342,031	9,709	4,640	69,969	7,418	10,981	9,589	476,659
	10.4%	11.0%	8.0%	10.3%	(D)	11.3%	11.9%	10.6%	12.5%	6.3%	9.8%	10.0%	11.1%
Arts, entertainment, and recreation	275	3,260	364	135	(D)	60,822	(D)	629	11,851	2,891	2,774	692	85,991
	1.0%	3.7%	1.7%	0.9%	(D)	2.0%	(D)	1.4%	2.1%	2.5%	2.5%	0.7%	2.0%
Accommodation and food services	1,063	14,645	1,988	1,049	(D)	212,406	8,557	4,067	41,557	7,739	10,622	7,560	317,706
	3.9%	16.5%	9.2%	7.4%	(D)	7.0%	10.5%	9.3%	7.4%	6.6%	9.4%	7.9%	7.4%
Other services	652	3,774	1,011	845	(D)	145,117	5,424	2,061	31,225	7,789	7,869	4,636	214,742
	2.4%	4.2%	4.7%	5.9%	(D)	4.8%	6.6%	4.7%	5.6%	6.7%	7.0%	4.8%	5.0%
Government and government enterprises	10,090	17,098	5,358	3,057	2,017	233,585	8,539	9,828	87,471	20,404	11,316	18,370	445,732
	37.5%	19.2%	24.7%	21.5%	24.7%	7.7%	10.5%	22.5%	15.7%	17.5%	10.1%	19.2%	10.4%

Source: BEA 2024a

D = not shown to avoid disclosure of confidential information; estimates are included in higher-level totals.

Employment in the analysis area counties represents approximately 98.1 percent of the total employment in Arizona. Farm employment in the 12 counties totaled about 26,000 jobs in 2022 and represented about 0.6 percent of the total employment in the analysis area counties. Farm employment made up a larger percentage of the total employment in Apache and Navajo Counties than the rest of the counties in the analysis area, with 19.2 percent and 8.7 percent of the total employment, respectively (BEA 2024a). In 2022, employment in the arts, entertainment, and recreation sector totaled approximately 84,000 jobs (or 2.0 percent of the total employment in the analysis area), which was an increase from 2010 jobs by about 27 percent.

Total personal income in Arizona was almost $430.1 billion in 2022, compared with $293.8 billion in 2010 (adjusted to 2022$). Likewise, per capita income increased from approximately $46,000 in 2010 (adjusted to 2022$) to approximately $58,000 in 2022; this is a 27.3 percent increase (see **Table TA 16-3**; BEA 2024b). Arizona farm earnings per farm worker, in 2022, were about $35,000 ($965.1 billion in farm earnings divided by 27,735 farm jobs), which was an increase of about $3,000 from 2010 earnings (adjusted to 2022$; BEA 2024a, 2024b).

The total personal income generated in the 12 counties represented 97.9 percent of the state total in 2022. Among the 12 counties, average per capita income ranged from a low of approximately $42,000 per year in Graham County and Navajo County to a high of $63,000 per year in Maricopa County. Only Maricopa and Coconino Counties had per capita income above the state of Arizona (about $58,000). Farm earnings per farm worker (including proprietor's income), in 2022, in the analysis area, ranged from an accounting loss of about $3,000 in Apache County to earnings per worker of about $112,000 in Yuma County (BEA 2024a, 2024b).

Table TA 16-3
2010 and 2022 Arizona Personal Income and Earnings (2022$)

Geographic Area	Year	Personal income ($1,000s)	Per capita personal income ($)	Earnings by place of work ($1,000s)	Wages and salaries ($1,000s)	Supplements to wages and salaries ($1,000s)	Proprietors' income ($1,000s)	Farm earnings ($1,000s)	Nonfarm earnings ($1,000s)
Apache County	2010	2,609,269	36,405	1,414,013	1,022,775	341,461	49,777	-16,648	1,430,661
	2022	2,985,841	45,633	1,258,823	933,078	291,883	33,862	-17,685	1,276,508
Coconino County	2010	6,320,272	46,927	4,242,788	3,002,872	858,815	381,102	7,835	4,234,954
	2022	8,489,905	58,933	5,104,144	3,429,711	831,405	843,028	18,221	5,085,923
Gila County	2010	2,292,299	42,815	1,031,683	733,922	202,274	95,487	-1,627	1,033,310
	2022	2,723,317	50,505	1,151,619	834,614	199,452	117,553	4,440	1,147,179
Graham County	2010	1,220,682	32,868	579,806	415,149	119,880	44,776	21,457	558,349
	2022	1,614,728	41,593	788,260	564,091	144,457	79,712	20,956	767,304
La Paz County	2010	730,733	35,875	350,640	233,038	68,798	48,804	7,817	342,823
	2022	891,281	53,997	438,520	303,349	73,280	61,891	2,279	436,241
Maricopa County	2010	188,035,877	49,196	138,424,028	106,164,387	23,093,967	9,165,674	268,309	138,155,719
	2022	288,842,282	63,461	214,404,981	161,524,726	29,587,729	23,292,526	309,573	214,095,408
Mohave County	2010	7,038,922	35,149	3,104,621	2,145,945	557,828	400,848	4,747	3,099,875
	2022	9,858,399	44,645	4,264,281	2,855,094	609,712	799,475	29,302	4,234,979
Navajo County	2010	3,602,578	33,492	1,871,351	1,341,136	393,864	136,351	9,635	1,861,715
	2022	4,573,766	42,096	2,083,700	1,444,111	385,028	254,561	4,493	2,079,207
Pima County	2010	45,472,764	46,340	29,279,856	20,803,977	5,403,156	3,072,723	53,300	29,226,556
	2022	57,601,036	54,464	33,730,853	24,181,286	5,425,568	4,123,999	38,815	33,692,038
Pinal County	2010	12,272,501	32,462	4,258,204	2,939,244	822,156	496,804	85,827	4,172,376
	2022	21,327,852	45,950	5,769,883	3,853,398	898,204	1,018,281	143,314	5,626,569
Yavapai County	2010	8,281,422	39,265	3,767,437	2,601,263.42	671,921.70	494,252.20	3,424.65	3,764,012.67
	2022	12,784,510	51,921	5,426,215	3,607,595	776,457	1,042,163	22,356	5,403,859
Yuma County	2010	7,434,183	37,768	4,869,064	3,199,051	929,114	740,899	422,731	4,446,333
	2022	9,313,549	44,811	6,007,178	4,013,230	1,047,861	946,087	347,302	5,659,876
Arizona	2010	293,846,986	45,899	198,706,221	148,343,547	34,563,721	15,798,954	912,061	197,794,160
	2022	430,083,534	58,442	285,840,783	211,131,613	41,274,140	33,435,030	965,062	284,875,721

Source: BEA 2024b

Table TA 16-4, Arizona Employment by Industry (2010), displays the annual unemployment rate and the population below poverty. Unemployment rate is a key economic indicator, which can indicate the financial health of an economy; a low rate generally indicates a functioning economy, while a high rate is a concern for the general economy and likely indicates that some individuals in the labor force are in economic distress due to the lack of work and associated income. In Arizona, eight of the study area counties, in 2023, had annual unemployment rates higher than the state unemployment rate of 3.9 percent. Unemployment was notably high in Yuma County, with an unemployment rate of 13.2 percent, over 3 times greater than the state of Arizona.

Across the Arizona analysis area, 9 out of the 12 counties had a higher percentage of people living below the poverty level than the state (12.8 percent), with the largest percentage of people below poverty in Apache County (31.2 percent) and Navajo County (24.7 percent). This suggests that economic considerations are important factors for many individuals throughout the analysis area, and management actions that impact economic opportunities and economic conditions could more greatly affect the surrounding communities.

Table TA 16-4
Arizona Analysis Area Unemployment and Poverty (2023)

Geographic Area	Unemployment	% Below Poverty
Apache County	7.9	31.2%
Coconino County	4.2	17.7%
Gila County	4.3	17.8%
Graham County	3.7	17.7%
La Paz County	4.8	18.4%
Maricopa County	3.4	11.3%
Mohave County	4.5	16.8%
Navajo County	5.7	24.7%
Pima County	3.8	14.4%
Pinal County	4.1	10.9%
Yavapai County	3.6	12.6%
Yuma County	13.2	16.5%
Arizona	3.9	12.8%

Source: U.S. Bureau of Labor Statistics 2023; U.S. Census Bureau 2023a

Agriculture

Agriculture is an important part of the economy in Arizona. Approximately 35 percent of Arizona's land area in 2022 was used for agricultural purposes (on cropland, pastureland, woodland, or other; USDA 2024). In 2022, the market value of agricultural products sold in Arizona contributed $5.2 billion to Arizona's economy. Additional contributions to the economy from agriculture come from the manufacture of crop inputs, crop processing, marketing, and distribution, and agriculture income (Lahmers and Edan 2018). The key crops produced and sold in Arizona include corn, wheat, vegetables and melons (USDA 2024). The types of crops, amount of water used for agriculture, and the role of agriculture in county economics vary across the state and analysis area. Additional

information on irrigated agricultural acreage within the analysis area is provided in **TA 17**, Population and Land Use.

Central and southwestern Arizona farms contribute the largest share of agricultural production in terms of sales values. In 2022, the total market value of agricultural products sold in the Arizona analysis area contributed $4.8 billion to Arizona's economy, which was about 91 percent of the market value of agricultural products sold in the state and about 1 percent of the Arizona total gross domestic product (GDP). The market value of crops sold in the analysis area (excluding values for La Paz and Yuma Counties to avoid disclosure of confidential information) was about $1.3 billion. Across Maricopa, Pima, and Pinal counties, the market value of crops sold, in 2022, ranged from about $87.1 million in Pima County to about $742.6 million in Maricopa County (USDA 2024). **Table TA 16-5** presents a summary of the market value of on-farm agricultural production with respect to county and state GDP.

Table TA 16-5
Market Value of Agricultural Production in Arizona Analysis Area (2022)

Area	Market Value of Crops Sold ($1,000)	Percent of Market Value of Crops Sold to County GDP	Percent of Market Value of Crops Sold to Arizona GDP	Market Value of Agriculture Products Sold ($1,000)
Maricopa County	742,596	0.21%	0.16%	1,558,021
Pima County	87,130	0.16%	0.02%	97,973
Pinal County	365,172	3.06%	0.08%	1,169,581
Total within CAP Counties	1,194,898	0.29%	0.25%	2,825,575
Apache County	3,411	0.12%	0.00%	16,985
Coconino County	1,437	0.02%	0.00%	22,593
Gila County	412	0.02%	0.00%	9,351
La Paz County	(D)	(D)	(D)	270,641
Mohave County	48,846	0.63%	0.01%	56,558
Navajo County	4,898	0.14%	0.00%	47,996
Yuma County	(D)	(D)	(D)	1,507,066
Total Arizona analysis area[1]	1,253,902	0.28%	0.26%	4,756,765

Source: BEA 2024c, USDA 2024

Note: CAP values are aggregated values of Maricopa, Pima, and Pinal Counties.

[1] The totals for the Arizona analysis area did not include data for La Paz and Yuma Counties due to the U.S. Department of Agriculture determining that the data was too sensitive to disclose.

In 2022, the CAP counties-Maricopa, Pima, and Pinal Counties- accounted for approximately 55 percent of Arizona's harvested acres of hay and haylage crops, 65 percent of the state's harvested acreage of cotton, and 44 percent of harvested wheat acreage. The three western Arizona counties that are located along the Colorado River—Mohave, La Paz, and Yuma Counties—accounted for approximately 33 percent of the statewide harvested hay and haylage acreage, 78 percent of the harvested acres of vegetable crops, and 53 percent of the harvested wheat acres in 2022. Yuma County alone accounted for 77 percent of the state's total harvested acres of vegetable crops (USDA 2024).

California

Employment and Personal Income

Table TA 16-6 and **Table TA 16-7**, below provide an overview for employment by sector for the counties in the analysis area in California in 2010 and 2022, respectively. [2] Full- and part-time employment in California totaled 25.3 million jobs in 2022, an increase of approximately 5.7 million jobs from 2010 levels.

Full- and part-time employment in the six-county analysis area totaled 13.9 million jobs in 2022, representing 55 percent of total California employment. Farm employment in the six counties totaled about 31,000 jobs in 2022 and represented about 0.2 percent of the total employment in the analysis area counties. Farm employment made up a larger percentage of the total employment in Imperial County than the rest of the counties in the analysis area, with 4.7 percent of the total employment coming from the farm sector in Imperial County (BEA 2024a). In 2022, employment in the arts, entertainment, and recreation sector totaled approximately 395,000 jobs (or 2.8 percent of the total employment in the analysis area), which was an increase from 2010 jobs by about 19 percent.

Total personal income in California was approximately $3.0 trillion in 2022, compared with about $2.2 trillion in 2010 (adjusted for inflation to 2022$). Statewide per capita income also increased from approximately $59,000 in 2010 (adjusted to 2022$) to approximately $77,000 in 2022 (BEA 2024b; see **Table TA 16-8**). California farm earnings per farm worker, in 2022, were about $70,000 ($16.0 trillion in farm earnings divided by about 228,000 farm jobs), which was a decrease of about $7,000 from 2010 earnings (adjusted to 2022$; BEA 2024a, 2024b).

The total personal income generated in the six analysis area counties represented 48.9 percent of the state total in 2022. Among the six counties, average per capita income ranged from a low of approximately $45,000 per year in Imperial County to a high of $84,000 per year in Orange County. Only Orange County had per capita income above the state of California (about $77,000 in 2022). Farm earnings per farm worker, in 2022, in the analysis area, ranged from about $42,000 in San Diego County to about $147,000 in Imperial County (BEA 2024a, 2024b).

[2] The analysis does not distinguish between the water source(s) that may support such employment, which may include sources other than, or blended with, mainstream Colorado River water.

Table TA 16-6
California Employment by Industry (2010)

Employment	Imperial County	Los Angeles County	Orange County	Riverside County	San Bernardino County	San Diego County	California
Total employment	72,569	5,361,888	1,882,771	806,985	831,765	1,804,100	19,642,544
Wage and salary employment	59,701	4,023,825	1,435,527	582,005	639,579	1,405,940	14,946,351
Proprietors' employment	12,868	1,338,063	447,244	224,980	192,186	398,160	4,696,193
Farm employment (number	3,705	5,410	2,423	7,491	2,755	12,151	232,546
and percentage of total employment)	5.1%	0.1%	0.1%	0.9%	0.3%	0.7%	1.2%
Non-farm employment	68,864	5,356,478	1,880,348	799,494	829,010	1,791,949	19,409,998
(number and percentage of total employment)	94.9%	99.9%	99.9%	99.1%	99.7%	99.3%	98.8%
Employment by Industry (Number and Percentage of Total Employment)							
Forestry, fishing,	(D)	2,807	1,497	7,556	1,005	2,801	212,035
and related	(D)	0.1%	0.1%	0.9%	0.1%	0.2%	1.1%
Mining, quarrying, and oil	(D)	13,967	5,426	1,967	1,350	4,016	60,312
and gas extraction	(D)	0.3%	0.3%	0.2%	0.2%	0.2%	0.3%
Utilities	485	12,288	4,224	1,811	4,308	7,556	59,332
	0.7%	0.2%	0.2%	0.2%	0.5%	0.4%	0.3%
Construction	1,853	179,611	93,087	55,658	41,158	81,056	865,756
	2.6%	3.3%	4.9%	6.9%	4.9%	4.5%	4.4%
Manufacturing	2,899	399,993	160,589	41,833	50,826	100,816	1,322,647
	4.0%	7.5%	8.5%	5.2%	6.1%	5.6%	6.7%
Wholesale trade	2,187	248,880	95,232	24,772	35,659	50,542	724,352
	3.0%	4.6%	5.1%	3.1%	4.3%	2.8%	3.7%
Retail trade	8,504	486,294	176,906	99,926	96,247	163,881	1,880,137
	11.7%	9.1%	9.4%	12.4%	11.6%	9.1%	9.6%
Transportation	2,478	189,424	31,791	26,524	55,234	29,650	567,941
and warehousing	3.4%	3.5%	1.7%	3.3%	6.6%	1.6%	2.9%
Information	448	232,777	31,550	12,969	7,892	31,710	508,677
	0.6%	4.3%	1.7%	1.6%	0.9%	1.8%	2.6%

Employment	Imperial County	Los Angeles County	Orange County	Riverside County	San Bernardino County	San Diego County	California
Finance and insurance	1,504	258,386	128,200	31,148	30,991	83,127	953,934
	2.1%	4.8%	6.8%	3.9%	3.7%	4.6%	4.9%
Real estate rental and leasing	1,748	299,202	131,862	45,325	33,414	100,269	1,033,813
	2.4%	5.6%	7.0%	5.6%	4.0%	5.6%	5.3%
Professional, scientific, and technical services	1,659	436,666	182,266	40,460	37,815	188,902	1,703,247
	2.3%	8.1%	9.7%	5.0%	4.5%	10.5%	8.7%
Management of companies and enterprises	257	58,381	25,158	3,384	6,176	18,993	207,094
	0.4%	1.1%	1.3%	0.4%	0.7%	1.1%	1.1%
Administrative, support, and waste management	3,201	353,393	156,216	59,039	69,840	110,621	1,248,610
	4.4%	6.6%	8.3%	7.3%	8.4%	6.1%	6.4%
Educational services	257	144,272	37,274	10,599	13,530	40,478	439,531
	0.4%	2.7%	2.0%	1.3%	1.6%	2.2%	2.2%
Health care and social assistance	8,420	531,002	162,038	71,692	86,653	150,232	1,868,599
	11.6%	9.9%	8.6%	8.9%	10.4%	8.3%	9.5%
Arts, entertainment, and recreation	354	198,153	55,081	18,853	12,728	45,621	538,952
	0.5%	3.7%	2.9%	2.3%	1.5%	2.5%	2.7%
Accommodation and food services	3,554	349,498	143,507	64,109	53,619	139,829	1,369,985
	4.9%	6.5%	7.6%	7.9%	6.4%	7.8%	7.0%
Other services	3,832	360,755	102,584	55,348	52,257	103,313	1,166,383
	5.3%	6.7%	5.4%	6.9%	6.3%	5.7%	5.9%
Government and government enterprises	18,455	600,729	155,860	126,521	138,308	338,536	2,678,661
	25.4%	11.2%	8.3%	15.7%	16.6%	18.8%	13.6%

Source: BEA 2024a

D = not shown to avoid disclosure of confidential information; estimates are included in higher-level totals.

Table TA 16-7
California Employment by Industry (2022)

Employment	Imperial County	Los Angeles County	Orange County	Riverside County	San Bernardino County	San Diego County	California
Total employment	84,886	6,805,191	2,386,649	1,199,971	1,193,681	2,270,595	25,300,974
Wage and salary employment	69,201	4,843,059	1,758,050	859,500	903,758	1,713,934	18,814,316
Proprietors' employment	15,685	1,962,132	628,599	340,471	289,923	556,661	6,486,658
Farm employment (number	3,967	4,197	1,271	7,156	2,466	11,749	228,186
and percentage of total employment)	4.7%	0.1%	0.1%	0.6%	0.2%	0.5%	0.9%
Non-farm employment	80,919	6,800,994	2,385,378	1,192,815	1,191,215	2,258,846	25,072,788
(number and percentage of total employment)	95.3%	99.9%	99.9%	99.4%	99.8%	99.5%	99.1%
Employment by Industry (Number and Percentage of Total Employment)							
Forestry, fishing,	6,356	2,862	1,115	6,845	1,201	2,763	259,767
and related	7.5%	0.0%	0.0%	0.6%	0.1%	0.1%	1.0%
Mining, quarrying, and oil	421	6,494	2,850	1,674	1,603	2,088	36,926
and gas extraction	0.5%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Utilities	522	13,497	3,504	1,910	4,112	5,984	67,516
	0.6%	0.2%	0.1%	0.2%	0.3%	0.3%	0.3%
Construction	2,583	247,498	134,674	100,111	61,113	115,692	1,259,662
	3.0%	3.6%	5.6%	8.3%	5.1%	5.1%	5.0%
Manufacturing	2,572	347,301	161,360	50,990	60,001	125,914	1,419,413
	3.0%	5.1%	6.8%	4.2%	5.0%	5.5%	5.6%
Wholesale trade	2,385	253,705	94,090	34,573	49,500	59,274	773,657
	2.8%	3.7%	3.9%	2.9%	4.1%	2.6%	3.1%
Retail trade	9,800	538,484	191,282	124,022	116,117	180,091	2,090,805
	11.5%	7.9%	8.0%	10.3%	9.7%	7.9%	8.3%
Transportation	3,939	412,112	78,540	118,550	177,757	92,798	1,474,413
and warehousing	4.6%	6.1%	3.3%	9.9%	14.9%	4.1%	5.8%
Information	322	297,427	34,274	9,851	8,061	31,637	727,797
	0.4%	4.4%	1.4%	0.8%	0.7%	1.4%	2.9%

Employment	Imperial County	Los Angeles County	Orange County	Riverside County	San Bernardino County	San Diego County	California
Finance and insurance	2,053	354,030	179,340	49,195	43,147	116,913	1,318,004
	2.4%	5.2%	7.5%	4.1%	3.6%	5.1%	5.2%
Real estate rental and leasing	2,264	458,500	180,924	61,940	48,684	133,935	1,454,721
	2.7%	6.7%	7.6%	5.2%	4.1%	5.9%	5.7%
Professional, scientific, and technical services	2,184	560,569	232,574	56,146	50,533	247,892	2,231,632
	2.6%	8.2%	9.7%	4.7%	4.2%	10.9%	8.8%
Management of companies and enterprises	187	79,182	45,272	4,747	5,669	28,457	284,267
	0.2%	1.2%	1.9%	0.4%	0.5%	1.3%	1.1%
Administrative, support, and waste management	3,625	425,270	202,696	86,326	94,572	143,628	1,581,853
	4.3%	6.2%	8.5%	7.2%	7.9%	6.3%	6.3%
Educational services	477	174,096	56,410	15,397	16,960	48,273	554,586
	0.6%	2.6%	2.4%	1.3%	1.4%	2.1%	2.2%
Health care and social assistance	11,607	890,342	243,499	136,687	140,876	231,189	2,942,827
	13.7%	13.1%	10.2%	11.4%	11.8%	10.2%	11.6%
Arts, entertainment, and recreation	381	231,016	72,196	23,911	15,433	51,915	617,031
	0.4%	3.4%	3.0%	2.0%	1.3%	2.3%	2.4%
Accommodation and food services	4,667	462,052	179,676	96,865	79,767	177,272	1,775,446
	5.5%	6.8%	7.5%	8.1%	6.7%	7.8%	7.0%
Other services	4,465	438,487	128,353	77,159	70,526	124,990	1,423,034
	5.3%	6.4%	5.4%	6.4%	5.9%	5.5%	5.6%
Government and government enterprises	20,109	608,070	162,749	135,916	145,583	338,141	2,779,431
	23.7%	8.9%	6.8%	11.3%	12.2%	14.9%	11.0%

Source: BEA 2024a

D = not shown to avoid disclosure of confidential information; estimates are included in higher-level totals.

Table TA 16-8
2010 and 2022 California Personal Income and Earnings (2022$)

Geographic Area	Year	Personal income ($1,000s)	Per capita personal income ($)	Earnings by place of work ($1,000s)	Wages and salaries ($1,000s)	Supplements to wages and salaries ($1,000s)	Proprietors' income ($1,000s)	Farm earnings ($1,000s)	Nonfarm earnings ($1,000s)
Imperial County	2010	6,913,837	39,579	4,965,502	2,896,362	997,334	1,071,806	637,013	4,328,489
	2022	8,075,656	45,188	5,545,837	3,539,261	1,131,471	875,105	582,341	4,963,496
Los Angeles County	2010	571,262,353	58,157	439,310,025	300,244,372	70,443,822	68,621,832	254,816	439,055,210
	2022	720,740,528	74,142	528,971,677	388,176,660	80,851,366	59,943,651	212,840	528,758,837
Orange County	2010	199,435,828	66,110	152,270,377	105,862,790	23,550,515	22,857,071	158,606	152,111,771
	2022	263,290,135	83,553	188,481,620	137,331,567	27,686,976	23,463,077	75,693	188,405,927
Riverside County	2010	92,596,623	42,088	48,434,234	31,451,692	9,018,065	7,964,477	456,367	47,977,867
	2022	127,195,983	51,415	69,321,008	49,411,833	11,980,844	7,928,331	416,727	68,904,281
San Bernardino County	2010	81,631,592	40,003	52,124,985	36,642,144	10,488,171	4,994,669	196,452	51,928,532
	2022	108,081,645	49,270	74,624,680	53,932,299	13,234,262	7,458,119	181,780	74,442,900
San Diego County	2010	185,043,527	59,645	138,585,701	100,107,049	25,985,297	12,493,354	798,029	137,787,672
	2022	243,506,541	74,326	178,214,544	134,153,290	30,704,869	13,356,385	490,452	177,724,092
California	2010	2,187,979,553	58,624	1,611,764,720	1,105,813,512	265,592,922	240,358,285	17,899,555	1,593,865,165
	2022	3,006,647,281	77,036	2,168,542,286	1,607,341,273	323,041,105	238,159,908	16,004,335	2,152,537,951

Source: BEA 2024b

Table TA 16-9, Unemployment and Poverty, displays the annual unemployment rate and the percentage of the population living below poverty. In California, all counties excluding Imperial and Los Angeles Counties had 2023 annual unemployment rates below the state annual unemployment rate of 4.8 percent. Unemployment was notably high in Imperial County, with an unemployment rate of 17.3 percent, over 3 times greater than the state of California.

Across the California analysis area, half of the counties had a higher percentage of people living below the poverty level than the state (12.0 percent)—Imperial, Los Angeles, and San Bernardino Counties. The largest percentage of people below poverty was in Imperial County (19.6 percent). This suggests that economic considerations are important factors, especially in these counties with high percentages of people living below poverty. Management actions that impact economic opportunities and economic conditions could affect the surrounding communities in these counties.

Table TA 16-9
California Analysis Area Unemployment and Poverty (2023)

Geographic Area	Unemployment	% Below Poverty
Imperial County	17.3	19.6%
Los Angeles County	5.0	13.6%
Orange County	3.6	9.5%
Riverside County	4.8	11.1%
San Bernardino County	4.7	13.6%
San Diego County	3.9	10.4%
California	4.8	12.0%

Source: U.S. Bureau of Labor Statistics 2023

Agriculture

Approximately 24 percent of California's land area in 2022 was used for agricultural purposes (on cropland, pastureland, woodland, or other; USDA 2024). In 2022, the market value of agricultural products sold in California contributed approximately $59 billion to the statewide economy (USDA 2024). The types of crops, amount of water used for agriculture, and the role of agriculture in county economics vary across the state and analysis area. Additional information on irrigated agricultural acreage within the analysis area is provided in **TA 17**, Population and Land Use.

In 2022, the total market value of agricultural products sold in the California analysis area contributed $6.1 billion to California's economy. The market value of crops sold in the analysis area was about $4.7 billion, ranging from about $69.5 million in Orange County to about $2.2 billion in Imperial County (USDA 2024). **Table TA 16-10** presents a summary of the market value of on-farm agricultural production with respect to county and state GDP.

The key crops in the California analysis area include hay, vegetables, and wheat. In 2022, the California analysis area counties accounted for approximately 30 percent of California's harvested acres of hay and haylage crops, 16 percent of the state's harvested acreage of vegetables, and 35 percent of harvested wheat acreage (USDA 2024).

Table TA 16-10
Market Value of Agricultural Production in California Analysis Area (2022)

Area	Market Value of Crops Sold ($1,000)	Percent of Market Value of Crops Sold to County GDP	Percent of Market Value of Crops Sold to Arizona GDP	Market Value of Agricultural Products Sold ($1,000)
Imperial County	2,236,942	20.22%	0.06%	3,046,146
Los Angeles County	177,940	0.02%	0.00%	199,849
Orange County	69,533	0.02%	0.00%	70,707
Riverside County	1,113,260	0.96%	0.03%	1,273,498
San Bernardino County	99,258	0.08%	0.00%	457,547
San Diego County	1,004,974	0.34%	0.03%	1,092,921
Total California analysis area	4,701,907	0.27%	0.02%	6,140,668

Source: BEA 2024c; USDA 2024

Nevada

Employment and Personal Income

Table TA 16-11, below, provides an overview for employment by sector for Clark County and the state of Nevada in 2010 and 2022. Full- and part-time employment in Nevada totaled almost 2.1 million jobs in 2022, an increase of approximately 584,000 jobs from 2010 levels. In 2022, employment in the arts, entertainment, and recreation sector totaled almost 62,000 jobs, or approximately 3 percent of the total employment in the state. Farm employment represented only 0.3 percent of the total employment, with a little more than 5,000 jobs.

Full- and part-time employment in Clark County totaled about 1.5 million jobs in 2022, an increase of approximately 466,000 jobs from 2010. Total employment in Clark County represented almost 74 percent of the total employment in Nevada. In 2022, employment in the arts, entertainment, and recreation sector totaled almost 47,000 jobs, or 3.1 percent of the total employment in the county. Farm employment represented less than 0.1 percent of the total employment, with a little more than 400 jobs (See **Table TA 16-11**).

Table TA 16-11
Nevada Employment by Industry (2010 and 2022)

Employment	Clark County		Nevada	
	2010	2022	2010	2022
Total employment	1,057,024	1,523,197	1,478,082	2,061,871
Wage and salary employment	834,301	1,120,039	1,153,906	1,528,778
Proprietors' employment	222,723	403,158	324,176	533,093
Farm employment (number and	384	437	5,354	5,208
percentage of total employment)	0.0%	0.0%	0.4%	0.3%
Non-farm employment (number and	1,056,640	1,522,760	1,472,728	2,056,663
percentage of total employment)	100.0%	100.0%	99.6%	99.7%

Employment	Clark County		Nevada	
	2010	2022	2010	2022
Employment by Industry (Number and Percentage of Total Employment)				
Forestry, fishing, and related	330	491	1,585	2,214
	0.0%	0.0%	0.1%	0.1%
Mining, quarrying, and oil and gas extraction	2,389	1,726	17,016	19,165
	0.2%	0.1%	1.2%	0.9%
Utilities	3,015	2,899	4,544	4,612
	0.3%	0.2%	0.3%	0.2%
Construction	55,382	93,558	75,643	129,422
	5.2%	6.1%	5.1%	6.3%
Manufacturing	21,605	32,929	41,667	71,259
	2.0%	2.2%	2.8%	3.5%
Wholesale trade	24,620	32,949	37,489	48,807
	2.3%	2.2%	2.5%	2.4%
Retail trade	109,280	141,831	152,355	191,956
	10.3%	9.3%	10.3%	9.3%
Transportation and warehousing	36,634	115,664	53,212	153,001
	3.5%	7.6%	3.6%	7.4%
Information	13,000	19,593	17,693	25,517
	1.2%	1.3%	1.2%	1.2%
Finance and insurance	61,578	95,406	83,043	122,182
	5.8%	6.3%	5.6%	5.9%
Real estate rental and leasing	66,955	95,228	94,363	130,455
	6.3%	6.3%	6.4%	6.3%
Professional, scientific, and technical services	56,485	88,272	81,695	121,060
	5.3%	5.8%	5.5%	5.9%
Management of companies and enterprises	16,574	31,130	21,739	37,971
	1.6%	2.0%	1.5%	1.8%
Administrative, support, and waste management	72,349	116,287	95,138	146,587
	6.8%	7.6%	6.4%	7.1%
Educational services	9,889	18,131	13,960	23,945
	0.9%	1.2%	0.9%	1.2%
Health care and social assistance	75,170	127,645	109,647	170,804
	7.1%	8.4%	7.4%	8.3%
Arts, entertainment, and recreation	32,432	46,868	46,698	61,968
	3.1%	3.1%	3.2%	3.0%
Accommodation and food services	242,559	263,173	290,879	314,012
	22.9%	17.3%	19.7%	15.2%
Other services	46,024	75,466	65,246	99,734
	4.4%	5.0%	4.4%	4.8%
Government and government enterprises	110,370	123,514	169,116	181992
	10.4%	8.1%	11.4%	8.8%

Source: BEA 2024a

Total personal income in Nevada was approximately $197.3 billion in 2022, compared with about $136.9 billion in 2010 (adjusted for inflation to 2022$). Statewide per capita income increased from approximately $51,000 in 2010 (adjusted to 2022$) to approximately $62,000 in 2022 (BEA 2024b; see **Table TA 16-12**). Nevada farm earnings per farm worker, in 2022, were about $34,000 ($177.9 billion in farm earnings divided by about 5,208 farm jobs), which was a decrease of about $3,000 from 2010 earnings (adjusted to 2022$; BEA 2024a, 2024b).

The total personal income in Clark County represented 69.6 percent of the state total in 2022. In 2022, the per capita income in Clark County was approximately $59,000, which was slightly lower than the per capita income for the state. Farm earnings were not a major portion of total earnings in Clark County, with less than 0.1 percent of earnings coming from the farm industry (BEA 2024b; see **Table TA 16-12**).

Table TA 16-12
2010 and 2022 Nevada Personal Income and Earnings (2022$)

Income/Earnings	Clark County		Nevada	
	2010	2022	2010	2022
Personal income ($1,000s)	94,708,479	137,403,632	136,919,356	197,290,898
Per capita personal income ($)	48,526	59,150	50,674	62,085
Earnings by place of work ($1,000s)	67,818,266	94,377,994	96,935,404	131,549,693
Wages and salaries ($1,000s)	49,631,728	69,754,265	68,438,673	96,490,818
Supplements to wages and salaries ($1,000s)	12,230,529	14,242,958	17,494,798	20,144,396
Proprietors' income ($1,000s)	5,956,009	10,380,771	11,001,933	14,914,479
Farm earnings ($1,000s)	5,080	491	196,486	177,935
Nonfarm earnings ($1,000s)	67,813,186	94,377,503	96,738,917	131,371,758

Source: BEA 2024b

Table TA 16-13, Nevada Analysis Area Unemployment and Poverty (2023), displays the annual unemployment rate and the percentage of the population below poverty. In the Nevada analysis area, in 2023, Clark County had an annual unemployment rate (5.4 percent) that was slightly higher than the state annual unemployment rate (5.1 percent). Similarly, the percentage of people living below poverty in Clark County (13.2 percent) was slightly higher than the percentage for Nevada (12.6 percent).

Table TA 16-13
Nevada Analysis Area Unemployment and Poverty (2023)

Geographic Area	Unemployment	% Below Poverty
Clark County	5.4	13.2%
Nevada	5.1	12.6%

Source: U.S. Bureau of Labor Statistics 2023; U.S. Census Bureau 2023a

Agriculture

Approximately 8.4 percent of Nevada's land area in 2022 was used for agricultural purposes (on cropland, pastureland, woodland, or other; USDA 2024). In 2022, the market value of agricultural products sold in Nevada contributed nearly $1 billion to the statewide economy. Additional information on irrigated agricultural acreage within the analysis area is provided in **TA 17**, Population and Land Use.

Utah

Employment and Personal Income

Table TA 16-14, below, provides an overview for employment by sector for the Utah analysis area in 2010 and 2022. Full- and part-time employment in Utah totaled almost 2.4 jobs in 2022, an increase of approximately 747,000 jobs from 2010 levels. In 2022, employment in the arts, entertainment, and recreation sector totaled almost 51,000 jobs, or approximately 2.2 percent of the total employment in the state.

Full- and part-time employment in the Utah analysis area totaled about 17,000 jobs in 2022, an increase of approximately 3,000 jobs from 2010. Total employment in the analysis area represented approximately 1.0 percent of the total employment in Utah. In 2022, employment in the arts, entertainment, and recreation sector totaled approximately 400 jobs (or 2.6 percent of the total employment in the analysis area) and represented 6.0 percent of employment in Kane County (See **Table TA 16-14**).

Total personal income in Utah was approximately $205.5 billion in 2022, compared with about $120.9 billion in 2010 (adjusted for inflation to 2022$). Statewide per capita income increased from approximately $44,000 in 2010 (adjusted to 2022$) to approximately $61,000 in 2022 (BEA 2024b; see **Table TA 16-15**).

The total personal income in the analysis area represented 0.6 percent of the state total in 2022. Among the counties in the analysis area, average per capita income ranged from a low of approximately $37,000 per year in San Juan County to a high of $52,000 per year in Garfield County. All counties in the analysis area had per capita income below the state of Utah (about $61,000 in 2022; BEA 2024b; see **Table TA 16-15**).

Table TA 16-14
Utah Employment by Industry (2010 and 2022)

Employment	Garfield County		Kane County		San Juan County		Utah	
	2010	2022	2010	2022	2010	2022	2010	2022
Total employment	3,432	3,907	4,376	6,101	6,310	6,836	1,620,793	2,367,996
Wage and salary employment	2,505	2,733	3,122	4,214	4,566	4,630	1,235,032	1,759,886
Proprietors' employment	927	1,174	1,254	1,887	1,744	2,206	385,761	608,110
Farm employment	293	289	159	169	724	715	20,007	21,081
(number and percentage of total employment)	8.5%	7.4%	3.6%	2.8%	11.5%	10.5%	1.2%	0.9%
Non-farm employment	3,139	3,618	4,217	5,932	5,586	6,121	1,600,786	2,346,915
(number and percentage of total employment)	91.5%	92.6%	96.4%	97.2%	88.5%	89.5%	98.8%	99.1%
Employment by Industry (Number and Percentage of Total Employment)								
Forestry, fishing, and related	(D)	(D)	(D)	(D)	39	88	3,314	4,704
	(D)	(D)	(D)	(D)	0.6%	1.3%	0.2%	0.2%
Mining, quarrying, and oil and gas extraction	(D)	(D)	(D)	(D)	423	331	14,664	13,730
	(D)	(D)	(D)	(D)	6.7%	4.8%	0.9%	0.6%
Utilities	(D)	34	(D)	(D)	(D)	(D)	4,276	5,064
	(D)	0.9%	(D)	(D)	(D)	(D)	0.3%	0.2%
Construction	137	148	214	332	370	345	91,001	166,041
	4.0%	3.8%	4.9%	5.4%	5.9%	5.0%	5.6%	7.0%
Manufacturing	66	64	(D)	(D)	155	112	118,124	160,756
	1.9%	1.6%	(D)	(D)	2.5%	1.6%	7.3%	6.8%
Wholesale trade	48	44	(D)	47	(D)	(D)	49,833	65,904
	1.4%	1.1%	(D)	0.8%	(D)	(D)	3.1%	2.8%
Retail trade	236	300	456	587	404	440	172,249	235,054
	6.9%	7.7%	10.4%	9.6%	6.4%	6.4%	10.6%	9.9%

Employment	Garfield County		Kane County		San Juan County		Utah	
	2010	2022	2010	2022	2010	2022	2010	2022
Transportation and warehousing	(D)	61	76	(D)	80	(D)	50,898	105,686
	(D)	1.6%	1.7%	(D)	1.3%	(D)	3.1%	4.5%
Information	(D)	156	28	47	(D)	(D)	34,346	54,369
	(D)	4.0%	0.6%	0.8%	(D)	(D)	2.1%	2.3%
Finance and insurance	59	74	126	117	114	151	111,560	174,506
	1.7%	1.9%	2.9%	1.9%	1.8%	2.2%	6.9%	7.4%
Real estate rental and leasing	95	177	271	584	(D)	(D)	93,563	154,826
	2.8%	4.5%	6.2%	9.6%	(D)	(D)	5.8%	6.5%
Professional, scientific, and technical services	53	(D)	124	219	(D)	167	107,012	194,639
	1.5%	(D)	2.8%	3.6%	(D)	2.4%	6.6%	8.2%
Management of companies and enterprises	0	35	0	39	(D)	(D)	22,683	36,775
	0.0%	0.9%	0.0%	0.6%	(D)	(D)	1.4%	1.6%
Administrative, support, and waste management	(D)	(D)	114	234	190	(D)	89,810	121,592
	(D)	(D)	2.6%	3.8%	3.0%	(D)	5.5%	5.1%
Educational services	(D)	(D)	(D)	31	(D)	167	48,952	77,750
	(D)	(D)	(D)	0.5%	(D)	2.4%	3.0%	3.3%
Health care and social assistance	(D)	(D)	(D)	201	(D)	919	137,119	193,936
	(D)	(D)	(D)	3.3%	(D)	13.4%	8.5%	8.2%
Arts, entertainment, and recreation	(D)	64	97	369	80	(D)	34,472	51,311
	(D)	1.6%	2.2%	6.0%	1.3%	(D)	2.1%	2.2%
Accommodation and food services	(D)	1,127	876	1,208	622	(D)	99,679	145,448
	(D)	28.8%	20.0%	19.8%	9.9%	(D)	6.2%	6.1%
Other services	117	150	623	727	295	(D)	82,781	111,237
	3.4%	3.8%	14.2%	11.9%	4.7%	(D)	5.1%	4.7%
Government and government enterprises	613	560	740	783	1,691	1,687	234,450	273,587
	17.9%	14.3%	16.9%	12.8%	26.8%	24.7%	14.5%	11.6%

Source: BEA 2024a

Table TA 16-15
2010 and 2022 Utah Personal Income and Earnings (2022$)

Income/Earnings	Garfield County		Kane County		San Juan County		Utah	
	2010	2022	2010	2022	2010	2022	2010	2022
Personal income ($1,000s)	200,913	273,047	292,876	421,930	434,479	526,823	120,869,769	205,519,377
Per capita personal income ($)	38,659	51,930	40,633	51,436	29,322	36,570	43,538	60,782
Earnings by place of work ($1,000s)	132,965	173,287	170,158	268,139	277,096	319,986	90,872,067	148,445,176
Wages and salaries ($1,000s)	96,926	128,996	121,971	186,110	204,063	214,016	67,410,631	108,895,737
Supplements to wages and salaries ($1,000s)	28,391	27,523	33,009	40,507	62,030	59,217	16,534,956	22,614,907
Proprietors' income ($1,000s)	7,648	16,768	15,179	41,522	11,004	46,753	6,926,480	16,934,532
Farm earnings ($1,000s)	-1,634	13,149	540	3,590	-2,808	6,216	295,906	784,034
Nonfarm earnings ($1,000s)	134,599	160,138	169,619	264,549	279,904	313,770	90,576,160	147,661,142

Source: BEA 2024b

Table TA 16-16, Unemployment and Poverty, displays the annual unemployment rate and the percentage of the population below poverty. In the Utah analysis area, in 2023, all of the counties had a higher annual unemployment rate and percentage of population living below poverty than the state of Utah. This suggests that economic considerations are important factors for many individuals throughout the analysis area, and management actions that impact economic opportunities and economic conditions could more greatly affect the surrounding communities.

Table TA 16-16
Utah Analysis Area Unemployment and Poverty (2023)

Geographic Area	Unemployment	% Below Poverty
Garfield County	7.8	11.1%
Kane County	3.2	10.4%
San Juan County	3.8	18.4%
Utah	2.7	8.6%

Source: U.S. Bureau of Labor Statistics 2023; U.S. Census Bureau 2023a

TA 16.1.3 Economic Contributions from Recreational Use

As discussed in **TA 14**, Recreation, recreational activities with the potential to be affected by proposed management include recreation (boating, camping, hiking, etc.) on and adjacent to reservoirs at Lake Powell and Lake Mead, as well as river-based recreation downstream in Glen Canyon and Grand Canyon. Information is also included on wildlife refuges on the Colorado River as these refuges may be affected by the alternatives.

When visitors recreate on lakes or rivers, the dollars that they spend on purchases—such as lodging, gas, food, and outdoor equipment—support local and regional economic contributions, including direct, indirect, and induced jobs, labor income, and economic output.[3] Direct economic contributions occur when businesses sell goods and services to area visitors, such as outfitter services. Indirect economic contributions are additional jobs and economic activity supported when businesses purchase supplies and services from other local businesses, such as supplies used by outfitter businesses. Induced economic contributions occur when employees use their income to purchase goods and services in the local economy, resulting in further induced effects from visitor spending. Economic output is a measure of the total estimated value of the production of goods and services supported by visitor spending, including the direct, indirect, and induced effects.

Table TA 16-17, below, displays the total economic contributions from lake-based recreation occurring in the Glen Canyon National Recreation Area (NRA), and Lake Mead NRA. **Table TA 16-18** displays economic contributions associated with Grand Canyon National Park (GCNP).

[3] Direct, indirect, and induced impacts—as used in this context—are economic terms used to describe the impacts from changes in economic activity. For more information on the types of economic activity that are included in each type of impact, please refer to Section **TA 16.2.1, Methodology**.

Table TA 16-17
Summary of Economic Contributions[1] for National Park Service-Lake-Based Recreation (2023)

NPS Unit	Total Recreational Visits	Visitor Spending (1,000s of 2023$)	Jobs	Labor Income (1,000s of 2023$)	Value Added (1,000s of 2023$)	Economic Output (1,000s of 2023$)	% of Spending from Nonlocals
Glen Canyon NRA[1]	5,206,934	$539,912	6,298	$226,266	$384,281	$670,369	96.3
Lake Mead NRA[2]	5,798,541	$292,463	3,131	$130,744	$219,232	$357,760	88.3

Source: Flyr and Koontz 2024

[1] Jobs measure annualized full- and part-time jobs that are supported by National Park Service (NPS) visitor spending. Labor income includes employee wages, salaries, and payroll benefits, as well as proprietors' incomes that are supported by NPS visitor spending. Value added measures the contribution of NPS visitor spending to the GDP of a regional economy. Value added is equal to the difference between the amount an industry sells a product for and the production cost of the product. Economic output is a measure of the total estimated value of the production of goods and services supported by NPS visitor spending. Economic output is the sum of all intermediate sales (business to business) and final demand (sales to consumers and exports).

[2] Results are based on visitor survey data at the designated park.

[3] Results are based on visitor characteristics and spending averages from generic profiles or best available data.

Table TA 16-18
Summary of Economic Contributions[1] for NPS River-Based Recreation (2023)

NPS Unit	Total Recreational Visits	Visitor Spending (1,000s of 2023$)	Jobs	Labor Income (1,000s of 2023$)	Value Added (1,000s of 2023$)	Economic Output (1,000s of 2023$)	% of Spending from Nonlocals
GCNP[1]	4,733,705	$768,411	10,060	$350,177	$582,513	$1,022,191	98.8

Source: Flyr and Koontz 2024

[1] Jobs measure annualized full- and part-time jobs that are supported by NPS visitor spending. Labor income includes employee wages, salaries, and payroll benefits, as well as proprietors' incomes that are supported by NPS visitor spending. Value added measures the contribution of NPS visitor spending to the GDP of a regional economy. Value added is equal to the difference between the amount an industry sells a product for and the production cost of the product. Economic output is a measure of the total estimated value of the production of goods and services supported by NPS visitor spending. Economic output is the sum of all intermediate sales (business to business) and final demand (sales to consumers and exports).

[2] Results are based on visitor survey data at the designated park.

[3] Results are based on visitor characteristics and spending averages from generic profiles or best available data.

Total economic output for lake-based recreation was $358 million from Lake Mead NRA and $670 million from Glen Canyon NRA. These amounts account for total visitor spending, which includes spending by local visitors who live in gateway regions and nonlocal visitors who travel to NPS sites from outside of gateway regions. Spending by nonlocal visitors represents an influx of dollars from outside of the local economy. In addition, nonlocal visitors typically have higher levels of spending on food, lodging, and other activities on a per-trip basis. The Glen Canyon NRA and Lake Mead NRA had 96.3 percent and 88.3 percent of spending from nonlocal visitors, respectively (Flyr and Koontz 2024).

Total economic output for river-based recreation was $1,022 million in GCNP. This amount accounts for total visitor spending, which includes spending by local visitors who live in gateway regions and nonlocal visitors who travel to NPS sites from outside of gateway regions. Spending by nonlocal visitors represents an influx of dollars from outside the local economy. In addition, nonlocal visitors typically have higher levels of spending on food, lodging, and other activities on a per-trip basis. GCNP had 98.8 percent spending from nonlocal visitors (Flyr and Koontz 2024).

River-based recreation is a major component of visitor use and economic activity along the Colorado River corridor. Two activities stand out for their economic and experiential importance: angling in Glen Canyon and whitewater rafting in Grand Canyon. Angling in Glen Canyon below Glen Canyon Dam attracts visitors seeking high-quality trout fishing opportunities, which depend on stable flows and accessible river conditions. These trips generate spending on guide services, lodging, food, and equipment in nearby communities. Similarly, whitewater rafting in Grand Canyon is a nationally important recreational experience, drawing thousands of visitors annually for multi-day trips that require specialized guides, equipment, and logistical support. These trips contribute to local economies through outfitter services, transportation, and hospitality sectors. For additional details on recreation and levels of use, see **TA 14**, Recreation.

Beyond direct spending, these activities provide considerable nonmarket recreational benefits, often expressed as consumer surplus. Consumer surplus represents the additional benefit participants receive beyond their actual costs, reflecting the unique quality and scarcity of these experiences. Flow conditions influence both angling success and rafting trip quality, making river operations an important factor in sustaining these values.

Recreational visits to Glen Canyon NRA and Lake Mead NRA correspond with a wide array of job sectors within local (predominately small town and rural) economies. **Table TA 16-19** shows the key sectors supported through recreation on Glen Canyon NRA and Lake Mead NRA. In 2023, Glen Canyon NRA recreation supported 6,300 jobs, including 1,467 indirect and induced jobs. Lake Mead NRA recreation supported 3,131 total jobs, including 872 indirect and induced jobs, in 2023 (Flyr and Koontz 2024).

Table TA 16-19
Jobs by Sector Supported by Economic Contributions from NPS Lake-Based Recreation (2023)

Jobs	Glen Canyon NRA	Lake Mead NRA
Direct Jobs by Sector		
Camping	130	122
Gas	108	79
Groceries	145	155
Hotels	2,112	613
Recreation industries	851	261
Restaurants	1,009	792
Retail	257	185
Transportation	221	52
Indirect and Induced Jobs	1,467	872
Total Jobs	6,300	3,131

Source: Flyr and Koontz 2024

Table TA 16-20 shows GCNP recreation supported 10,064 jobs, including 2,316 indirect and induced jobs in 2023. In addition to the direct economic impact from gross revenues on GCNP and the NPS, it is estimated that the regional economic impact of commercial river trips supports hundreds of additional jobs and generates millions in additional revenue throughout the mostly rural communities and small businesses of northern Arizona and southern Utah each season.

Table TA 16-20
Jobs by Sector Supported by Economic Contributions from NPS River-Based Recreation (2023)

Jobs	GCNP
Direct Jobs by Sector	
Camping	156
Gas	99
Groceries	134
Hotels	2,630
Recreation industries	2,032
Restaurants	1,631
Retail	460
Transportation	606
Indirect and Induced Jobs	2,316
Total Jobs	**10,064**

Source: Flyr and Koontz 2024

In addition to general recreation sector contributions, visitor use supports concessionaires, including those associated with water-based recreation, such as commercial river trips. In GCNP, commercial river trips hosted 17,313 passengers in 2023, which was a slight decrease from 19,990 passengers in 2022 and 20,749 passengers in 2021. From these river trips, river concessionaires contributed $63.6

million in 2023 in gross revenue, representing 29 percent of the total concessionaire revenue at GCNP, which amounted to $220 million that year. Gross revenue from river concessions have remained relatively consistent over the past three years, with a small decrease from $66.4 million in 2021 to $61.8 million in 2022, followed by a small increase to $63.6 million in 2023 (2021 and 2022 values adjusted for inflation to 2023$). River concessioner franchise fees paid to the NPS in 2023 totaled $6.25 million, 80 percent of which stays at GCNP.[4] It should be noted that concessionaires include those operated by tribes.

National Wildlife Refuges (NWRs) also support economic contributions through expenditures from recreational visitors such as entrance fees, lodging near the refuges, and purchases from local businesses for items to pursue their recreational experience including but not limited to food and recreational gear. This spending supports economic activity throughout the local economy (Caudill and Carver 2019). Three refuges receive Colorado River water, Imperial NWR and Cibola NWR and Havasu NWR. Based on 2017 data, the most recent publicly available information, Imperial NWR, located in Arizona and California, has a total of 274,159 visits and supported 100 jobs and $11.1 million in total economic output (see **Table TA 16-21**). Equivalent data is not available for Cibola and Havasu NWR.

Table TA 16-21
Economic Contributions from NWRs (2017)[1]

NWR	Total Recreational Visits	Total Economic Output ($1,000)	Total Employment Income ($1,000)	Total Jobs
Imperial NWR (Arizona and California)	274,159	$11,069.8	$3,228.6	100

Source: Caudill and Carver 2019

[1] The data shown is presented for 2017, which is the most recent publicly available data.

TA 16.1.4 Demographics

Population is a driver of demand for consumptive water use. Populations throughout much of western U.S. have followed trends of increasing populations over the past decade. Details of population trends and forecasts are provided in **TA 17**, Population and Land Use**.**

In addition to overall population trends, racial and ethnic composition can play a role in determining social and cultural groups with potential for impacts from changes to river operations. **Table TA 16-22**, Study Area Demographics (2023), shows the racial and Hispanic status composition for the study area counties, as well as the composition of Arizona, California, Nevada, and Utah. Several counties in the study area had American Indian and Alaska Native populations that were higher than the respective state level. In Arizona, Apache (72.1 percent), Coconino (25.2), Gila (13.2 percent), Graham (11.4 percent), La Paz (14.2 percent), and Navajo (43.1 percent) Counties had American Indian and Alaska Native populations far exceeding the state population of 4.1 percent.

[4] Laurie Dyer, NPS supervisory concessions management specialist in the Commercial Services Division at GCNP, personal communication provided on September 27, 2024.

Table TA 16-22
Study Area Demographics (2023)

Geographic Area	Total Population	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some other Race	Two or more races	Hispanic or Latino (of any race)	White alone, not Hispanic or Latino
State Data										
Arizona	7,268,175	63.20%	4.60%	4.10%	3.40%	0.20%	8.20%	16.2%	31.00%	53.40%
California	39,242,785	44.00%	5.50%	1.10%	15.30%	0.40%	17.40%	16.30%	39.80%	34.60%
Nevada	3,141,000	53.20%	9.40%	1.30%	8.70%	0.70%	11.80%	14.80%	29.20%	46.00%
Utah	3,331,187	80.70%	1.10%	1.00%	2.40%	0.90%	5.60%	8.30%	15.40%	75.70%
County Data										
Apache County, Arizona	65,680	20.20%	1.00%	72.10%	0.60%	0.10%	1.30%	4.70%	6.20%	18.60%
Coconino County, Arizona	144,643	57.00%	1.50%	25.20%	1.80%	0.10%	5.40%	8.90%	15.20%	52.50%
Gila County, Arizona	53,610	67.70%	0.60%	13.20%	0.80%	0.10%	4.50%	13.10%	17.80%	62.00%
Graham County, Arizona	38,860	66.20%	1.30%	11.40%	0.60%	0.70%	3.90%	15.80%	30.30%	53.10%
La Paz County, Arizona	16,605	61.30%	0.40%	14.20%	1.10%	0.00%	6.90%	16.00%	25.50%	57.80%
Maricopa County, Arizona	4,491,987	63.00%	5.80%	1.90%	4.40%	0.20%	8.40%	16.40%	30.90%	53.40%
Mohave County, Arizona	217,420	81.50%	1.20%	1.60%	1.10%	0.20%	4.90%	9.50%	16.70%	75.60%
Navajo County, Arizona	107,744	45.40%	1.20%	43.10%	0.40%	0.20%	3.30%	6.50%	10.60%	42.40%
Pima County, Arizona	1,049,947	63.20%	3.60%	3.10%	3.00%	0.20%	9.90%	17.00%	36.10%	51.20%
Pinal County, Arizona	449,219	66.00%	5.00%	4.70%	1.70%	0.40%	8.30%	13.90%	29.30%	55.90%
Yavapai County, Arizona	241,656	82.70%	0.60%	1.50%	1.10%	0.10%	4.40%	9.70%	15.00%	78.30%
Yuma County, Arizona	207,685	48.40%	1.70%	1.40%	1.10%	0.10%	13.20%	34.10%	64.40%	29.60%
Imperial County, California	179,319	30.40%	2.50%	1.60%	1.50%	0.00%	37.80%	26.20%	85.60%	9.40%
Los Angeles County, California	9,848,406	35.40%	7.80%	1.30%	15.00%	0.20%	23.60%	16.70%	48.30%	25.20%
Orange County, California	3,164,063	46.40%	1.60%	0.80%	21.90%	0.30%	14.10%	14.90%	34.10%	37.70%
Riverside County, California	2,449,909	42.20%	6.50%	1.20%	7.00%	0.30%	24.30%	18.50%	50.60%	32.00%

Geographic Area	Total Population	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some other Race	Two or more races	Hispanic or Latino (of any race)	White alone, not Hispanic or Latino
San Bernardino County, California	2,187,816	39.10%	8.00%	1.30%	8.10%	0.30%	24.50%	18.60%	54.60%	25.60%
San Diego County, California	3,282,782	53.00%	4.70%	0.90%	12.20%	0.40%	10.60%	18.10%	34.30%	43.20%
Clark County, Nevada	2,293,764	47.10%	12.10%	1.10%	10.50%	0.80%	12.90%	15.50%	31.40%	39.40%
Garfield County, Utah	5,170	94.70%	0.10%	2.10%	0.00%	0.50%	0.90%	1.70%	7.00%	89.30%
Kane County, Utah	7,996	90.80%	0.20%	2.20%	0.10%	0.10%	2.40%	4.20%	4.80%	88.70%
San Juan County, Utah	14,466	46.70%	0.10%	45.90%	0.50%	0.40%	3.00%	3.30%	5.60%	44.90%

Source: U.S. Census Bureau 2023b

According to 2023 census data, 13 of the study area counties had Hispanic/Latino populations exceeding 25 percent of the total population. In Arizona, Hispanic/Latino population exceed 25 percent in Graham (30.3 percent), La Paz (25.5 percent), Maricopa (30.9 percent), Pima (36.1 percent), Pinal (29.3 percent), and Yuma (64.4 percent) Counties. In California, Hispanic/Latino population exceeded 31 percent in Imperial (85.6 percent), Los Angeles (48.3 percent), Orange (34.1 percent), Riverside (50.6 percent), San Bernardino (54.6 percent), and San Diego (34.3 percent) Counties. Clark County, Nevada, had a Hispanic/Latino population of 31.4 percent. In contrast, in the three Utah study area Counties, Hispanic/Latino population comprised between 4.8 percent to 7 percent of the total population.

TA 16.1.5 Social and Nonmarket Values

Nonmarket values refer to resource benefits that are not captured in market transactions or traditional economic measures. Along the Colorado River, these values include the enjoyment of natural scenery, opportunities for recreation and solitude, preservation of landscapes, and the symbolic and ecological importance of the river itself. Such values are important for understanding how river operations affect people's experiences, sense of place, and well-being, even when no direct economic exchange is involved.

Place-based communities along the Colorado River corridor derive nonmarket values from their proximity to the river and its resources. Gateway communities such as Page, Arizona; Boulder City, Nevada; Bullhead City, Arizona; and Lake Havasu City, Arizona benefit from river-related recreation and tourism and identify with the surrounding landscape as part of their community character. Agricultural communities in counties in Arizona and California are closely tied to irrigated farmland supported by Colorado River water, and their identity is shaped in part by this long-standing relationship between land and water. Residents of these communities often emphasize quality of life, access to outdoor spaces, and continuity of traditional uses as nonmarket dimensions of the river.

In addition to supporting place-based communities, the river also supports nonmarket values for non-place-based communities. These include recreationists and visitors from across the U.S. who seek rafting, boating, angling, or other experiences on the river, as well as individuals who may never visit but who value the river for its ecological health, scenic integrity, or symbolic importance as a national resource. Conservation organizations and advocacy groups also emphasize the preservation of nonmarket values such as wilderness character and ecosystem health.

The expression of these values varies, but they generally encompass cultural identity, recreational quality, aesthetics, and existence values. For local communities, this may involve community identity or reliance on a healthy river system for recreational opportunities. For nonlocal stakeholders, it often reflects support for maintaining the river's ecological and scenic qualities. These values are not measured through market activity but are nevertheless a critical part of how people interact with and assign meaning to the Colorado River.

Together, these social and nonmarket values establish a baseline for evaluating the social and cultural environment in the Colorado River Basin (Basin). They highlight that the river provides more than economic contributions, supports community identity, recreational experiences, and environmental

quality that extend beyond direct market measures. These values provide important context for assessing potential changes under the post-2026 operational alternatives.

TA 16.2 Environmental Consequences

TA 16.2.1 Methodology

The following subsection outlines the methodology, impact analysis area, and assumptions used in the analysis of impacts on economic and social conditions from changes in agriculture and recreation as well as the analysis of impacts on ecosystem services and nonmarket values. For an analysis of impacts on hydropower, including impacts on energy generation, please reference **TA 15**, Dams and Electrical Power Resources.

Agriculture

The purpose of the agricultural impact assessment is to estimate the change in economic conditions from changes in agricultural production as a result of a reduction of irrigation water. The change in the value of agricultural production is directly related to the acres of cropland assumed to be fallowed and the estimated forgone revenue per acre of the fallowed crop. In addition to revenue loss from agricultural products, agricultural jobs and wages would potentially be lost. To analyze the impacts on economic conditions from these changes in agriculture, U.S. Bureau of Reclamation (Reclamation) used a similar agricultural modeling framework that was applied in the 2007 Interim Guidelines Final Environmental Impact Statement (2007 Final EIS; Reclamation 2007) and the 2024 Near-term Colorado River Operations Final Supplemental Environmental Impact Statement (SEIS; Reclamation 2024), with some changes and updates as discussed below.

As described in **TA 4**, Water Deliveries, Reclamation used Colorado River Simulation System to analyze water deliveries across the alternatives. Modeling details for each alternative are described in **Chapter 2**, Description of Alternatives. Additionally, as described in the Shortage Allocation Model and Alternative Distribution Model Documentation (**Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation), Reclamation used Shortage Allocation Models and Alternative Distribution Models in addition to Colorado River Simulation System to analyze the potential impacts of the alternatives on individual agricultural water users within each Lower Division State under different shortage scenarios. Based on the Shortage Allocation and Alternative Distribution Models, Reclamation estimated the change in agricultural revenue for each county in the analysis area where the individual agricultural and tribal agricultural water users were being affected from water shortages at a variety of shortage levels across each alternative and comparative baseline.

Irrigated crops in the analysis area that were analyzed include field crops, vegetables, and fruit and nut trees and vines, separated out into agricultural crop group types, where at least approximately 1 percent of a county's harvested acres came from the crop group (USDA 2024, Reclamation 2016, Imperial County 2019, 2020, 2021, 2022, 2023; Riverside County 2020, 2021, 2022, 2023, 2024; San Bernardino County 2019, 2020, 2021, 2022, 2023). The methodology for estimating which crops will be fallowed first is the same as that used in the 2007 Final EIS and the 2024 Final SEIS and is based on the crops' water use and the farmer's ability to cover the variable cost of production of a given

crop (which is based on the profitability of the crop; Dale and Dixon 1998; Frisvold et al. 2013). The analysis assumes that the least profitable crop would be fallowed first, analyzed for each county separately. Crops would continue to be fallowed in the order of least profitable crop, until the full volume of water shortage is offset. Calculation of crop profitability per acre-foot of water followed the method outlined in Appendix H of the 2007 Final EIS, which used the difference between revenue and the variable costs per acre of land required to grow a given crop. Based on the order of fallowing and the shortages analyzed across the alternatives, the following eight crop group types were analyzed: alfalfa, cotton, crucifer vegetables, field grains, fruit and tree nuts and vines, other hay and haylage, small grains, and small vegetables.

To determine how much a farmer would be willing to pay for water before a choice is made to fallow a crop, the cost of irrigation for growing each crop was added back to the calculated revenue minus variable production cost. To account for each crop's required amount of water (different for each crop), the estimated return plus irrigation cost was divided by the amount of water per acre needed to grow that crop (USDA 2024; Reclamation 2016; University of Arizona 1999, 2001, 2023, 2025; University of Nevada 2004, 2007, 2010, 2012, 2022; University of California 1956, 1962, 1963, 1964, 1965, 1967, 1972, 1973, 1974, 1975, 1977, 1978, 1979, 1984, 1988, 1989, 1992, 1995, 1996, 1997, 1998, 2000, 2002, 2004, 2011). Based on this method, the order in which crops would be fallowed varied across the counties in the study area.

County-level operations cost data for each crop, including the difference in irrigation cost, are not updated frequently. To capture the difference in the irrigation cost for each crop in different counties in Arizona, California, and Nevada, variable costs-of-production estimates were based on historical crop and livestock budgets developed by the University of Arizona, University of California Davis, and University of Nevada Reno, respectively, for a range of years, depending on the type of crop and county for which it was developed (University of Arizona 1999, 2001, 2023, 2025; University of Nevada 2004, 2007, 2010, 2012, 2022; University of California 1956, 1962, 1963, 1964, 1965, 1967, 1972, 1973, 1974, 1975, 1977, 1978, 1979, 1984, 1988, 1989, 1992, 1995, 1996, 1997, 1998, 2000, 2002, 2004, 2011; USDA ERS 2025). For operations cost and irrigation cost data that was not available for specific crops grown in the county, estimated data was used based on data from nearby counties or from nearby states or regions for the same or similar crops. All dollar values were converted to 2022 dollars. The purpose of using the cost estimates was only to determine the order in which crops would be fallowed; the estimates are not considered an accurate measure of the current cost and return estimates.

Forgone agricultural revenue from fallowed crops was estimated by multiplying the county-level revenue per acre by the number of acres reduced (or fallowed) for each crop. The county-level revenue was calculated based on the most recent available data on yields and prices. The number of acres reduced for each crop was modeled based on the order in which crops are fallowed, the level of shortages and available water for each county, and the most recent available data on acres harvested (USDA NASS 2024; Reclamation 2016; Imperial County 2019, 2020, 2021, 2022, 2023; Riverside County, 2020, 2021, 2022, 2023, 2024; San Bernardino County 2019, 2020, 2021, 2022, 2023). For data that were not available for specific crops grown in the county, estimated data were used based on statewide averages, data from nearby counties, or averages from nearby states or regions for the same or similar crops.

Reclamation acknowledges that it is difficult to project exactly how individual farmers, irrigation districts, or each Lower Division State may mitigate potential future agricultural impacts from shortages. For example, farmers may use groundwater and other surface water resources to mitigate impacts from allocated shortages; however, the amount of groundwater that the farmers will use to replace the surface water depends on many factors such as the amount of groundwater available, local and state restrictions on groundwater pumping, and cost of pumping. Therefore, similar to the assumption made in the 2007 Final EIS and the 2024 Final SEIS, the quantitative projected change in agricultural production did not include the use of groundwater as a replacement water source; however, the use of groundwater to replace the estimated water shortage is discussed qualitatively.

As in the 2007 Final EIS and the 2024 Final SEIS, impacts on economic conditions, such as jobs and income, from changes in agricultural production were analyzed using the IMPLAN input-output economic model. IMPLAN is a regional economic model that describes the flow of money, goods, and services from producers to intermediate and final consumers using a series of economic multipliers. The IMPLAN model provides annual average estimates of how a direct change in economic spending (such as through reduced agricultural revenues) would ripple through the broader economy and other industries. These ripple or multiplier effects include: (1) indirect impacts resulting from changes in economic activity in industries that sell inputs to the industries that may be directly affected (for example, changes in supply purchases made by agriculture producers or farmers); and (2) induced impacts resulting from changes in household spending as households adjust their spending in response to changes in labor income supported by industries affected by management actions (for example, changes in purchases at local stores for personal groceries). This analysis used IMPLAN Cloud and data from IMPLAN's 2023 data release (the most recent period of data available on the IMPLAN Cloud platform at the time of analysis; IMPLAN 2023). Prior to running the model, cost data were converted to a consistent dollar year (2025). Unless stated otherwise, monetary values are reported in the year 2025 dollars.

The modeled shortage volumes, based on the Shortage Allocation and Alternative Distribution Models, are presented in terms of consumptive use shortage relative to the consumptive use (or modeled equivalent) entitlement, in order to allow for comparison across the alternatives and shortage distribution methods. This is a change to volumetric shortage modeling from the 2007 Final EIS and the 2024 Final SEIS, which modeled shortages relative to future demand schedule or recent history of use, respectively. However, the quantitative agricultural economic analysis in this Draft Environmental Impact Statement (EIS) captures the impacts that occur from immediate reductions in available water, and does not capture impacts on future water consumption expansion and development opportunities for irrigation entitlement holders with current consumptive use that is less than their entitlement. There are many uncertain factors that impact future consumption, so impacts from shortages on water consumption expansion opportunities for irrigation entitlement holders with current consumptive use that is less than their entitlement will be discussed qualitatively.

Impact Analysis Area

Potential changes in economic contributions and social conditions from agricultural production within the analysis area due to estimated shortages were quantitatively assessed for the counties expected to experience impacts; these include Apache, Coconino, Gila, Graham, La Paz, Maricopa,

Mohave, Navajo, Pima, Pinal, Yavapai, and Yuma Counties in Arizona; Imperial, Riverside, and San Bernardino Counties in California; and Clark County in Nevada.

Quantitative impacts were analyzed at the county-level and presented at the state-level, for comparison purposes.

Assumptions

For the purposes of this analysis, Reclamation assumed the following. Any future changes in these assumptions would change the impacts on economic contributions and social conditions associated with agriculture. The extent to which impacts on economic contributions and social conditions change due to changes in assumptions depends on many factors and future conditions that Reclamation cannot predict with sufficient certainty to quantify in this EIS; however, where possible and as stated below, a qualitative discussion on the impacts of changes in the assumptions is provided in the impacts analysis.

- All dollar values in the impacts analysis are reported in 2025 dollars, unless otherwise noted.
- Farmers would fallow irrigated crops in response to water shortages or an increased cost of irrigation. Farmer will fallow the land rather than switch from one crop to an alternative, more profitable or less water-intensive crop due to investments and institutional knowledge that have been made in plants, supply chains/relationships, and/or machinery that create barriers for changing crops. Reclamation understands that there could be farmers who are able to switch crops, rather than fallow; however, for the purpose of this analysis, this assumption provides a bound to the analysis and any changes in this assumption would likely result in less impacts than discussed below.
- Crops have a constant profitability per acre of land and per acre-foot of water.
- Changes in the amount of irrigated crops would be the result of changes in water deliveries from the Colorado River sources; they do not involve changes to allocations or to irrigation water from groundwater or other surface water sources. However, the use of groundwater to replace the estimated water shortage is discussed qualitatively.
- Estimated shortages in the agricultural sector are based on the Shortage Allocation and Alternative Distribution Models (**Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation). Shortages to individual entitlement holders are measured in terms of consumptive use for a common basis of comparison with state apportionments and volumes of total shortage. Impacts from shortages on water consumption expansion opportunities for irrigation entitlement holders with current consumptive use that is less than their entitlement are discussed qualitatively.
- In most cases, the contractor, subcontractor, or entitlement holder of an allocation is shown as the entity bearing shortage. In some cases, water allocated to an entitlement holder (for example, a tribal CAP contractor) may lease its allocation to other users (for example, to a non-Indian municipality). The Shortage Allocation and Alternative Distribution Models does not attempt to replicate those arrangements, and it only provides approximate estimates at the level of the entitlement holder, contractor, or subcontractor. The entitlement holder, contractor, or subcontractor to the leasing arrangements would have specific decisions to

make during Shortage Conditions to administer those arrangements that Reclamation cannot predict with sufficient certainty to analyze in this EIS.

Impact Indicators

- Change in acres of fallowed cropland
- Change in production value or revenue associated with fallowed cropland
- Change in jobs and income associated with agriculture
- Change in nonmarket values and social conditions associated with changes in agriculture

Recreation

The recreation economic impact analysis evaluates how operational changes under the alternatives may influence visitor spending and related economic activity in the Colorado River corridor (see **TA 14**, Recreation, for discussion of impacts on recreation).

For lake-based recreational economic contributions, the approach integrates estimates of baseline visitor use with spending profiles and applies a regional economic modeling framework, primarily IMPLAN, to estimate total economic contributions. Visitor use levels are derived from data reported by the NPS Public Use Statistics Office and Reclamation visitor counts, with visits categorized by activity type (e.g., day use, overnight camping, boating). Total visitor counts were divided by average party size data from NPS to estimate the number of visiting parties for analysis since the spending profile data is by party.

Visitors are further classified by type to reflect differences in recreational behavior and spending. Categories include local versus nonlocal visitors, day trips versus overnight stays, and distinctions among camping and lodging in nearby communities, or other site-specific recreational activities. For each visit type, spending profiles are assigned based on available NPS and regional survey data. Profiles capture expenditures across categories such as lodging, food and beverages, transportation, recreational equipment and guide services, entrance and activity fees, and miscellaneous retail purchases.

Visitor spending estimates are then aggregated and input into the IMPLAN regional input-output model to estimate economic impacts. The model distinguishes among direct effects (visitor purchases in the local economy), indirect effects (business-to-business transactions, such as hotel purchases of supplies), and induced effects (household spending supported by recreation-related employment). Results are reported as total visitor spending, jobs supported, labor income, value added (contribution to gross regional product), and total sales. Impacts on direct, indirect and induced economic contributions by alternative are discussed qualitatively.

A baseline assessment of economic contributions from river-based general recreation utilizing input-output analysis is included utilizing the same methodology as described for lake-based recreation above.

In addition, for boating and angling, the socioeconomic analysis includes net economic value changes for a subset of activities, specifically angling in Glen Canyon and whitewater rafting in Grand Canyon. This approach follows the methods used in the Glen Canyon Dam Long-Term

Experimental and Management Plan Final SEIS, where past survey research (Bishop et al. 1987; Neher et al. 2017) informed models to project the change in net economic value under different river flow scenarios. These models link willingness-to-pay estimates for anglers and boaters to hydrologic conditions, providing a measure of recreational benefits that extends beyond market spending (Bair 2026). Reclamation used similar methods for the analysis of potential impacts on recreation as were used in the 2007 Final EIS and 2024 Final SEIS to assess the effects on recreational value associated with white-water boating and angling This analysis also incorporates additional decision making under deep uncertainty (DMDU) concepts, specifically robustness heat maps and conditional box plots, developed to provide an indicator of an alternative's performance across many possible hydrologic futures. Refer to **TA 3.2.6** in **TA 3**, Hydrologic Resources for an overview of interpreting the DMDU robustness heat maps and conditional box plots.

Impacts on river-based concessionaires are also assessed qualitatively using existing NPS and outfitters' data and informed by modeled flow thresholds from **TA 14**, Recreation.

For wildlife refuge recreation at Imperial NWR and Bill Williams River NWR, baseline economic contribution data are drawn from U.S. Fish and Wildlife Service visitor spending reports, with impacts discussed qualitatively due to limited modeling inputs.

Impact Analysis Area

The analysis area is consistent with the general socioeconomic study area defined in **Chapter 3**. This includes major recreational hubs, gateway communities, and rural areas where economies rely heavily on river- and reservoir-based recreation. Specifically, the recreation impact analysis area encompasses three primary NPS units: Lake Mead NRA, Glen Canyon NRA, and GCNP.

Gateway counties associated with these areas include:

- Lake Mead NRA – Clark County and Lincoln County (Nevada); Mohave County (Arizona)
- Glen Canyon NRA – Coconino County (Arizona); Garfield, Kane, San Juan, and Wayne Counties (Utah)
- GCNP – Coconino, Mohave, Navajo, and Yavapai Counties (Arizona)

These counties represent the primary economic regions where visitor spending and recreation-related employment occur.

Assumptions

For the purposes of this analysis, Reclamation assumed the following. Any future changes in these assumptions would change the impacts on economic contributions associated with recreation. The extent to which impacts on economic contributions and social conditions change due to changes in assumptions depends on many factors and future conditions that Reclamation cannot predict with sufficient certainty to analyze in this EIS.

- All dollar values in the impacts analysis are reported in 2025 dollars, unless otherwise noted.
- Lake-based recreational spending per visitor trip is based on the most recent NPS Visitor Spending Profiles.

- IMPLAN results represent regional effects, including direct, indirect, and induced economic activity associated with lake-based recreation.
- Recreational spending per trip for anglers and whitewater rafting (adjusted for inflation) would follow results from willingness-to-pay surveys (Gaston et al. 2015) with variation based on river flows.

Impact Indicators

- Changes in direct recreational visitor spending across the affected NPS units and recreation sites
- Changes in regional employment, labor income, value added, and total economic output from lake-based recreation-related activities
- Impacts on recreational value associated with river-based boating and angling
- Effects on commercial outfitters, concessionaires, and permittees, especially in areas dependent on rafting, boating, and guided recreation

Ecosystem Services and Nonmarket Values

Discussion of ecosystem services and nonmarket values are provided in a qualitative format based on existing literature.

Impact Analysis Area

- The analysis area for social and nonmarket values is the Colorado River corridor from Lake Powell to the Southerly International Boundary, consistent with the overall socioeconomic study area.
- Consideration is focused on but not limited to geographic boundaries; this is because non-place-based communities also hold nonmarket values. The area therefore includes both local communities along the river and the broader public for whom the river holds symbolic, ecological, or recreational importance.

Assumptions

For the purposes of this analysis, Reclamation assumed the following:

- Nonmarket values are not directly quantifiable through market-based indicators but can be described qualitatively based on existing studies, stakeholder input, and related resource analyses.
- Changes in nonmarket values are assumed to be closely linked to conditions evaluated in other TAs, such as the TAs for recreation, population and land use, cultural resources, and visual resources.
- Changing hydrology may influence how these values are perceived, particularly where access, scenic character, or ecological conditions are affected.

Impact Indicators

- Changes in the availability or quality of recreational opportunities not captured by direct spending.
- Changes in the existence and symbolic values of the river due to shifts in the scenic character or ecological conditions.

TA 16.2.2 Issue 1: How would the anticipated water shortages affect the economic contributions and social conditions from agriculture?

Under all alternatives and the Continued Current Strategies (CCS) Comparative Baseline, anticipated shortages would result in increases in acres of fallowed cropland and agricultural production loss, and the modeled agricultural production loss would result in impacts on the associated jobs, income, and total economic output. However, there are regional differences as well as differences in magnitude of impacts across the alternatives and the CCS Comparative Baseline, as discussed below.

Figure TA 16-1 presents the estimated number of agriculture acres fallowed for each alternative and the CCS Comparative Baseline, across a range of shortage volumes—0.6 million acre-feet (maf) to 5.0 maf—for non-tribal and tribal irrigation entitlement holders in Arizona, California, and Nevada. The shading highlights the magnitude of fallowed croplands across the alternatives and the CCS Comparative Baseline and shortage levels for each state and entitlement holder group, with the darker shaded numbers representing larger magnitudes of fallowed croplands. Across the alternatives and the CCS Comparative Baseline, the greatest impacts on fallowed lands occur in Arizona on non-tribal and tribal agriculture entitlement holders as well as California non-tribal agriculture entitlement holders. For non-tribal agriculture entitlement holders in Arizona and California with shortages less than or equal to 3.0 maf, the greatest impacts on fallowed lands occurs under the Enhanced Coordination Alternative or Supply Driven Alternative (Lower Basin [LB] Pro Rata approach), compared with the other alternatives and the CCS Comparative Baseline. During shortages greater than 3.0 maf, for non-tribal agriculture entitlement holders in Arizona, the greatest impacts on fallowed lands occurs under the Maximum Operational Flexibility Alternative, due to the larger maximum shortages allowed under this alternative; however, for non-tribal agriculture entitlement holders in California, the greatest impacts on fallowed lands occurs under the Enhanced Coordination Alternative. When the shortage is 0.6 maf, the smallest impacts on fallowed lands occurs under the Maximum Operational Flexibility and Supply Driven (Lower Basin Priority approach) Alternatives for Arizona non-tribal entitlement holders, and there would be no impacts on fallowed lands for California non-tribal entitlement holders under the CCS Comparative Baseline and the No Action, Basic Coordination, Maximum Operational Flexibility, and Supply Driven (LB Priority approach) Alternatives. When comparing impacts due to maximum levels of shortages across all alternatives and the CCS Comparative Baseline, for Arizona non-tribal entitlement holders, the Maximum Operational Flexibility Alternative would result in the greatest level of impacts on fallowed lands (with an increase of about 102,000 acres of fallowed lands) during a maximum shortage of 4.0 maf, and for California non-tribal entitlement holders, the Enhanced Coordination Alternative would result in the highest level of impacts on fallowed lands (with an increase of about 283,000 acres of fallowed lands) during a maximum shortage of 3.0 maf. The CCS Comparative Baseline and the No Action, Basic Coordination, and Supply Driven (LB Priority approach) Alternatives would result in the lowest impacts on fallowed lands due to maximum levels of

Figure TA 16-1
Acres of Fallowed Cropland in the Analysis Area by Alternative and Shortage Level, in Thousand Acre-feet (kaf)

State, Water Entitlement Holders	Shortage Level (kaf)	600	1,000	1,500	1,800	2,000	2,100	2,300	3,000	3,500	4,000
Arizona, Non-Tribal Agriculture	CCS Comparative Baseline[1]	1,695	2,675								
	No Action Alternative	1,222									
	Basic coordination Alternative[2]	1,222	3,592	6,240							
	Enhanced Coordination Alternative	9,068	15,076	22,743	27,808	32,368	34,643	40,346	62,044		
	Maximum Operational Flexibility Alternative	464	2,007	3,496	5,061	6,105	6,680	8,324	27,902	63,394	101,670
	Supply-Driven – LB Priority Approach Alternative	464	2,007	3,496	5,061	6,105	6,680				
	Supply-Driven – LB Pro Rata Approach Alternative	17,875	26,374	44,351	52,435	57,825	60,520				
California, Non-Tribal Agriculture	CCS Comparative Baseline[1]	0	3,305								
	No Action Alternative	0									
	Basic coordination Alternative[2]	0	0	0							
	Enhanced Coordination Alternative	71,338	105,658	148,559	174,299	191,459	200,039	217,199	283,344		
	Maximum Operational Flexibility Alternative	0	0	12,276	12,276	12,276	12,276	12,276	101,129	161,883	205,107
	Supply-Driven – LB Priority Approach Alternative	0	0	12,276	12,276	12,276	12,276				
	Supply-Driven – LB Pro Rata Approach Alternative	39,211	65,017	97,274	125,145	143,725	153,015				
Arizona, Tribal Agriculture	CCS Comparative Baseline[1]	15,576	22,274								
	No Action Alternative	12,428									
	Basic coordination Alternative[2]	12,428	29,215	49,049							
	Enhanced Coordination Alternative	8,072	13,412	19,953	24,057	26,788	28,136	30,621	39,176		
	Maximum Operational Flexibility Alternative	6,535	16,782	28,505	40,548	48,095	52,377	59,148	61,582	64,042	66,987
	Supply-Driven – LB Priority Approach Alternative	6,535	16,782	28,505	40,548	48,095	52,377				
	Supply-Driven – LB Pro Rata Approach Alternative	15,801	23,181	32,200	35,388	37,513	38,575				
California, Tribal Agriculture	CCS Comparative Baseline[1]	0	0								
	No Action Alternative	0									
	Basic coordination Alternative[2]	0	0	0							
	Enhanced Coordination Alternative	1,298	1,930	2,721	3,195	3,511	3,669	3,985	5,092		
	Maximum Operational Flexibility Alternative	0	0	0	0	0	0	0	0	0	0
	Supply-Driven – LB Priority Approach Alternative	0	0	0	0	0	0				
	Supply-Driven – LB Pro Rata Approach Alternative	579	1,181	1,776	2,289	2,632	2,803				
Nevada, Tribal Agriculture	CCS Comparative Baseline[1]	0	0								
	No Action Alternative	0									
	Basic coordination Alternative[2]	0	0	0							
	Enhanced Coordination Alternative	131	219	328	393	437	459	503	656		
	Maximum Operational Flexibility Alternative	0	0	0	0	0	0	0	0	0	0
	Supply-Driven – LB Priority Approach Alternative	0	0	0	0	0	0				
	Supply-Driven – LB Pro Rata Approach Alternative	131	219	329	394	438	460				

Source: IMPLAN 2025

Note: The highlighting shows the values from the smallest (in white or no highlighting) to the largest (in yellow highlighting). The cells with hash-marks represent the values above shortages; these values are outside of the scope of this analysis. See **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation for more information on the shortage values for each entitlement holder type above shortages.

[1] Due to its fixed shortage volumes for CCS Comparative Baseline, shortages for 600K and 1,000K are actually associated with 613K and 1,013K in CCS Comparative Baseline. Greater shortages are based on an extension of priority beyond the levels of shortage provided by the pertinent documents.

[2] The maximum shortage for the Basic Coordination Alternative is 1.48 maf, however, the table above shows the maximum shortage as 1.5 maf for ease of comparison across the alternatives.

shortage, with an increase in total fallowed land across Arizona and California non-tribal entitlement holders of about 6,000 acres (with a shortage of 1.0 maf), 1,000 acres (with a shortage of 0.6 maf), 6,000 acres (with a shortage of 1.5 maf), and 19,000 acres (with a shortage of 2.1 maf) under the CCS Comparative Baseline, the No Action Alternative, the Basic Coordination Alternative, and the Supply Driven Alternative (LB Priority approach), respectively.

For Arizona tribal entitlement holders, when the shortage is 0.6 maf, the largest impacts on fallowed lands occurs under the Supply Driven Alternative (LB Pro Rata approach) and the smallest impacts on fallowed lands occurs under the Maximum Operational Flexibility and Supply Driven (LB Priority approach) Alternatives. For shortages greater than 0.6 maf but not more than 2.0 maf, impacts on fallowed lands would be largest under the Basic Coordination Alternative and smallest under the No Action Alternative, because the maximum shortage for this alternative is 0.6 maf. For shortages greater than 2.0 maf, impacts on fallowed lands would be greatest under the Maximum Operational Flexibility Alternative, with annual impacts as large as an increase in fallowed lands of about 67,000 acres, occurring during a shortage of 4.0 maf. The maximum level of impacts on fallowed lands due to shortages for Arizona tribal entitlement holders were the lowest under the No Action Alternative (with about 12,000 acres fallowed under a shortage of 0.6 maf), the CCS Comparative Baseline (with about 22,000 acres of fallowed lands under a shortage of 1.0 maf), the Supply Driven Alternative (LB Priority approach; with about 39,000 acres fallowed under a shortage of 2.1 maf), and the Enhanced Coordination Alternative (with about 39,000 acres fallowed under a shortage of 3.0 maf; see **Figure TA 16-1**).

For California and Nevada tribal entitlement holders, impacts on fallowed lands would be greatest under the Enhanced Coordination Alternative and Supply Driven Alternative (LB Pro Rata approach), with impacts as large as an increase in fallowed lands of about 6,000 acres (about 5,000 acres and 700 acres of fallowed lands in California and Nevada, respectively), under the Enhanced Coordination Alternative, with a shortage of 3.0 maf. There are no expected impacts on fallowed lands under all other alternatives and the CCS Comparative Baseline (see **Figure TA 16-1**).

For more information on impacts on changing land use and water deliveries due to potential long-term water shortages to irrigation entitlement holders, see **TA 4**, Water Deliveries, and **TA 17**, Population and Land Use.

Figure TA 16-2 shows the estimated loss in market value of crops due to water shortages and fallowed lands for each alternative and the CCS Comparative Baseline across a range of shortage volumes (0.6 maf to 5.0 maf) for Arizona, California, and Nevada non-tribal and tribal irrigation entitlement holders. The patterns in loss of market values across regions, non-tribal and tribal entitlement holders, and shortage levels are similar to those discussed for fallowed acres. For Arizona non-tribal and tribal entitlement holders, the Maximum Operational Flexibility Alternative would result in the largest level of impacts on market value of crops during a maximum level of shortage compared with the alternatives, with a reduction in market value of crops of about $130.7 million and $101.0 million, during a shortage of 4.0 maf, for Arizona non-tribal and Arizona tribal entitlement holders, respectively. For California non-tribal and tribal entitlement holders, the Enhanced Coordination Alternative would result in the largest level of impacts on market value of crops during a maximum level of shortage compared with the alternatives, with a reduction in

market value of crops of about $691.8 million. For the non-tribal entitlement holders in Arizona and California, the level of impact on market value of crops, during a maximum level of shortage, would be considerably lower under the CCS Comparative Baseline and the No Action, Basic Coordination, and Supply Driven (LB Priority approach) Alternatives, compared with the other action alternatives. For the tribal entitlement holders in Arizona, the impacts on market value of crops, during a maximum level of shortage, would be lowest under the CCS Comparative Baseline and the No Action, Enhanced Coordination, and Supply Driven (LB Pro Rata approach) Alternatives, compared with the other action alternatives. As discussed above for impacts on fallowed lands, for the tribal entitlement holders in California and Nevada, impacts on the market value of crops would only occur under the Enhanced Coordination Alternative and Supply Driven Alternative (LB Pro Rata approach).

As agricultural entitlement holders fallow lands due to water shortages, the loss in market value of crops would likely lead to reductions in economic contributions in the region across agricultural-related sectors as well as sectors that supply goods and services to the farmers and their households. The impacts on economic contributions, such as jobs, labor income and total economic output, across the alternatives and the CCS Comparative Baseline would follow similar patterns as those described for impacts on fallowed lands and market values of crops. **Figure TA 16-3**, **Figure TA 16-4**, and **Figure TA 16-5** show the results of the impact analysis on total jobs, labor income, and economic output, respectively, including direct, indirect, and induced impacts, by state and type of entitlement holder. For non-tribal entitlement holders in Arizona, the greatest impacts on jobs, labor income, and total economic output due to a maximum level of shortage occurs under the Maximum Operational Flexibility Alternative, during a shortage of 4.0 maf, with annual reductions of almost 1,000 jobs, about $46.8 million in labor income, and $126.8 million in economic output. For non-tribal entitlement holders in California, the greatest impact on economic output due to a maximum level of shortage occurs under the Enhanced Coordination Alternative (during a shortage of 3.0 maf), with an annual reduction about $1.0 billion in economic output. However, due to small variations in industry-level estimates for employment and labor income for each crop that would be fallowed, the greatest impacts on jobs and labor income due to a maximum level of shortage, for non-tribal entitlement holders in California, occurs under the Maximum Operational Flexibility Alternative (during a shortage of 4.0 maf), with annual reductions of almost 5,000 jobs and about $336.3 million in labor income. The CCS Comparative Baseline and the No Action, Basic Coordination, and Supply Driven (LB Priority approach) Alternatives would result in the lowest maximum levels of impacts on economic conditions, across Arizona and California non-tribal entitlement holders, with total annual reduction ranges of about 13 to 225 jobs, $0.6 million to $12.3 million in labor income, and $2.8 million to $53.9 million in economic output, for the No Action Alternative during a 0.6 maf shortage and the Supply Driven Alternative (LB Priority approach) during a 2.1 maf shortage, respectively.

Figure TA 16-2
Loss of Direct Market Value of Agricultural Production in the Analysis Area by Alternative and Shortage Level, in Thousand Acre-feet (2025$ millions)

Water Entitlement Holders	Shortage Level (kaf)	600	1,000	1,500	1,800	2,000	2,100	2,300	3,000	3,500	4,000
Arizona, Non-Tribal Agriculture	CCS Comparative Baseline[1]	2.5	4.1								
	No Action Alternative	1.8									
	Basic coordination Alternative[2]	1.8	5.7	10.3							
	Enhanced Coordination Alternative	13.0	21.7	32.7	40.4	48.3	52.3	58.9	79.6		
	Maximum Operational Flexibility Alternative	0.6	2.9	5.5	8.3	10.1	11.1	13.4	41.6	84.4	130.7
	Supply-Driven – LB Priority Approach Alternative	0.6	2.9	5.5	8.3	10.1	11.1				
	Supply-Driven – LB Pro Rata Approach Alternative	25.7	37.9	62.7	70.4	75.6	78.2				
California, Non-Tribal Agriculture	CCS Comparative Baseline[1]	0.0	6.8								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	329.8	390.3	466.0	511.4	541.6	556.8	587.0	691.8		
	Maximum Operational Flexibility Alternative	0.0	0.0	25.4	25.4	25.4	25.4	25.4	233.7	550.7	628.6
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	25.4	25.4	25.4	25.4				
	Supply-Driven – LB Pro Rata Approach Alternative	273.1	318.6	375.5	424.7	457.5	473.8				
Arizona, Tribal Agriculture	CCS Comparative Baseline[1]	21.7	30.9								
	No Action Alternative	17.4									
	Basic coordination Alternative[2]	17.4	41.4	77.6							
	Enhanced Coordination Alternative	11.4	18.2	26.8	32.0	35.5	37.2	40.6	52.4		
	Maximum Operational Flexibility Alternative	9.7	23.4	40.2	62.4	76.1	83.1	92.5	95.3	98.1	101.0
	Supply-Driven – LB Priority Approach Alternative	9.7	23.4	40.2	62.4	76.1	83.1				
	Supply-Driven – LB Pro Rata Approach Alternative	21.3	30.9	42.8	47.2	50.1	51.6				
California, Tribal Agriculture	CCS Comparative Baseline[1]	0.0	0.0								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	5.6	6.4	7.6	8.2	8.7	8.9	9.4	10.9		
	Maximum Operational Flexibility Alternative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	0.0	0.0	0.0	0.0				
	Supply-Driven – LB Pro Rata Approach Alternative	2.8	5.4	6.2	7.0	7.4	7.7				
Nevada, Tribal Agriculture	CCS Comparative Baseline[1]	0.0	0.0								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.6		
	Maximum Operational Flexibility Alternative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	0.0	0.0	0.0	0.0				
	Supply-Driven – LB Pro Rata Approach Alternative	0.1	0.2	0.3	0.4	0.4	0.5				

Source: IMPLAN 2025

Note: The highlighting shows the values from the smallest (in white or no highlighting) to the largest (in yellow highlighting). The cells with hash-marks represent the values above shortages; these values are outside of the scope of this analysis. See **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation for more information on the shortage values for each entitlement holder type above shortages.

[1] Due to its fixed shortage volumes for CCS Comparative Baseline, shortages for 600K and 1,000K are actually associated with 613K and 1,013K in CCS Comparative Baseline. Greater shortages are based on an extension of priority beyond the levels of shortage provided by the pertinent documents.

[2] The maximum shortage for the Basic Coordination Alternative is 1.48 maf, however, the table above shows the maximum shortage as 1.5 maf for ease of comparison across the alternatives.

Figure TA 16-3
Loss of Total Jobs from Agricultural Production in the Analysis Area by Alternative and Shortage Level, in Thousand Acre-feet

State, Water Entitlement Holders	Shortage Level (kaf)	600	1,000	1,500	1,800	2,000	2,100	2,300	3,000	3,500	4,000
Arizona, Non-Tribal Agriculture	CCS Comparative Baseline[1]	18	31								
	No Action Alternative	13									
	Basic coordination Alternative[2]	13	43	79							
	Enhanced Coordination Alternative	100	166	251	305	347	368	405	525		
	Maximum Operational Flexibility Alternative	5	22	42	63	77	85	102	318	567	888
	Supply-Driven – LB Priority Approach Alternative	5	22	42	63	77	85				
	Supply-Driven – LB Pro Rata Approach Alternative	197	292	427	472	502	517				
California, Non-Tribal Agriculture	CCS Comparative Baseline[1]	0	38								
	No Action Alternative	0									
	Basic coordination Alternative[2]	0	0	0							
	Enhanced Coordination Alternative	1,975	2,310	2,729	2,981	3,149	3,232	3,400	3,981		
	Maximum Operational Flexibility Alternative	0	0	141	141	141	141	141	2,240	4,210	4,704
	Supply-Driven – LB Priority Approach Alternative	0	0	141	141	141	141				
	Supply-Driven – LB Pro Rata Approach Alternative	1,661	1,913	2,228	2,500	2,682	2,773				
Arizona, Tribal Agriculture	CCS Comparative Baseline[1]	172	252								
	No Action Alternative	135									
	Basic coordination Alternative[2]	135	358	805							
	Enhanced Coordination Alternative	99	156	230	274	303	317	347	453		
	Maximum Operational Flexibility Alternative	77	187	342	617	786	871	967	988	1,008	1,029
	Supply-Driven – LB Priority Approach Alternative	77	187	342	617	786	871				
	Supply-Driven – LB Pro Rata Approach Alternative	183	265	367	406	433	446				
California, Tribal Agriculture	CCS Comparative Baseline[1]	0	0								
	No Action Alternative	0									
	Basic coordination Alternative[2]	0	0	0							
	Enhanced Coordination Alternative	33	38	45	48	51	52	55	63		
	Maximum Operational Flexibility Alternative	0	0	0	0	0	0	0	0	0	0
	Supply-Driven – LB Priority Approach Alternative	0	0	0	0	0	0				
	Supply-Driven – LB Pro Rata Approach Alternative	17	32	37	41	44	45				
Nevada, Tribal Agriculture	CCS Comparative Baseline[1]	0	0								
	No Action Alternative	0									
	Basic coordination Alternative[2]	0	0	0							
	Enhanced Coordination Alternative	3	4	6	8	9	9	10	13		
	Maximum Operational Flexibility Alternative	0	0	0	0	0	0	0	0	0	0
	Supply-Driven – LB Priority Approach Alternative	0	0	0	0	0	0				
	Supply-Driven – LB Pro Rata Approach Alternative	3	4	6	8	9	9				

Source: IMPLAN 2025

Note: The highlighting shows the values from the smallest (in white or no highlighting) to the largest (in yellow highlighting). The cells with hash-marks represent the values above shortages; these values are outside of the scope of this analysis. See **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation for more information on the shortage values for each entitlement holder type above shortages.

[1] Due to its fixed shortage volumes for CCS Comparative Baseline, shortages for 600K and 1,000K are actually associated with 613K and 1,013K in CCS Comparative Baseline. Greater shortages are based on an extension of priority beyond the levels of shortage provided by the pertinent documents.

[2] The maximum shortage for the Basic Coordination Alternative is 1.48 maf, however, the table above shows the maximum shortage as 1.5 maf for ease of comparison across the alternatives.

Figure TA 16-4
Loss of Labor Income from Agricultural Production in the Analysis Area by Alternative and Shortage Level, in Thousand Acre-feet (2025$ millions)

State, Water Entitlement Holders	Shortage Level (kaf)	600	1,000	1,500	1,800	2,000	2,100	2,300	3,000	3,500	4,000
Arizona, Non-Tribal Agriculture	CCS Comparative Baseline[1]	0.9	1.4								
	No Action Alternative	0.6									
	Basic coordination Alternative[2]	0.6	2.0	3.5							
	Enhanced Coordination Alternative	4.4	7.4	11.1	13.9	17.2	18.8	21.3	29.0		
	Maximum Operational Flexibility Alternative	0.2	1.0	1.9	2.8	3.5	3.8	4.6	14.2	30.5	46.8
	Supply-Driven – LB Priority Approach Alternative	0.2	1.0	1.9	2.8	3.5	3.8				
	Supply-Driven – LB Pro Rata Approach Alternative	8.8	12.9	22.7	25.6	27.5	28.4				
California, Non-Tribal Agriculture	CCS Comparative Baseline[1]	0.0	2.3								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	125.2	145.4	170.8	186.0	196.2	201.2	211.4	246.5		
	Maximum Operational Flexibility Alternative	0.0	0.0	8.5	8.5	8.5	8.5	8.5	176.9	303.9	336.3
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	8.5	8.5	8.5	8.5				
	Supply-Driven – LB Pro Rata Approach Alternative	106.2	121.4	140.5	157.0	167.9	173.4				
Arizona, Tribal Agriculture	CCS Comparative Baseline[1]	13.3	19.1								
	No Action Alternative	10.7									
	Basic coordination Alternative[2]	10.7	25.4	45.3							
	Enhanced Coordination Alternative	6.6	10.6	15.8	18.8	20.8	21.8	23.9	31.2		
	Maximum Operational Flexibility Alternative	5.9	14.4	24.7	37.0	44.4	48.2	53.0	54.4	55.7	57.1
	Supply-Driven – LB Priority Approach Alternative	5.9	14.4	24.7	37.0	44.4	48.2				
	Supply-Driven – LB Pro Rata Approach Alternative	12.5	18.2	25.3	28.0	29.8	30.7				
California, Tribal Agriculture	CCS Comparative Baseline[1]	0.0	0.0								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	2.1	2.4	2.8	3.0	3.2	3.2	3.4	3.9		
	Maximum Operational Flexibility Alternative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	0.0	0.0	0.0	0.0				
	Supply-Driven – LB Pro Rata Approach Alternative	1.1	2.1	2.3	2.6	2.8	2.8				
Nevada, Tribal Agriculture	CCS Comparative Baseline[1]	0.0	0.0								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1		
	Maximum Operational Flexibility Alternative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	0.0	0.0	0.0	0.0				
	Supply-Driven – LB Pro Rata Approach Alternative	0.0	0.0	0.1	0.1	0.1	0.1				

Source: IMPLAN 2025

Note: The highlighting shows the values from the smallest (in white or no highlighting) to the largest (in yellow highlighting). The cells with hash-marks represent the values above shortages; these values are outside of the scope of this analysis. See **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation for more information on the shortage values for each entitlement holder type above shortages.

[1] Due to its fixed shortage volumes for CCS Comparative Baseline, shortages for 600K and 1,000K are actually associated with 613K and 1,013K in CCS Comparative Baseline. Greater shortages are based on an extension of priority beyond the levels of shortage provided by the pertinent documents.

[2] The maximum shortage for the Basic Coordination Alternative is 1.48 maf, however, the table above shows the maximum shortage as 1.5 maf for ease of comparison across the alternatives.

Figure TA 16-5
Loss of Total Economic Output from Agricultural Production in the Analysis Area by Alternative and Shortage Level, in Thousand Acre-feet (2025$ millions)

State, Water Entitlement Holders	Shortage Level (kaf)	600	1,000	1,500	1,800	2,000	2,100	2,300	3,000	3,500	4,000
Arizona, Non-Tribal Agriculture	CCS Comparative Baseline[1]	3.8	6.3								
	No Action Alternative	2.8									
	Basic coordination Alternative[2]	2.8	8.7	15.8							
	Enhanced Coordination Alternative	19.9	33.1	50.0	61.8	74.2	80.3	91.2	126.8		
	Maximum Operational Flexibility Alternative	1.0	4.5	8.5	12.7	15.4	17.0	20.6	63.6	133.5	207.6
	Supply-Driven – LB Priority Approach Alternative	1.0	4.5	8.5	12.7	15.4	17.0				
	Supply-Driven – LB Pro Rata Approach Alternative	39.3	57.9	97.7	111.0	119.8	124.3				
California, Non-Tribal Agriculture	CCS Comparative Baseline[1]	0.0	9.9								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	479.9	567.8	677.7	743.7	787.6	809.6	853.6	1,005.8		
	Maximum Operational Flexibility Alternative	0.0	0.0	36.9	36.9	36.9	36.9	36.9	378.4	841.6	957.1
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	36.9	36.9	36.9	36.9				
	Supply-Driven – LB Pro Rata Approach Alternative	397.6	463.7	546.4	617.8	665.4	689.2				
Arizona, Tribal Agriculture	CCS Comparative Baseline[1]	43.4	61.8								
	No Action Alternative	34.8									
	Basic coordination Alternative[2]	34.8	82.7	153.1							
	Enhanced Coordination Alternative	22.5	36.1	53.4	63.8	70.7	74.1	80.9	104.5		
	Maximum Operational Flexibility Alternative	19.4	46.7	80.2	123.5	150.1	163.9	182.3	187.8	193.4	199.2
	Supply-Driven – LB Priority Approach Alternative	19.4	46.7	80.2	123.5	150.1	163.9				
	Supply-Driven – LB Pro Rata Approach Alternative	42.4	61.5	85.3	94.0	99.9	102.8				
California, Tribal Agriculture	CCS Comparative Baseline[1]	0.0	0.0								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	8.1	9.4	11.0	12.0	12.6	13.0	13.6	15.9		
	Maximum Operational Flexibility Alternative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	0.0	0.0	0.0	0.0				
	Supply-Driven – LB Pro Rata Approach Alternative	4.2	7.8	9.1	10.1	10.8	11.2				
Nevada, Tribal Agriculture	CCS Comparative Baseline[1]	0.0	0.0								
	No Action Alternative	0.0									
	Basic coordination Alternative[2]	0.0	0.0	0.0							
	Enhanced Coordination Alternative	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.9		
	Maximum Operational Flexibility Alternative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Supply-Driven – LB Priority Approach Alternative	0.0	0.0	0.0	0.0	0.0	0.0				
	Supply-Driven – LB Pro Rata Approach Alternative	0.2	0.3	0.4	0.5	0.6	0.6				

Source: IMPLAN 2025

Note: The highlighting shows the values from the smallest (in white or no highlighting) to the largest (in yellow highlighting). The cells with hash-marks represent the values above shortages; these values are outside of the scope of this analysis. See **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation for more information on the shortage values for each entitlement holder type above shortages.

[1] Due to its fixed shortage volumes for CCS Comparative Baseline, shortages for 600K and 1,000K are actually associated with 613K and 1,013K in CCS Comparative Baseline. Greater shortages are based on an extension of priority beyond the levels of shortage provided by the pertinent documents.

[2] The maximum shortage for the Basic Coordination Alternative is 1.48 maf, however, the table above shows the maximum shortage as 1.5 maf for ease of comparison across the alternatives.

For Arizona tribal entitlement holders, impacts on economic contributions would be more similar across the alternatives and the CCS Comparative Baseline for each level of shortage than other entitlement holder types. The largest maximum impact on economic conditions due to shortages occurs under the Maximum Operational Flexibility Alternative, during a shortage of 4.0 maf, with annual reductions of about 1,000 jobs, about $57.1 million in labor income, and $199.2 million in economic output. The lowest impacts on jobs, labor income, and economic output, during a maximum level of shortage, occurs under the CCS Comparative Baseline and the No Action, Enhanced Coordination, and Supply Driven (LB Pro Rata approach) Alternatives, with annual reduction ranges of about 135 to 453 jobs, $10.7 million to $31.2 million in labor income, and $34.8 million to $104.5 million in economic output, for the No Action Alternative during a 0.6 maf shortage and the Enhanced Coordination Alternative during a 3.0 maf shortage, respectively.

For California and Nevada tribal entitlement holders, impacts on economic contributions such as jobs, labor income, and economic output, would be greatest under the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives, with impacts as large as a reduction of over 60 jobs, about $3.9 million in labor income, and $15.9 million in total economic output for tribal entitlement holders in California, under the Enhanced Coordination Alternative, with a shortage of 3.0 maf; for Nevada tribal entitlement holders, under the same alternative and shortage level, there would be an estimated reduction of over 10 jobs, about $0.1 million in labor income, and $0.9 million in total economic output. There are no expected impacts on economic contributions under all other alternatives, including the CCS Comparative Baseline and No Action Alternative.

The analysis on economic contributions provides estimated impacts per year of shortage. If shortages continue over multiple years, there will continue to be impacts on economic conditions, including reductions in jobs, labor income, and economic output. Depending on the magnitude of the water delivery shortages each year and the number of years of shortage, impacts on economic contributions could lead to farms ceasing operations permanently, especially for small farmers with limited resources for withstanding multiple years of fallowed lands. If farms cease operating, there could be large, cascading impacts throughout the local and regional economies, especially in regions that heavily rely on agriculture to support livelihoods and wellbeing throughout the communities. For more information on long-term impacts on changing land use and water deliveries due to water shortages to irrigation entitlement holders, see **TA 4**, Water Deliveries, and **TA 17**, Population and Land Use.

Long-term and deep Colorado River water shortages could result in further impacts on the economic contributions to entitlement holders that have unused water entitlement above their current consumptive use. As discussed in the Methodology section above, as well as in the Shortage Allocation Model and Alternative Distribution Model Documentation (**Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation), the analysis of impacts on economic conditions due to changes in agriculture in this EIS is based on modeled shortage volumes to irrigation entitlement holders that are calculated based on consumptive use shortage relative to the consumptive use (or modeled equivalent) entitlement, in order to allow for comparison across the alternatives and shortage distribution methods. On average, from 2019 to 2023, consumptive use was estimated at 87 percent and 85 percent of entitlement for non-tribal irrigation entitlement holders in Arizona and California, respectively. Consumptive use as a

percentage of entitlement was considerably less for tribal irrigation entitlement holders across the analysis area, with consumptive use making up approximately 66 percent of entitlement for tribal irrigation entitlement holders, on average, across Arizona, California, and Nevada (Reclamation 2019, 2020, ,2021, 2022, 2023). During long-term shortages, these irrigation entitlement holders with current consumptive use that is less than their entitlement could experience further impacts on economic contributions through the loss of future opportunities to expand their water consumption, through future developments or leasing water to other end users. These future impacts could reduce economic contributions associated with either future expansion of crop production or future opportunities to lease water.

The analysis of impacts on economic conditions discussed above examines the impacts of shortages on agriculture entitlement holders. If there is not enough water in Lake Mead to fully meet downstream demands and/or if Hoover Dam infrastructure constraints result in releases below the demand volume, other measures would be taken in the Lower Basin, such as water conservation or dead pool–related reductions. During some instances of dead pool–related reductions, these unplanned reductions occur because Lake Mead is approaching dead pool (elevation 895 feet) and in some cases it occurs earlier (up to elevation 950 feet). If there are dead pool–related reductions, the impacts on acreages fallowed would likely extend to other types of crops that were not analyzed in this analysis due to the high profitability and low water use of the crops; the crops that are present in the analysis area but were not part of the fallowed crops analyzed include lettuce and leafy greens vegetables, legume and solanum vegetables, melons and gourds, sugar beets, and sweet corn. Increases in fallowed lands of these high-valued types of crops would likely lead to greater and longer-term effects on the production value as well as the jobs, labor income and economic output associated with the loss of crop production. The magnitude of these impacts depends on many factors, including the water distribution methods and conservation measures that are implemented; the approach to distributing reductions associated with dead pool is not addressed in this analysis. See the subsection *Shortage vs. Dead Pool-Related Reductions: Comparison for Full Lower Basin,* under **TA 4**, Water Deliveries, for a discussion on the relationship between shortages and dead pool–related reductions for water deliveries across all entitlement holders.

In addition to impacts on economic conditions, increases in water shortages would likely lead to changes in quality and access to nonmarket values and social conditions associated with changes in agriculture. As more land is fallowed due to shortages in water delivered from the Colorado River, the livelihoods and the way of life of individuals throughout the surrounding communities could change, which can impact how the individuals perceive their sense of place and interact with the local communities, land, and individuals around them. Many communities, especially tribes in the surrounding regions, value the use of Colorado River water for irrigation for the food that it supports as well as for access to cultural, traditional, and spiritual purposes, and impacts on agriculture can greatly reduce access to and quality of these values (Curtis et al. 2023). Additionally, impacts on agriculture due to water shortages can affect the well-being of communities through effects on access to affordable health and dental care, especially for tribes and farmers who rely on agricultural revenues to pay for healthcare. For non-tribal entitlement holders in Arizona and California, when the total shortages are less than or equal to 3.0 maf, the greatest impacts on social conditions and access and quality of nonmarket values associated with agriculture are likely to occur under the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives; with

shortages greater than 3.0 maf, the greatest impacts on social conditions and nonmarket values due to changes in agriculture are likely to occur under the Maximum Operational Flexibility and Enhanced Coordination Alternatives, for non-tribal agriculture entitlement holders in Arizona and California. For Arizona tribal entitlement holders, under shortages of 0.6 maf, impacts on social conditions and access to and quality of nonmarket values associated with agriculture would be the greatest under the Supply Driven Alternative (LB Pro Rata approach); with shortages greater than 0.6 maf but not more than 2.0 maf, impacts on social conditions and access to and quality of nonmarket values would be greatest under the Basic Coordination Alternative; with shortages greater than 2.0 maf, impacts on social conditions and access and quality of nonmarket values would be the biggest under the Maximum Operational Flexibility Alternative. For California and Nevada tribal entitlement holders, impacts on social conditions and access and quality of nonmarket values would be greatest under the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives, and there would be little to no impacts on social conditions and access and quality of nonmarket values under all other alternatives and the CCS Comparative Baseline. For more information on the impacts on tribal interests and tribal entitlement holders, see **TA 13**, Tribal Resources, and **TA 18**, Indian Trust Assets.

As discussed above in the *Assumptions* subsection, under *Agriculture*, the analysis of impacts on economic and social conditions due to changes in agriculture assumes that water shortages would lead to an increase in fallowed lands rather than a change in water sources—for example, a switch to use groundwater or other surface water sources for irrigation. If other surface water or groundwater sources are used instead of fallowing agriculture acreages, the impacts on economic and social conditions due to lost agriculture production are likely to be lessened, at least in the short term. However, the reliance on more pumped groundwater to offset delivery shortages can lead to substantial additional pumping costs, particularly for electricity (for an analysis of impacts on hydropower, including impacts on energy generation, please reference **TA 15**, Dams and Electrical Power Resources). The magnitude of the increase in costs due to pumping groundwater depends on several factors including the proximity of the agriculture land to the Colorado River. If there are large increases in cost for agriculture production—for example, on land near the Colorado River and for farmers who previously had low costs for Colorado River water delivery—the increase in cost would lead to reduced profitability of crops and could lead to an increase in fallowed lands and reduced agriculture production, especially for small farmers who are not able to absorb higher operating costs or who produce low-profitable or water-intensive crops. Additionally, in the long term, if water delivery shortages continue over multiple years and there is more sustained reliance on groundwater for irrigation, resulting in the depletion of aquifers, the water supply of both groundwater as well as the surface water from the Colorado River could reduce, which would likely lead to greater levels of fallowed lands, a decrease in market value of crops produced, and a reduction in jobs, labor income, and economic output. A greater demand for groundwater could also lead to impacts on users and tribes who rely on groundwater for irrigation and domestic needs, similar to those impacts on economic and social conditions discussed above.

TA 16.2.3 Issue 2: How would operational changes affect economic contributions and the value associated with lake-based and river-based recreation?

Economic contribution analysis is presented below in **Table TA 16-23** for Lake-based **and Table TA 16-24** for River-based recreation for the CCS Comparative Baseline. Qualitative analysis is provided by action alternative based on potential changes to recreational visitation data.

Table TA 16-23
Economic Contributions- Lake-Based Recreation — CCS Comparative Baseline, 2025$

	Employment (jobs)	Output ($)	Labor Income ($)
Glen Canyon Totals	**3,697**	**484,052,913**	**164,064,861**
Direct	2,878	343,102,820	119,990,451
Indirect	412	68,662,216	22,184,610
Induced	407	72,287,877	21,889,800
Lake Mead Totals	**1,768**	**266,778,297**	**93,043,949**
Direct	1,223	159,360,100	59,751,812
Indirect	243	50,135,433	15,668,510
Induced	302	57,282,764	17,623,628

Source: IMPLAN 2025

Table TA 16-24
Economic Contributions- River-Based Recreation — CCS Comparative Baseline, 2025$

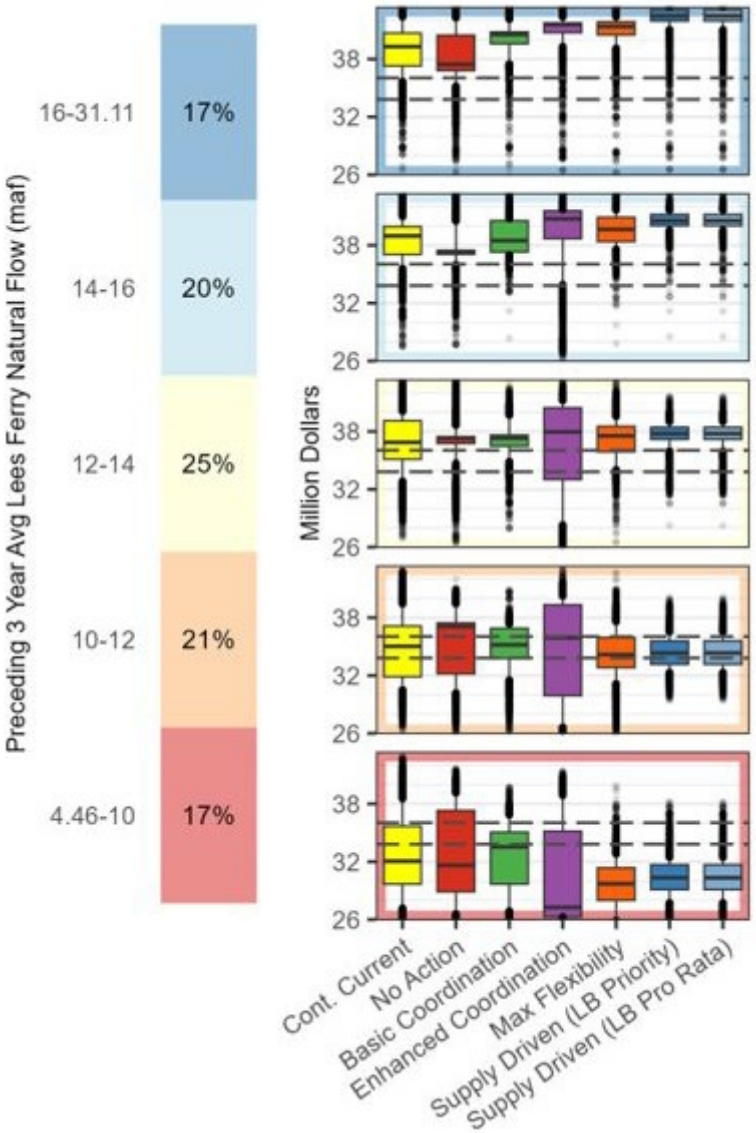
	Employment (jobs)	Output ($)	Labor Income ($)
Grand Canyon Totals	**6,805**	**846,100,020**	**163,163,321**
Direct	5,301	584,485,312	119,097,734
Indirect	765	129,646,343	22,299,651
Induced	740	131,968,365	21,765,936

Source: IMPLAN 2025

Figure TA 16-6 and **Figure TA 16-7** illustrate how the different Post-2026 operational alternatives perform in maintaining angling and boating recreational value across a wide range of plausible future hydrologic conditions. For white-water boating, the lower reference line (33.81 million dollars of annual value) represents a 'bad year' for economic value of whitewater rafting. It is calculated by modeling CCS Comparative Baseline in 2000-2023 hydrology and taking the 10th percentile (i.e. only 10 percent of years resulted in less than or equal to a value of 33.81 million dollars). The upper reference line (36.05 million dollars) represents a 'normal year' and is calculated as the 50th percentile of CCS Comparative Baseline tested in 2000-2023 hydrology. The same approach is taken for angling values, with the lower reference line (lowest 10th percentile) of 1.77 million dollars representing poor past performance and 1.84 million dollars (50th percentile) for the upper reference line of a "normal" year (Bair 2026). Below these levels, impacts on overall recreational

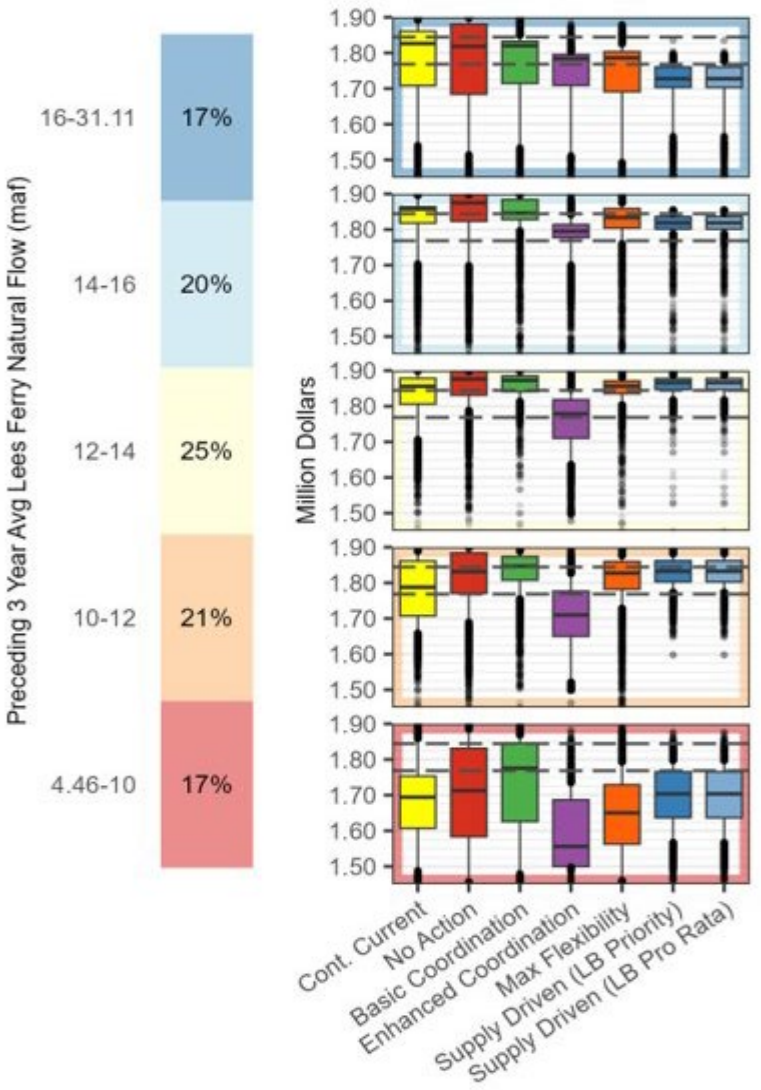
values from these uses would be anticipated. It should be noted that the conditional box-plots for all alternative exhibit a high range of variability of data, particularly in the case of angling value, with outliers at the high and low ends of the economic value output. As a result, the alternative comparison below focuses primarily on median and the interquartile range.

Figure TA 16-6
Annual Value of Whitewater Rafting Conditional Box Plot (2025 dollars)



Source: Bair 2026

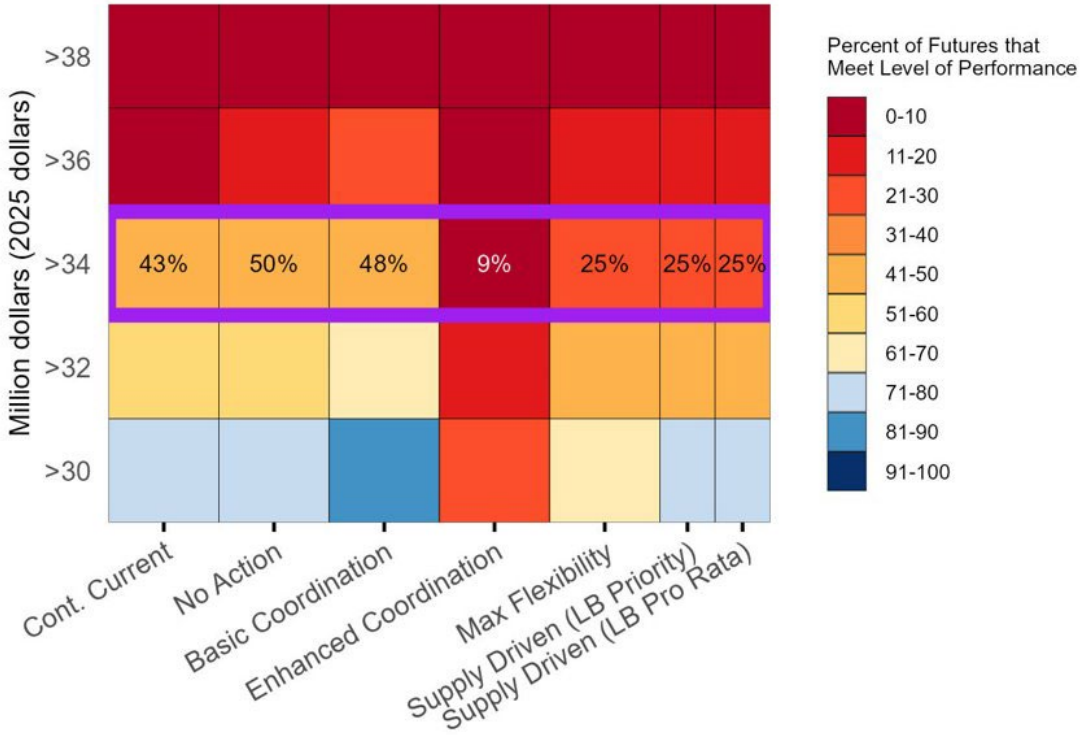
Figure TA 16-7
Annual Value of Angling Conditional Box Plot (2025 dollars)



Source: Bair 2026

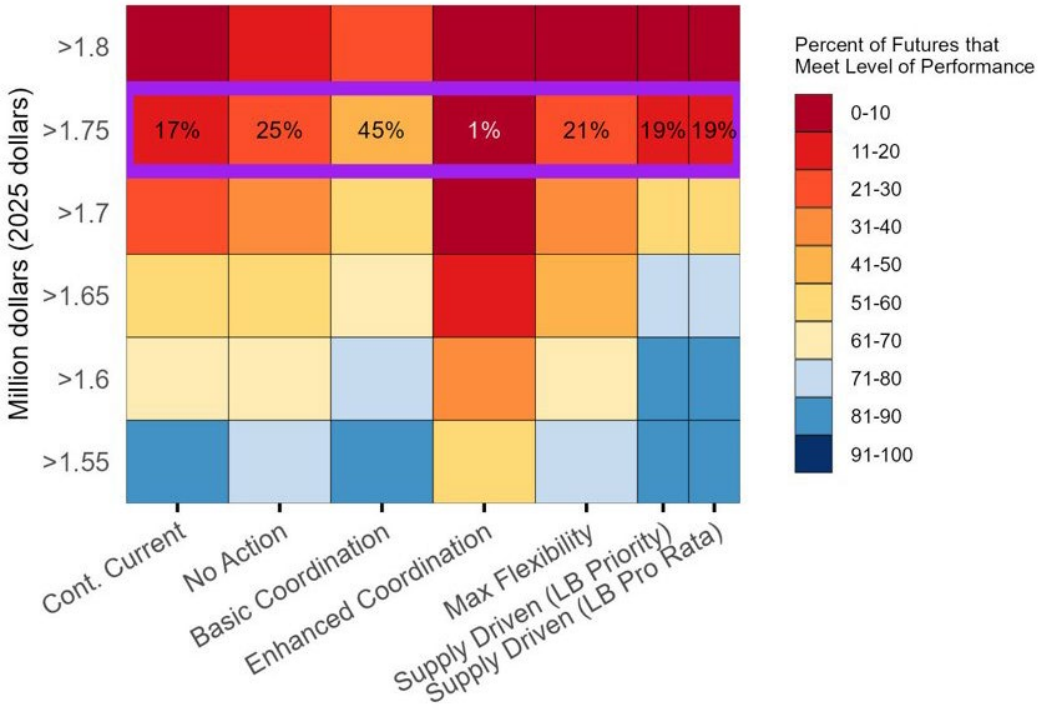
Figure TA 16-8 and **Figure TA 16-9** carry forward the minimum performance threshold representing the worst 10 percent of recreational value outcomes (i.e., 34 million dollars for whitewater boating and 1.8 million dollars for angling), as indicated in the purple highlighted row. These figures show a heatmap for the complete modeling period, with the percentage of futures indicated which meet the specified level of performance for at least 90 percent of years.

Figure TA 16-8
Whitewater Boating Economic Value: Robustness.
Percent of futures in which the annual value of whitewater boating exceeds the value specified in each row in at least 90% of years



Source: Bair 2026

Figure TA 16-9
Angling Economic Value: Robustness.
Percent of futures in which the annual value of angling exceeds the value specified in each row in at least 90% of years



Source: Bair 2026

Operational changes influence recreation primarily through their effects on reservoir elevations and river flows, which in turn shape visitor access, trip quality, and spending patterns. The following discussion examines how these dynamics affect economic contributions and recreational value across lake-based and river-based settings.

For lake-based recreation, under the CCS Comparative Baseline, recreation-related economic contributions are shaped by projected reservoir conditions that affect access and participation. Lake Powell recreation access under CCS Comparative Baseline would be similar to the No Action Alternative, with 15 percent and 17 percent of futures, respectively, over the full analysis period meeting thresholds for recreational site access in Lake Powell and 66 percent, and 56 percent of futures respectively met for navigational thresholds (see **TA 14**, Recreation). For Lake Mead, CCS Comparative Baseline succeeds in only 17 percent of futures, and the No Action Alternative, which has the worst performance at an 8 percent success rate over the full analysis period for recreational site access. Similarly, for navigation thresholds, the No Action Alternative and CCS Comparative Baseline are the least robust, succeeding in 29 percent of futures (**TA 14**, Recreation).

IMPLAN results for the CCS Comparative Baseline (**Table TA 16-23**) show current recreational activity supports approximately 3,697 jobs and $484.1 million in output related to recreation at Glen Canyon NRA 1,768 jobs and $266.8 million related to recreation at Lake Mead NRA. These totals

reflect direct visitor spending and the indirect and induced effects that ripple through gateway economies. The CCS Comparative Baseline serves as the benchmark for comparing the action alternatives' potential impacts on recreation-related employment and economic activity.

As described in **TA 14**, Recreation (**Figures TA 14-1 and 14-2**), Lake Powell elevations for much of the analysis period are expected to remain below critical thresholds for some launch facilities and navigational routes across all alternatives, resulting in reduced reservoir boating opportunities. Lake Mead faces similar challenges across all alternatives in maintaining elevations above navigational hazard thresholds (**Figures TA 14-3 and 14-4**). These access limitations are expected to suppress lake-based recreational spending. Research supports the link between lake levels and recreational spending and employment. Water-based recreation represents a large share of visitor activity at Lake Powell, with 46 percent of visitors participating in motorized boating (NPS 2018). Studies have found lake volume to be a predictor of visitation and spending: a 100,000-af increase in Lake Powell volume was associated with 5,280 additional visits and $374,000 in spending in Coconino County (Nehr et al. 2013). Duvel et al. 2022, found that reservoir elevation for Lake Powell had a positive, statistically significant effect on total monthly recreational visits, and a negative correlation with unemployment. Conversely, reductions in elevation from 3,675 to 3,625 feet were estimated to result in more than a 25 percent decline in visitation (Johnson et al. 2016). Similar patterns are expected at Lake Mead, where low water levels would render most boat launches inaccessible and increase navigational hazards, reducing visitor experience and spending (Reclamation 2024), although some studies suggest this relationship may be less robust than that in Lake Powell. Reservoir elevation was estimated to have a positive, but not statistically significant effect on total monthly recreational visitors in a study by Duval et al. (2022). These changes could affect concessionaire viability and reduce revenue streams for gateway businesses reliant on extended recreational seasons (Reclamation 2024).

River-based recreation, including angling in Glen Canyon and whitewater rafting in Grand Canyon, is sensitive to flow conditions below Glen Canyon Dam. As noted in the **TA 14**, Recreation, flows below 10,000 cubic feet per second (cfs) and above 45,000 cfs are considered less than optimal for rafting, while flows between 20,000 and 26,000 cfs are optimal. Commercial guides identify 8,000–9,000 cfs as the minimum level necessary for safe trips. Analysis for impacts of proposed management on flow indicates that the No Action Alternative is slightly less robust than the CCS Comparative Baseline at maintaining daytime flows of at least 8,000 cfs for 64 percent of futures across the modeling period, compared to 69 percent under the CCS Comparative Baseline. This suggests the No Action Alternative may provide less consistent support for preferred rafting conditions than current conditions (see **TA 14**, Recreation, **Table TA 14-5**). Variability in flows could influence trip quality and safety, which in turn affects both the value associated with the recreational experience and economic contributions from commercial river trips and related services in gateway communities.

IMPLAN output for CCS Comparative Baseline for GCNP estimates support for 6,805 jobs and $846.1 million. As for lake-based recreation, these totals reflect direct visitor spending and the indirect and induced effects that ripple through gateway economies.

CCS Comparative Baseline and the No Action Alternative are successful at keeping both whitewater boating values above determined thresholds feet 90 percent of the time in 43 percent and 50 percent of futures, respectively. For angling CCS Comparative Baseline and the No Action Alternative are successful at keeping values above determined thresholds 17 percent and 25 percent of the time respectively. When examining conditional box plots, under wet and moderate hydrologic conditions, all alternatives and the CCS Comparative Baseline maintain recreational value associated with boating and angling above the established critical threshold ranges. Under dry hydrologic conditions, CCS Comparative Baseline and the No Action Alternative median values fall below the threshold levels for whitewater boating although the upper quartile falls above the minimum thresholds for both the CCS Comparative Baseline and the No Action Alternative. For angling recreational value, under dry hydrologic conditions, the CCS Comparative Baseline remains below the defined thresholds, however, under the No Action Alternative, the upper quartile (Q3) falls above the minimum range. This data indicates that under the No Action Alternative and CCS Comparative Baseline, under dry hydrological conditions, future recreational values could be affected.

Under the Basic Coordination Alternative, greater flexibility in releases begins to shift the frequency and duration of low-elevation periods, with implications for both lake access and river flow stability. The Basic Coordination Alternative introduces shortages up to 1.48 maf and allows Lake Powell releases to fall to 7.0 maf in low-storage years. These operational changes increase the frequency and duration of low-elevation conditions at Lake Mead and Lake Powell, reducing marina operability and shortening boating seasons. For Lake Powell, in terms of recreational site access, the Basic Coordination is less robust than the CCS Comparative Baseline and No Action Alternative, with only a 15 percent success rate over the full analysis period. For navigation in Powell, the Basic Coordination Alternative performs similarly to the No Action Alternative and the CCS Comparative Baseline, succeeding in 61 percent of futures (see **TA 14**, Recreation). For Lake Mead, the Basic Coordination Alternative succeeded in 35 percent of futures for recreational site access and met desired threshold for navigation in Mead in 37 percent of futures, more robust performance than both the CCS Comparative Baseline and No Action Alternative (see **TA 14**, Recreation).

These data indicate that economic contributions under the Basic Coordination Alternative may be reduced as compared to the CCS Comparative Baseline and No Action Alternative for both Lake Powell and Lake Mead.

For river-based recreation, the Basic Coordination Alternative has a similar level of robustness for white water boating value as the No Action Alternative (48 percent of futures having a value above the defined threshold). For angling recreational value, the Basic Coordination Alternative is more robust than the No Action Alternative, with 45 percent of futures maintaining values above the defined threshold for 90 percent of modeled years compared to 25 percent in the No Action Alternative. When examining conditional box-plots, under dry hydrologic conditions, for whitewater boating the Basic Coordination Alternative performs better than the No Action Alternative, with the median just below the identified lower critical threshold, there is less variability in the range of outcomes under this alternative. For angling, the Basic Coordination Alternative performs the best of all Alternatives under dry hydrologic conditions, with the median within the identified threshold range. DMDU analysis performed in **TA 14**, Recreation (**Figure TA 14-5**) also indicates that the Basic Coordination Alternative performs more robustly than the No Action Alternative in

maintaining daytime flows of at least 8,000 cfs, which are considered minimally adequate for rafting (81 percent of futures compared to 69 percent of futures), supporting continued or increased economic contributions from commercial river trips over the full modeling period.

For river based recreation, the Enhanced Coordination Alternative would be the least robust in at maintaining or exceeding minimum desired daytime flows to support boating in Grand Canyon (only 14 percent of futures would meet the defined threshold (**TA 14**, Recreation, **Figure TA 14-5**). DMDU modeling output for angling and boating aligns with these findings, with whitewater boating and angling values having the least robust performance of all alternatives, with only 9 percent and 1 percent of futures meeting or exceeding defined thresholds for recreational value for boating and angling respectively. When examining conditional box-plots, under dry hydrologic conditions, this is the worst performing alternative for both whitewater boating and angling, with the median falling far below the identified minimum threshold (with a median of approximately 27 million dollars in annual value for whitewater boating and 1.55 million dollars for angling). As a result, this alternative would result in the greatest potential for a reduction in recreational value for whitewater rafting and angling as well as the associated regional economic contributions associated with this use.

For reservoir-based recreation, the Enhanced Coordination Alternative introduces proactive storage balancing and shortages up to 3.0 maf. This alternative is among the most robust in terms of meeting thresholds for recreational site access and navigation in Lake Powell (see **TA 14**, Recreation). Consequently, economic contributions from lake-based recreation would likely be higher than the CCS Comparative Baseline and No Action Alternative. For Lake Mead, analysis indicates that recreational site access thresholds would be achieved in 37 percent of futures, and navigation thresholds achieved in 58 percent of futures, more robust than both the CCS Comparative Baseline and No Action Alternative. As noted above, as under all alternatives, however, access to launch facilities and safe navigation routes for Lake Powell and navigational challenges in Lake Mead would continue to impact lake-based recreational opportunities and the associated spending, though storage balancing may help limit the duration of extreme low-elevation periods compared to the other action alternatives.

The Maximum Operational Flexibility Alternative allows shortages up to 4.0 maf and Powell releases as low as 5.0 maf. In terms of flow conditions, daytime flows below Glen-Canyon Dam under this alternative are more volatile than under the CCS Comparative Baseline and No Action Alternative, increasing the likelihood of extended periods below 8,000 cfs and even near 5,000 cfs which are considered adverse for rafting (42 percent of futures would meet threshold conditions) (see **TA 14**, Recreation, **Figure TA 14-2**). These conditions would diminish trip quality and safety, reducing long-run economic contributions from river-based recreation and nonmarket values tied to scenic quality and experience. DMDU modeling output for angling indicates that the Maximum Operational Flexibility Alternative performs similarly to the No Action Alternatives, with 21 percent of futures meeting the minimum defined thresholds 90 percent of future years. For whitewater boating, however, the Maximum Operational Flexibility Alternative is less robust than the No Action Alternative, with 25 percent of futures meeting or exceeding the defined threshold for recreational value. When examining conditional box-plots, under dry hydrologic conditions, for angling value and whitewater boating the Maximum Operational Flexibility Alternative performs

worse than the No Action Alternative and CCS Comparative Baseline, with the median and upper quartile (Q3) below the defined minimum threshold.

In terms of reservoir elevations, **TA 14**, Recreation, indicates that under the Maximum Operational Flexibility Alternative, access to recreational sites in Lake Powell is among the most robust alternative, with access maintained in 26 percent of futures. Similarly for navigation in Powell, thresholds are achieved in 84 percent of futures (compared to 66 percent and 56 percent in the CCS Comparative Baseline and No Action Alternative, respectively). For Lake Mead, recreation access and navigation is similarly more robust than the No Action Alternative and the CCS Comparative Baseline. As discussed under for the Maximum Operational Flexibility Alternative, consequently, economic contributions from lake-based recreation would likely be higher than the CCS Comparative Baseline and No Action Alternative. As under all alternatives, however, access to launch facilities and safe navigation routes for Lake Powell and navigational challenges in Lake Mead would continue to impact lake-based recreational opportunities and the associated spending.

The Supply Driven Alternative ties Powell releases to a percentage of three-year average natural flow and applies Mead shortage tiers up to 2.1 maf. Within this framework, two approaches for the Supply Driven Alternative were considered: a Pro Rata approach, which distributes available Colorado River water supplies proportionally across entitlement holders, and a Priority approach, which distributes available Colorado River water supplies in accordance with statutes, case law, and contracts. For Lake based recreation, for Lake Powell both the Priority and Pro Rata approaches would be less robust than the No Action Alternative and the CCS Comparative Baseline which could further impact recreational spending and gateway businesses and concessionaire associated with Lake Powell. In contrast, for Lake Mead, the Supply Driven Alternative modeling represents the most robust outcomes for recreational site access and navigation, supporting continued or increased spending associated with recreational activities for this reservoir.

For river-based recreation, the Supply Driven Alternative (both LB Priority and LB Pro Rata approaches) is the most robust at maintaining or exceeding daytime flows of 8,000 cfs below Glen Canyon Dam over the full modeling period, providing the strongest support for maintained or improved recreational value for boating and angling, and economic contributions associated with river based recreation. DMDU modeling output for angling indicates that the LB Priority and Pro Rata Supply Driven Alternative performs similarly to the No Action Alternatives, with 19 percent of futures meeting the minimum defined thresholds 90 percent of future years. For whitewater boating, however, the Maximum Operational Flexibility Alternative is less robust than the No Action Alternative, with 25 percent of futures meeting or exceeding the defined threshold for recreational value. When examining conditional box-plots, under dry hydrologic conditions, for angling value and whitewater boating both the LB Priority and Pro Rata perform similarly to the No Action Alternative and CCS Comparative Baseline, with the median values slightly below that of the No Action, although there is a smaller range of variability in the Supply Driven Alternative, and as a result the upper quartile (Q3) of data does not fall within the identified minimum threshold.

TA 16.2.4 Issue 3: How would anticipated water shortages and changes in water levels in reservoirs and river segments affect access and quality of nonmarket values?

Nonmarket values with potential to be affected by operations generally encompass cultural identity, recreational quality, aesthetics, and existence values, and may vary based on site specific conditions, user preferences and other factors. However, in general, the alternatives that facilitate higher reservoir elevations, and maintain more consistent flows along the Colorado River including through Grand Canyon would result in the reduced impacts on identified nonmarket values.

During wet hydrologic conditions, the range of alternatives would generally produce conditions where lake levels and flows along the Colorado River would result in minimal impacts on nonmarket values. For example, nonmarket values such as scenic integrity, solitude, and cultural connections to the river corridor would be maintained at a level similar to current conditions. Recreational experiences for boating, angling, and rafting maintain their quality, supporting sense of place for gateway communities and visitors. Ecological services, including riparian habitat and wildlife viewing opportunities, remain similar to current conditions (see **TA 8**, Fish and Aquatic Resources), and cultural landscapes retain the factors which are associated with nonmarket values (see **TA 11**, Cultural Resources).

As conditions become drier, however, the No Action Alternative and CCS Comparative Baseline would result in the most modeled futures where impacts could occur to resources with nonmarket values. For example, nonmarket values for recreation and ecosystem services could be reduced in instances of prolonged drought, which could reduce shoreline aesthetics and diminish the opportunities for solitude at Lake Powell and Lake Mead over time (see **TA 14**, Recreation). Extended low-flow periods could also impact river-based experiences in Grand Canyon due to changes in setting which could impact to perceived naturalness (see **TA 3**, Hydrologic Resources). Cultural and spiritual values tied to iconic landscapes and cultural artifacts could also be affected in low-hydrologic flow periods (see **TA 11**, Cultural Resources). Ecological services such as riparian habitat stability may decline, influencing nonuse values related to wildlife and vegetation communities (see **TA 8**, Fish and Aquatic Resources).

Under drier conditions, the Enhanced Coordination and Maximum Operational Flexibility Alternatives would more robust in terms of the support for nonmarket values, particularly for values associated with Lake Powell. Reservoir levels would be maintained at thresholds that support access for boating and camping in more modeled futures, supporting experiential benefits and cultural connections (see **TA 11**, Cultural Resources). The quality of river-based recreation is expected to remain high, due to increased stability with flow-dependent activities (see **TA 14**, Recreation). Nonuse values tied to ecosystem services, such as wildlife habitat and riparian vegetation, would also be supported (see **TA 8**, Biological Resources – Fish and Other Aquatic Resources).

More frequent low-elevation conditions could occur in the Basic Coordination Alternative, which could noticeably affect nonmarket values tied to lake-based recreation and scenic quality (see **TA 14**, Recreation) although at a reduced level compared with the No Action Alternative and the CCS Comparative Baseline. Reduced reservoir levels may expose previously submerged areas, altering visual character and diminishing the opportunities for solitude. River-based recreation could

experience flow variability that affects trip quality and angling success (see **TA 3**, Hydrologic Resources).

Outcomes produced by the Supply Driven Alternative vary depending on the hydrology and location. In wet years, the nonmarket values remain similar to those under the CCS Comparative Baseline; however, in dry sequences, reduced reservoir elevations and altered flow regimes would diminish the scenic quality and access for boating and angling (see **TA 14**, Recreation), for Lake Powell. For Lake Mead, the Supply Driven Alternative is the most robust for supporting reservoir levels at Lake Mead which support the nonmarket values. River-based recreation would experience moderate variability in trip quality, while ecosystem services and the associated nonuse values would fluctuate with water availability (see **TA 8**, Biological Resources – Fish and Other Aquatic Resources). Cultural and spiritual values tied to river corridors may also be affected during extended drought periods (see **TA 11**, Cultural Resources).

TA 16.2.5 Summary Comparison of Alternatives

Issue 1: How would anticipated water shortages affect economic contributions and social conditions from agriculture?

The lowest impacts on economic and social conditions from reductions in agricultural production and increases in fallowed lands due to shortages in irrigation water, across all alternatives, states, and tribal and non-tribal irrigation entitlement holders, would occur under the No Action Alternative due to the low maximum shortage of 0.6 maf; however, across the action alternatives, impacts on economic and social conditions from changes in agriculture would vary across irrigation entitlement groups, based on the maximum shortage levels and water shortage distribution methods. Under low shortage levels, for all irrigation entitlement holders except Arizona tribal (Arizona non-tribal, California non-tribal, California tribal, and Nevada tribal irrigation entitlement holders), impacts on the economic and social conditions due to reductions in agricultural production would tend to be lower under the alternatives with priority shortage distribution methods (such as under the Basic Coordination, Maximum Operational Flexibility, and Supply Driven [LB Priority approach] Alternatives), and impacts would tend to be higher under the alternatives with pro rata shortage distribution methods (under the Enhanced Coordination and Supply Driven [LB Pro Rata approach] Alternatives). In contrast, under low shortage levels, for Arizona tribal irrigation entitlement holders, impacts on the economic and social conditions due to reductions in agricultural production would be similar across all action alternatives. During times of extensive drought, when maximum shortage levels are implemented, for all irrigation entitlement holders except Arizona tribal, impacts on the economic and social conditions from agricultural activity would tend to be lower under the alternatives with a low maximum shortage level and priority shortage distribution methods (such as under the Basic Coordination Alternative), and impacts would tend to be higher under the alternatives with a high maximum shortage level or pro rata shortage distribution methods (such as the Enhanced Coordination, Maximum Operational Flexibility, or Supply Driven [LB Pro Rata approach] Alternatives), compared with the other action alternatives. However, for Arizona tribal entitlement holders, during times of maximum shortage levels, lower impacts on the economic and social conditions due to reductions in agricultural production would occur under the alternatives with pro rata shortage distribution methods (such as under the Enhanced Coordination, Maximum Operational Flexibility, or Supply Driven [LB Pro Rata approach] Alternatives) and higher impacts

would occur under the alternatives with priority shortage distribution methods (such as under the Basic Coordination, Maximum Operational Flexibility, and Supply Driven [LB Priority approach] Alternatives), compared with the other action alternatives. Overall, the alternatives demonstrate a trade-off between shortage distributions across irrigation entitlement holders, flexibility in the maximum allowable shortage implementation, and the ability to support stable agricultural production and social well-being.

Issue 2: How would operational changes affect economic contributions and value associated with lake-based and river-based recreation?

Recreation-based economies are highly sensitive to changes in reservoir elevations and river flow conditions. Under the alternatives that sustain more stable water levels, boating and shoreline access would remain consistent, supporting steady visitation and related spending that currently contributes about 12,000 jobs and $1.6 billion in output across the Basin.

Operational changes under the proposed alternatives would influence these conditions in different ways. The alternatives that maintain higher and more consistent water levels would preserve boating access, marina operations, and shoreline recreational opportunities. This stability would support continued visitation and minimize disruptions to businesses dependent on tourism. Conversely, the alternatives that result in greater variability in lake elevations and river flows would affect the recreational quality and access and the related levels of contributions.

The Supply Driven Alternatives (both LB Priority and LB Pro Rata approaches) poses the greatest risk to recreation-based economies relying on economic contributions from reservoir-based recreation in Lake Powell, while the CCS Comparative Baseline and the No Action Alternative have the least robust modeled performance for supporting recreational opportunities and spending associated with Lake Mead recreation. In contrast, the Enhanced Coordination and Maximum Operational Flexibility Alternatives would result in more consistent reservoir levels at Lake Powell to support recreation, and the Supply Driven Alternative would support the greatest level of contributions from recreation in Lake Mead. However, under all alternatives, access to launch facilities and safe navigation routes for Lake Powell and navigational challenges in Lake Mead would continue to impact lake-based recreational opportunities and the associated spending. As a result, outfitters and concessionaires operating in these areas would face increased uncertainty, affecting employment and revenue streams under all Alternatives. Research indicates that declines in lake elevation can reduce visitation by more than 25 percent, amplifying economic losses for local communities (Johnson et al. 2016). Lake Mead would experience similar constraints, with boating access severely limited during extended drought periods.

River-based recreation is also vulnerable to operational changes. Activities such as angling in Glen Canyon and whitewater rafting in Grand Canyon depend on stable flows to ensure safety and trip quality. Reduced flows shorten rafting seasons and diminish the overall experience, leading to lower recreational value and reduced demand for outfitter services and the associated hospitality sectors. The Basic Coordination Alternative would provide the most support for continued or increased economic value associated with boating and angling and related economic contributions. The Enhanced Coordination Alternative would be the least robust at maintaining or exceeding the minimum desired daytime flows to support boating in Grand Canyon; it also would result in the

greatest potential for a reduction in recreational value for whitewater rafting and angling as well as the associated regional economic contributions associated with these uses. Impacts would be most pronounced under dry hydrologic conditions.

Economic impacts extend beyond direct visitor spending. Gateway communities, often small and rural, rely heavily on tourism-related income to sustain local businesses and municipal services. When lake levels drop or river flows decline, these communities experience cascading effects, including reduced tax revenues and job losses in sectors such as lodging, food service, and transportation. The magnitude of these impacts would depend on the frequency and duration of low-elevation conditions, which would vary significantly across the alternatives.

Issue 3: How would anticipated water shortages and changes in water levels in reservoirs and river segments affect access and quality of nonmarket values?

Changes in reservoir elevations and river hydrology also influence nonmarket values such as scenic quality, solitude, and cultural and spiritual connections to the river corridor. More stable operating conditions preserve visual continuity and access to culturally important sites, supporting a sense of place and maintaining the experiential qualities associated with national parks, recreation areas, and other designated lands (see **TA 11**, Cultural Resources). In wet hydrologic conditions, all alternatives support the preservation of conditions which support nonmarket values. Under dry hydrologic conditions, however, the No Action Alternative and CCS Comparative Baseline would result in reductions in reservoir levels and greater variability in river flow especially as compared to the Enhanced Coordination and Maximum Operational Flexibility Alternatives. This would result in more frequent exposure of drawdown zones and shifts in shoreline character, diminishing the aesthetic and spiritual values tied to the river's natural appearance. Variability in flows and elevations could also affect the timing and accessibility of traditional practices for tribes and local communities. In general, the alternatives that moderate elevation changes better sustain these nonmarket benefits, while those allowing greater fluctuation introduce tradeoffs between resource protection and system adaptability.

TA 16.3 References

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