THE ECONOMIC IMPORTANCE OF THE COLORADO RIVER TO THE BASIN REGION

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RESEARCH INSTITUTE

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EXECUTIVE SUMMARY

- This study examines the economic importance of the Colorado River for the Upper and Lower Basin Regions for one calendar year (2012).

- Modified IMPLAN input-output models are used to estimate the Colorado River's economic importance to Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming at a state level and also for seven contiguous Southern California counties (treated as a single economy). The Southern California counties are Imperial, LA, Orange, Riverside, San Bernardino, San Diego, and Ventura.

- A separate, single IMPLAN run is then implemented for all recipients of Colorado River water in the entire Basin Region, to take into account the total flow of dollars among all states and counties examined in the Basin Region.[1]

- Economic impacts are estimated based on two assumptions:

    - The non-availability of Colorado River water for one full year (2012).[2]
    - The non-substitutability of the Colorado River water - that is, no other sources of water are available to compensate for the loss of Colorado River water deliveries for the study year.

- Three measures of economic impact are assessed for each geographical area studied. These are: Gross State Product (GSP),[3] employment,[4] and labor income.[5]

- The United States Bureau of Reclamation's (USBR) 2015 water demand projections for the Basin Region are used in conjunction with historical consumption data collated by the Federal agency as a proxy for water demand in each geographical area of study.[6]

- The following Table estimates the total amount of water consumption by geography in 2015 for a split of water demand into two categories: Agriculture, and Municipal & Industrial.

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[1] This is greater than a simple summation of the analyses for the Basin Region constituents studied because each state-specific analysis only takes into account any transactions wholly occurring within their state. They do not take into account any transactions made with other Basin Region states. For a more detailed explanation, please see page 31 in this report.

[2] The authors recognize that the total non-availability of Colorado River water for one full year is an unlikely scenario. However, it is the best way to arrive at a comprehensive estimate of the value of the Colorado River for the Basin Region economy.

[3] GSP represents the dollar value of all goods and services produced for final demand in a state. It is often used as a key measure of the health of a specific state's economy.

[4] Employment is a count of full- and part-time jobs for one full year.

[5] Labor income includes employee compensation (wages and benefits) and proprietor income.

[6] The latest available year of historical water consumption varies by Basin Region state, so it is possible that USBR's 2015 projections could be higher or lower than actual use.

Estimated Annual Water Consumption, and Percent Sourced from Colorado River, by Geography

GEOGRAPHY	AGRICULTURAL[7]		MUNICIPAL & INDUSTRIAL[8]	
	Total Requirement *Million Acre Feet (MAF)*	Percent Sourced from Colorado River	Total Requirement *Million Acre Feet (MAF)*	Percent Sourced from Colorado River
Arizona	2.20	49%	1.98	41%
Colorado	6.13	31%	1.25	41%
Nevada	0	0%	0.37	79%
New Mexico	0.72	15%	0.30	60%
Southern Cal. 7 Counties	3.52	92%	4.17	37%
Utah	2.04	22%	0.84	34%
Wyoming	1.95	20%	0.15	70%
Entire Basin Region	**16.56**	43%	**9.05**	**41%**

Source: USBR (2012)[9]

- The study assumes that over 7.15 MAF of the Basin Region's annual Agricultural water usage, and 3.72 MAF of the Basin Region's annual Municipal and Industrial water usage, are sourced from the Colorado River.

- The estimated total economic impacts of Colorado River water loss by Basin Region geography for one full calendar year is estimated in the following Table.

[7] Agricultural demand is defined by USBR as the water used to meet the irrigation requirements of crops, maintain stock ponds, and sustain livestock.

[8] Municipal & Industrial is defined by USBR as the water used to meet urban and rural population needs, including any industrial needs within urban areas. Commercial is included as part of the USBR's Municipal & Industrial estimates. Seidman has also included Energy and Mineral sector consumption in these totals.

[9] Source: USBR, (2012). *Technical Memorandum C – Quantification of Water Demand Scenarios*, available for download at: http://www.usbr.gov/lc/region/programs/crbstudy/techmemoC.html

Estimated Total Economic Impacts of Colorado River Water Loss by Geography

GEOGRAPHY	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*[10]	LABOR INCOME *Billions 2014 $*
Arizona	185.01	2,147,770	107.80
Colorado	188.95	2,147,141	115.97
Nevada	115.39	1,417,283	70.57
New Mexico	59.76	771,618	34.17
Southern Cal. 7 Counties	657.45	7,046,110	406.58
Utah	69.79	969,735	43.30
Wyoming	21.67	284,276	13.18

Source: Authors' Calculations

- The contribution of the Colorado River for the annual GSP of each Upper Basin state (Colorado, New Mexico, Utah, and Wyoming) is estimated to range from approximately $22 billion to $189 billion (2014 $).

- The contribution of the Colorado River for the annual GSP of each Lower Basin state (Arizona, Nevada, and the Southern California 7 counties) is estimated to range from $115 billion to over $657 billion (2014 $).

- The economic importance of the non-availability of Colorado River water for the *entire* Basin Region economy as a whole is summarized in the following Table.[11]

Estimated Impact of Colorado River Water Loss for the Entire Basin Region Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*[12]	LABOR INCOME *Billions 2014 $*
Direct Losses	694.78	7,859,245	434.29
Indirect Losses	231.12	2,361,250	139.35
Induced Losses	508.22	5,780,501	297.81
Total Estimated Economic Losses [13]	**1,434.12**	**16,000,996**	**871.45**

Source: Authors' Calculations

[10] A job year is equivalent to one person having a full-time job for exactly one year.
[11] For the purpose of these estimates, the Basin Region economy encompasses Arizona, Colorado, Nevada, New Mexico, Utah, Wyoming, and seven Southern California counties.
[12] A job year is equivalent to one person having a full-time job for exactly one year.
[13] Columns may not correspond exactly to totals due to rounding.

- Approximately 64.4% of the Basin Region's annual GSP could be lost if the Colorado River water is no longer available to residents, businesses, industry, and agriculture.

- To put this into perspective, the annual contribution of the Colorado River to the combined GSP of the Basin Region is equivalent to approximately one twelfth of total U.S. gross domestic product (GDP) in fiscal year (FY) 2012.[14]

- The annual contribution of the Colorado River to Basin Region GSP is also equivalent to approximately three times the total U.S. retail sales of Walmart in FY 2012.[15]

- The Top 5 private (non-Government) sectors estimated to experience the biggest shortfall in total GSP contributions if Colorado River water is unavailable for a year are:

    - Real Estate and Rental (e.g. any establishment engaged in renting, leasing or allowing the use of property, motor vehicles, consumer goods, and nonfinancial intangible assets) - $174.3 billion.
    - Healthcare and Social Services (e.g. ambulatory healthcare; child day care; hospitals; nursing; residential care; and vocational rehabilitation) - $148.6 billion.
    - Finance and Insurance (e.g. banking; credit intermediation; insurance; securities, commodities and trusts) - $137.1 billion.
    - Professional, Scientific and Technical Services (e.g. accounting and bookkeeping; advertising; architectural and engineering; computer services; consulting; legal; photography; research; translation services; veterinary services) - $130.6 billion.
    - Retail Trade (e.g. any establishment engaged in retailing merchandise) - $96.2 billion.

- Over 16 million public and private sector jobs in the Basin Region rely on the availability of Colorado River water each year, and $871 billion (2014 $) labor income.

- Focusing exclusively on private employment, the Colorado River is estimated to help generate almost 12.2% of national private employment in the Basin Region.[16]

- The availability and delivery of Colorado River water to municipal, industrial, and agricultural customers therefore has a crucial impact on the economic development of the region.

- The annual losses to GSP resulting from the non-availability of Colorado River water range from 49.5% to 87.4%, dependent on the geography studied.

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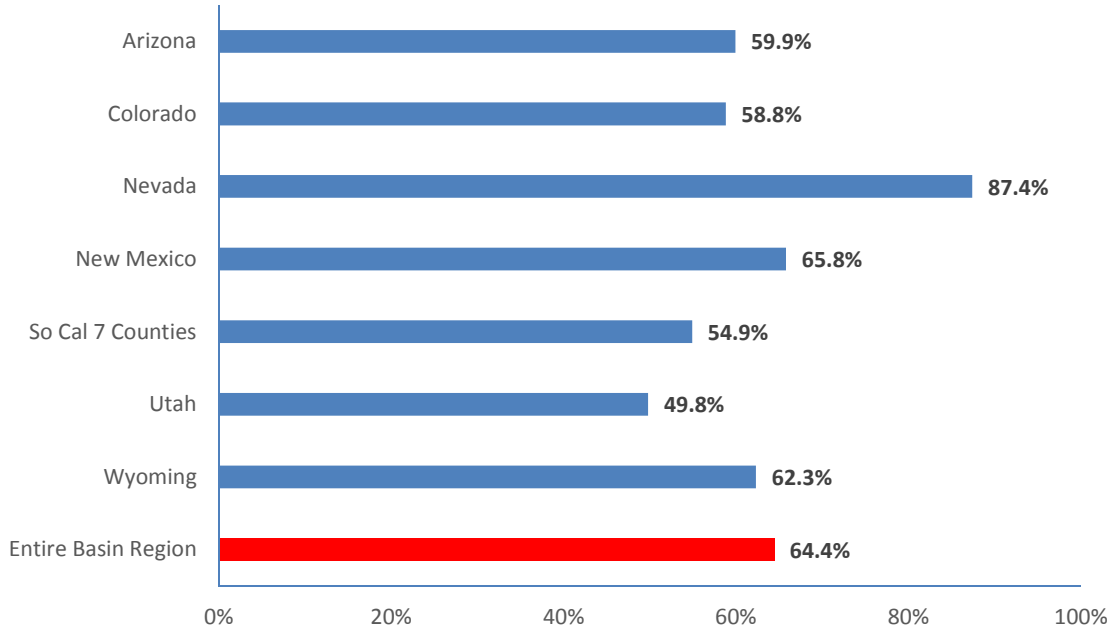
[14] GDP is the national equivalent of GSP. The GDP of the U.S. in current dollars in FY 2012 is $16.16 trillion (current $). Source: http://www.statista.com/statistics/188105/annual-gdp-of-the-united-states-since-1990/

[15] Source: http://fortune.com/fortune500/2013/

[16] Total U.S. private employment in 2012 was 115,610,216. Source: U.S. Census Bureau, (2014). State and County Quick Facts, available at: http://quickfacts.census.gov/qfd/states/00000.html

Percent GSP Losses in the Absence of Colorado River Water for One Year



Source: Authors' Calculations

- Given the linear nature of the IMPLAN models, an extrapolation of economic impacts based on uniform percentage declines in the availability of Colorado River water throughout the Basin Region's constituent geographies for one year, rather than its total absence, is possible and shown below.[17]

Extrapolated Estimates of Total Economic Impacts of Different Amounts of Colorado River Water Loss for the Entire Basin Region

PERCENT DECLINE IN AVAILABILITY OF COLORADO RIVER WATER	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Millions Job Years*	LABOR INCOME *Billions 2014 $*
10%	143.4	1.6	87.1
15%	215.1	2.4	130.7
25%	358.5	4.0	217.9
50%	717.1	8.0	435.7

Source: Authors' Calculations

[17] This extrapolation is only possible if, for example, a 10% decline in Colorado River water availability applies equally throughout the six Basin Region states and the seven Southern California counties studied. If the decline in water availability is not shared at a uniform percentage rate between the constituent geographies, the level of trade between those geographies will decline at different percentage rates, which will have non-linear consequences for the estimated combined economic impacts in the entire Basin Region.

- The inclusion of leisure benefits associated with Colorado River water, or Tribal water rights, will in all probability increase the economic impacts of Colorado River water availability for the Basin Region economies.[18]

- The authors also highlight inconsistencies in water data collation methods currently implemented by USBR and the United States Geological Survey (USGS). Both Federal agencies have expressed a long-term goal to collect water usage data in a more consistent manner.

- The authors therefore recommend the publication of withdrawal and consumption results on a more frequent basis, akin to the United States Energy Information Administration's (EIA) annual electric power analyses, to increase understanding of water issues throughout the nation.

[18] For example, a 2012 report produced by Protect the Flows and Southwick Associates estimates the recreational value of the Colorado River at $26 billion. See: http://protectflows.com/wp-content/uploads/2013/09/PTF-Fact-Sheet-Colorado.pdf. However, the key findings in the recreational report should not be added to the current study's estimates, as this could potentially result in at least some double-counting of impacts – e.g. for the Art, Entertainment, and Recreation sector.

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1.0 INTRODUCTION

The Colorado River stretches for 1,450 miles from the central Rocky Mountains in the U.S. in a southwesterly direction across the Colorado Plateau to Lake Mead, before turning south into Mexico, emptying into the Gulf of California between Baja California and Sonora.

Known for its dramatic canyons and whitewater rapids, the Colorado River is a vital source of water for agricultural and urban areas in seven U.S. and two Mexican states. The seven U.S. states are Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The two Mexican states are Baja California and Sonora.

Controlled by an extensive system of dams, reservoirs, and aqueducts, which furnish irrigation and municipal water supply for almost 40 million people both inside and outside the watershed, the Colorado's large flow and steep gradient are used for generating hydroelectric power. Its major dams also regulate peaking power demands in much of the Intermountain West.

Since the mid-20th century, intensive water consumption has dried the lower 100 miles of the Colorado River such that it no longer reaches the sea except in years of heavy run-off; and the United States Bureau of Reclamation (USBR) anticipates significant shortfalls between projected water supplies and demands in the Colorado River Basin in the coming decades.[19]

The principal objective of this study is to quantify the economic importance of the Colorado River to the seven U.S. bordering states for one full calendar or fiscal year. The analysis is carried out at a county level for Southern California, and at a state level for the remaining six U.S. states. The Southern California counties assessed in this study are: Imperial, LA, Orange, Riverside, San Bernardino, San Diego, and Ventura. No additional insights are provided for other California-based counties as they do not directly receive Colorado River water.

A series of IMPLAN models, customized by the research team for the Basin Region geographies, is used to estimate economic impacts.

Section 2 offers a brief history of Colorado River management.

Section 3 describes the study's method and data inputs.

The economic impacts of the Colorado River for each state and the group of Southern California states are estimated in Sections 4- 10.

[19] See: USBR, (2012). *Colorado River Basin Water Supply and Demand Study*, available for download at: http://www.usbr.gov/lc/region/programs/crbstudy.html

An estimate of total (negative) economic impact on the entire (combined) Basin Region is offered in Section 11 if Colorado River water is not available.[20]

Conclusions and recommendations are provided in Section 12.

[20] Seidman acknowledges the unlikelihood of the total non-availability of Colorado River water for one full year for an individual state or county in the Basin Region. However, this type of scenario represents the best way to arrive at a comprehensive estimate of the value of Colorado River water for the Basin Region economy.

2.0 COLORADO RIVER MANAGEMENT: A BRIEF HISTORY

The Colorado River stretches for 1,450 miles from the central Rocky Mountains in the U.S. in a southwesterly direction across the Colorado Plateau to Lake Mead, before turning south into Mexico, emptying into the Gulf of California between Baja California and Sonora. Joined by over 25 significant tributaries, including the Green River (UT) and Gila River (AZ), the Colorado is a vital source of water for approximately 40 million people in seven U.S. Basin States.[21] It is also of great importance to Baja California and Sonora in Mexico.

Colorado River water is used for agricultural, municipal, industrial and commercial purposes in both the U.S. and Mexico. The river is also described by the United States Bureau of Reclamation (USBR) as the "lifeblood" of 22 federally recognized tribes, 7 National Wildlife Refuges, 4 National Recreation Areas, and 11 National Parks.

In its natural state, the Colorado used to deposit up to 16.3 million acre-feet (MAF) of water into the Gulf of California each year. However, since 1960, intensive water consumption has dried the lower 100 miles of the river such that it no longer reaches the sea except in years of heavy run-off.

The treaties, compacts, decrees, statutes, regulations, contracts and other legal documents and agreements applicable to the allocation, appropriation, development, exportation and management of the waters of the Colorado River Basin are collectively known as the "Law of the River".

The Colorado River Compact lies at the heart of the "Law of the River". This defining document for Colorado River management was signed by the seven U.S. Basin States in November 1922, and is still in use today. The Compact allocates 7.5 MAF in total each year to the Upper Basin States, and a similar total amount to the Lower Basin States. Wyoming, Colorado, Utah and New Mexico are designated Upper Basin States. California, Arizona[22] and Nevada are designated Lower Basin States. State-specific allocations within the Upper and Lower Basins are left to the discretion of each group. The annual current apportionment of water by state is illustrated in Table 1.

The Compact is based on 1920s hydrologic data indicating Colorado River flow of 16.4 MAF at Lees Ferry. However, this USBR figure is increasingly believed to overestimate annual river flow. Three centuries of data indicates an average Colorado flow of about 13.5 MAF, with annual flows ranging from 4.4 MAF to over 22 MAF.[23]

A 1944 Water Treaty allocated 1.5 MAF to be delivered to Mexico each year.

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[21] The seven U.S. states are Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

[22] Although Arizona is a Lower Basin State, a small part is actually in the Upper Basin, entitling the state to an additional 50,000 acre-feet of Colorado River water each year.

[23] Source: Gelt, J., (1997). *Sharing Colorado River Water: History, Public Policy, and the Colorado River Compact*, The Water Resources Research Center, University of Arizona, available at: https://wrrc.arizona.edu/publications/arroyo-newsletter/sharing-colorado-river-water-history-public-policy-and-colorado-river

Table 1: Current Colorado River Apportionment by State

GEOGRAPHY	WATER APPORTIONMENT *Million Acre Feet (MAF)*
Upper Basin Allocation	**7.5**
Colorado	*3.9*
New Mexico	*0.85*
Utah	*1.7*
Wyoming	*1.0*
Lower Basin Allocation	**7.5**
Arizona	*2.8*[24]
California	*4.4*
Nevada	*0.3*

Source: USBR (2008)[25]

The original signatories of the Colorado River Compact also paid little attention to Indian water rights. However, in 1963 the Supreme Court guaranteed five Indian reservations in the Lower Basin annual rights to approximately 900,000 acre-feet of water;[26] and the Upper Basin tribes have subsequently secured around 1 MAF through federal legislation and court cases.

In December 2007, a set of interim guidelines signed by the U.S. Secretary of the Interior suggested a strategy for reallocating Colorado River water in the event of water shortages through 2026. The agreement specifies three levels of shortage conditions, based on the level of Lake Mead:

- **Light shortage:** When the surface elevation of Lake Mead ranges between 1,050 and 1,075 feet relative to mean sea level, the Lower Basin States' allocation will fall to 7.167 MAF per year.
- **Heavy shortage:** When the surface elevation of Lake Mead ranges between 1,025 and 1,050 feet relative to mean sea level, the Lower Basin States' allocation will fall to 7.083 MAF per year
- **Extreme shortage:** When the level of Lake Mead drops below 1,025 feet, the Lower Basin States' allocation will fall to 7 MAF per year.

There are potential economic implications associated with all three lower levels of water allocation listed above, thereby necessitating the need for the current study.

In December 2012, USBR also published a comprehensive study for the Colorado River Basin, identifying current and future imbalances in water supply and demand through 2060. This latter study also develops and analyzes adaptation and mitigation strategies to resolve the imbalances.

[24] An additional 50,000 acre-feet is allocated to Arizona from the Upper Basin apportionment.
[25] Source: USBR, (2008). *The Colorado River*, available at: http://www.usbr.gov/lc/hooverdam/faqs/riverfaq.html
[26] The five reservations are Chemehuevi, Cocopah, Colorado River, Fort Mohave and Quechan (Fort Yuma).

3.0 METHOD AND DATA SOURCES

Water availability is a critical component in the development of any economy. In the absence, or lower availability, of Colorado River water, the historical economic development of U.S. Basin States and counties would have followed different trajectories.

The purpose of this section is to explain Seidman's method and the data used in estimating the extent to which a specific state or county economy could be smaller for one year, without the availability and supply of water from the Colorado River. The analysis assumes the non-substitutability of Colorado River annual water deliveries in each geography studied.

3.1 Method

Economic impact analysis traces the full impact - direct, indirect and induced - of an economic activity on jobs and incomes in a defined economy.

The availability of Colorado River water in the Basin States affects the maximum level of production possible in each sector, and therefore the number of people directly employed by all firms operating in those sectors. These are known as direct economic impacts. Indirect effects arise, for example, through supplier purchases placed by firms as part of their production process. Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues. The total jobs and incomes associated with the productive activity made possible by the availability of Colorado River water are a multiple of the initial direct production.

To estimate the economic impact of Colorado River water for the Basin Region, Seidman uses modified versions of IMPLAN input-output models. An input-output model is a system of linear equations describing the inter-industry relationships in an economy.

IMPLAN is widely used for economic assessments and can provide detailed estimates of secondary expenditures and income generated as a result of a business investment or operation for a finite period of time (typically one full calendar or fiscal year).

Modified versions of state-specific IMPLAN models are implemented for Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. A single modified version of county-specific IMPLAN models is implemented for the seven Southern California county recipients of Colorado River water. These are Imperial, LA, Orange, Riverside, San Bernardino, San Diego, and Ventura. Insights for other California-based counties are not provided as they are not directly apportioned Colorado River water.

Seidman's method for estimating the economic impacts consists of three fundamental steps:

1. **Prepare a baseline estimate of the size/nature of the economy for a defined geography:** This Business as Usual (BAU) case consists of a historical input-output table for the year of study, in which the intermediate demand and final demand of a state or county economy is described, and a distinction made between the use of water as a primary input to the production process of each industry or sector, and other water supplies that are directly consumed.
2. **Develop a policy scenario:** This policy scenario assumes the non-availability of Colorado River water for one full year for each sector listed in the input-output table.[27] It also assumes that no other sources of water are available to compensate for the loss of Colorado River water deliveries for the study year.
3. **Run an IMPLAN analysis**: This produces annual and cumulative economic impact estimates at a state or county level for GSP, employment, and labor income for the reduced water availability scenario.

3.2 Data Inputs

Two federal bodies are responsible for the collection and collation of water data: the United States Geological Survey (USGS) and the United States Bureau of Reclamation (USBR).

The USGS works in cooperation with local, State, and Federal environmental agencies to collect water-use information, which they publish every 5 years. Their most recent report (featuring 2010 data) was released in November 2014, and is aggregated at the county, state, and national levels.

The USBR water data is the result of a more comprehensive review process, and is also considered as the data of record to administer water rights along the lower main stem Colorado. Their latest publically available report for the Colorado River Basin Region was published in 2012,[28] but some additional insights have been privately shared by USBR representatives with Seidman for individual Basin Region states. The water data used in this analysis is therefore drawn from the USBR.

Table 2 projects the total amount of water consumption by Basin Region geography in 2015 for two specific types of water demand – Agriculture, and Municipal & Industrial. Agricultural demand is defined by USBR as the water used to meet the irrigation requirements of crops, maintain stock ponds, and sustain livestock. Municipal & Industrial is defined by USBR as the water used to meet urban and rural population needs, including any industrial needs within urban areas. The latter category therefore encompasses, but does not separately identify, water used for commercial purposes.[29] For the current analysis, Seidman additionally includes within the Municipal & Industrial projections two other USBR water demand categories. These are the water used for energy services and development (Energy) and the water used

[27] Seidman acknowledges the unlikelihood of the total non-availability of Colorado River water for one full year for an individual state or county. However, this type of scenario represents the best way to arrive at a comprehensive estimate of the value of the Colorado River water for the Basin Region economy.
[28] See USBR, (2012). *Colorado River Basin Water Supply and Demand Study*.
[29] Source: USBR, (2012). *Colorado River Basin Water Supply and Demand Study*, Technical Report C – Water Demand Assessment, page C-15.

for mineral extraction not related to energy services (Minerals). Two USBR water demand categories are excluded from this analysis. These are Fish, Wildlife and Recreation, and Tribal.

Table 2: Projected Annual Water Consumption and Percent Sourced from the Colorado River

GEOGRAPHY	AGRICULTURAL		MUNICIPAL & INDUSTRIAL[30]	
	Total Requirement *Million Acre Feet (MAF)*	Percent Sourced from Colorado River	Total Requirement *Million Acre Feet (MAF)*	Percent Sourced from Colorado River
Arizona	2.20	49%	1.98	41%
Colorado	6.13	31%	1.25	41%
Nevada	0	0%	0.37	79%
New Mexico	0.72	15%	0.30	60%
Southern Cal. 7 Counties	3.52	92%	4.17	37%
Utah	2.04	22%	0.84	34%
Wyoming	1.95	20%	0.15	70%
Entire Basin Region	**16.56**	43%	**9.05**	**41%**

Source: USBR (2012)[31]

USBR's projections are based on historical consumptive use for a range of years (2005-2010). However, the latest available year of water consumption data varies by Basin Region state. Seidman acknowledges that USBR's 2015 projections could be higher or lower than actual use, but nevertheless believes that they serve as a good approximation for a single common year throughout the Basin Region, given the Federal agency's status as an authority in these matters.

3.3 Economic Impact Indicators

Three variables are provided to illustrate the economic impacts of Colorado River water in Seidman's analysis. These are:

- ***Gross State Product (GSP)***: this is synonymous with value added. It represents the dollar value of all goods and services produced for final demand in a state or county. It excludes the value of intermediate goods and services purchased as inputs to final production. It can also be defined as the sum of employee compensation (wages, salaries and benefits, including employer contributions to health insurance and retirement pensions), proprietor income, property income, and indirect business taxes.

[30] Commercial is included as part of the USBR Municipal & Industrial estimates. Seidman has also included Energy and Mineral sector consumption in these totals.

[31] USBR, (2012). *Technical Memorandum C – Quantification of Water Demand Scenarios*, available for download at: http://www.usbr.gov/lc/region/programs/crbstudy/techmemoC.html

- ***Employment***: this is a count of full- and part-time jobs. It includes both wage and salary workers, and the self-employed. In the current study, employment is measured in job years. A job year is equivalent to one person having a full-time job for exactly one year.
- ***Labor Income***: this includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income.[32]

All results are provided for one full calendar year – namely, 2012. The year of study is determined by the latest set of economic data featured in the IMPLAN model (2012). The USBR 2015 projections are assumed to serve as a proxy for water consumption in 2012. The availability of historical consumption data varies by year throughout the Basin Region; and it is therefore possible that USBR's 2015 projections are higher or lower than actual use.

Results are provided at an individual state level for six states, at an aggregate level for the seven Southern California counties studied, and also for the Basin Region as a whole. All dollar amounts are expressed in current 2014 dollars (2014 $).

[32] Labor income is also included in GSP.

4.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: STATE OF ARIZONA

Table 2 previously stated that 49% of all Agricultural water consumption and 41% of all Municipal & Industrial water usage in the State of Arizona is supplied each year by the Colorado River.

Table 3 estimates the economic impact of a shortfall in water availability for the State of Arizona economy. The shortfall is assumed to be caused by the loss of the state's Colorado River water for one full year (2012). The estimated metrics (where appropriate) are expressed in 2014 dollars, and assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in the State of Arizona for the study year.

The first line of Table 3 estimates the anticipated direct losses for the State of Arizona economy if Colorado River water is unavailable for one year.[33] These losses are estimated at over $93 billion GSP, approximately 1.1 million jobs, and $55.9 billion labor income (2014 $).

The second line of Table 3 estimates the indirect losses sustained by the State of Arizona economy if Colorado River water is unavailable for one year.[34] This is estimated at $25.1 billion GSP, over 276,000 jobs, and $14.3 billion labor income (2014 $).

Table 3: Estimated Impact of Colorado River Water Loss for the State of Arizona Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	93.01	1,097,192	55.93
Indirect Losses	25.05	276,127	14.34
Induced Losses	66.95	774,451	37.52
Total Estimated Economic Losses [35]	**185.01**	**2,147,770**	**107.80**

Source: Authors' Calculations

The third line of Table 3 estimates the induced losses sustained by the State of Arizona economy if Colorado River water is unavailable for one year.[36] This is estimated at approximately $66.9 billion GSP, over 774,000 jobs, and $37.5 billion labor income (2014 $).

[33] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.

[34] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.

[35] Columns may not correspond exactly to totals due to rounding.

[36] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

The total impact of the loss of Colorado River water for one year for the State of Arizona economy is estimated at $185 billion GSP, over 2.1 million jobs, and almost $108 billion labor income (2014 $). To put this into perspective, an estimated 59.9% of the State of Arizona's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

Table 4: Estimated GSP Sector Losses by Order of Magnitude for One Year in the State of Arizona

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Real Estate and Rental	27.12
Public Administration and Other	23.30
Healthcare and Social Services	23.17
Finance and Insurance	19.66
Professional, Scientific and Technical Services	14.28
Retail Trade	14.19
Wholesale Trade	9.20
Administrative and Waste Services	8.10
Accommodation and Food Services	6.79
Other Services	6.38
Information	5.96
Manufacturing	4.73
Utilities	4.64
Transportation and Warehousing	4.52
Educational Services	3.63
Management of Companies	2.63
Construction	2.39
Arts, Entertainment, and Recreation	2.21
Mining	1.26
Agriculture, Forestry, Fishing, and Hunting	0.85
Estimated Total GSP Losses	**185.01**

Source: Authors' Calculations

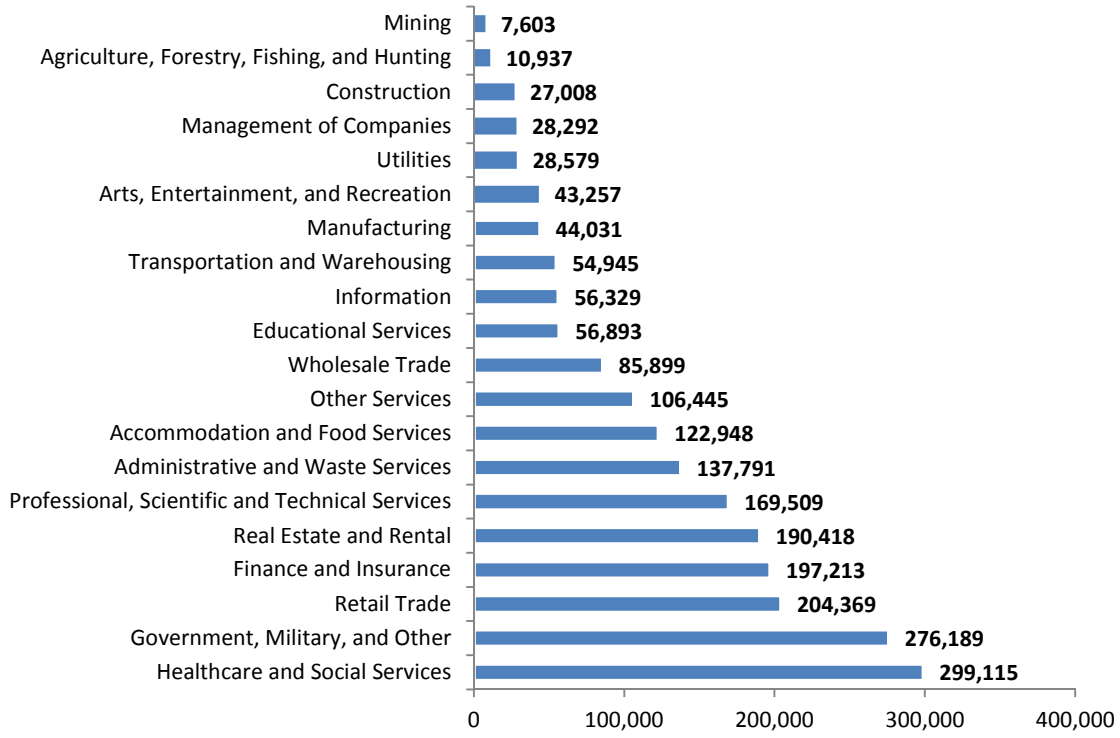
Table 4 estimates the total statewide GSP losses at a sectoral level in the State of Arizona, compared to a Business as Usual (BAU) scenario in which Colorado River water is assumed to be available at current levels. The GSP estimates encompass direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[37] An explanation of the categories of business activity included within each NAICS sector is provided in Appendix A.

[37] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Two private sector establishment categories are each estimated to each contribute over $20 billion less to GSP in the State of Arizona if Colorado River water supply is unavailable. These sectors are Real Estate and Rental; and Healthcare and Social Services. Public Administration and Other includes State and Local Government workers, and the Military. The Top 6 private and public sector categories listed in Table 4 account for approximately two-thirds of the estimated decrease in statewide GSP in Arizona.

Figure 1 estimates the total statewide employment losses at a sectoral level for one year in the State of Arizona. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in statewide employment for one year are: Healthcare and Social Services (13.9% of job losses); Retail Trade (9.5% of job losses); Finance and Insurance (9.2% of job losses); Real Estate and Rental (8.9% of job losses); and Professional, Scientific and Technical Services (7.9% of job losses). Figure 1 also estimates that Administrative and Waste Services, Accommodation and Food Services, and Other Services could employ 100,000 people less per sector for one year as a result of the shortfall in water availability in the State of Arizona.

Figure 1: Estimated Job Losses by Sector for One Year in the State of Arizona



Source: Authors' Calculations

5.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: STATE OF COLORADO

Table 2 previously stated that 31% of all Agricultural water consumption and 41% of all Municipal & Industrial water usage in the State of Colorado is supplied each year by the Colorado River.

Table 5 estimates the economic impact of a shortfall in water availability for the State of Colorado economy. The shortfall is assumed to be caused by the loss of the state's Colorado River water for one full year (2012). The estimated metrics (where appropriate) are expressed in 2014 dollars, and assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in the State of Colorado for the study year.

The first line of Table 5 estimates the anticipated direct losses for the State of Colorado economy if Colorado River water is unavailable for one year.[38] This is estimated at $96.6 billion GSP, over 1.1 million jobs, and approximately $60.5 billion labor income (2014 $).

The second line of Table 5 estimates the indirect losses sustained by the State of Colorado economy if Colorado River water is unavailable for one year.[39] This is estimated at $28.3 billion GSP, over 288,000 jobs, and approximately $17.5 billion labor income (2014 $).

Table 5: Estimated Impact of Colorado River Water Loss for the State of Colorado Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	96.60	1,112,291	60.49
Indirect Losses	28.29	288,423	17.48
Induced Losses	64.06	746,427	38.00
Total Estimated Economic Losses [40]	**188.95**	**2,147,141**	**115.97**

Source: Authors' Calculations

The third line of Table 5 estimates the induced losses sustained by the State of Colorado economy if Colorado River water is unavailable for one year.[41] This is estimated at over $64 billion GSP, more than 746,000 jobs, and $38 billion labor income (2014 $).

[38] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.
[39] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.
[40] Columns may not correspond exactly to totals due to rounding.
[41] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

The total impact of the loss of Colorado River water for one year for the State of Colorado economy is estimated at approximately $189 billion GSP, over 2.1 million jobs, and almost $116 billion labor income (2014 $). To put this into perspective, an estimated 58.8% of the State of Colorado's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

Table 6: Estimated GSP Sector Losses by Order of Magnitude for One Year in the State of Colorado

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Public Administration and Other	26.68
Real Estate and Rental	24.98
Professional, Scientific and Technical Services	19.51
Healthcare and Social Services	19.33
Finance and Insurance	18.39
Retail Trade	11.97
Information	9.49
Wholesale Trade	9.17
Administrative and Waste Services	7.44
Other Services	6.55
Accommodation and Food Services	6.51
Manufacturing	5.52
Transportation and Warehousing	4.29
Utilities	3.99
Management of Companies	3.43
Educational Services	3.18
Arts, Entertainment, and Recreation	2.68
Construction	2.51
Mining	1.86
Agriculture, Forestry, Fishing, and Hunting	1.47
Estimated Total GSP Losses	**188.95**

Source: Authors' Calculations

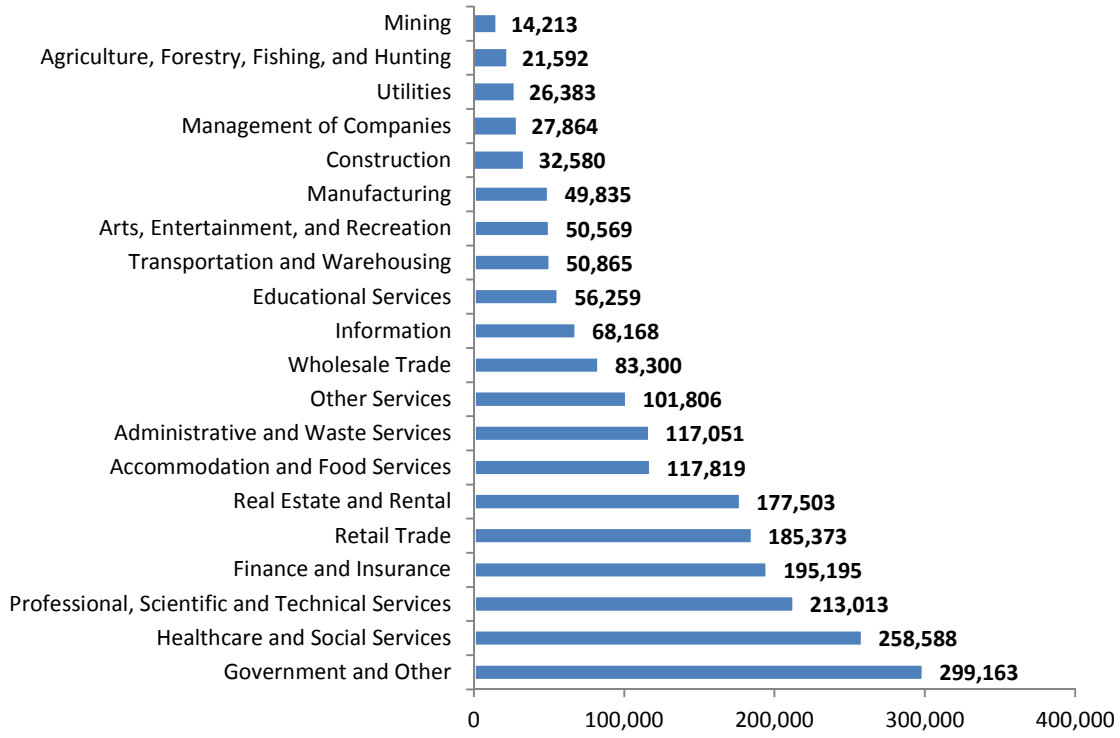
Table 6 estimates the total statewide GSP losses at a sectoral level in the State of Colorado, compared to a Business as Usual (BAU) scenario in which Colorado River water is assumed to be available at current levels. The GSP estimates encompass direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[42] An explanation of the categories of business activity included within each NAICS sector is provided in Appendix A.

[42] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

One private sector establishment category is estimated to contribute over $20 billion less to GSP in the State of Colorado if Colorado River water supply is unavailable. This is Real Estate and Rental. Public Administration and Other includes State and Local Government workers, and the Military. The Top 6 private and public sector categories listed in Table 6 account for approximately 58% of the estimated decrease in statewide GSP in Colorado.

Figure 2 estimates the total statewide employment losses at a sectoral level for one year in the State of Colorado. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in statewide employment for one year are: Healthcare and Social Services (12% of job losses); Professional, Scientific and Technical Services (9.9% of job losses); Finance and Insurance (9.1% of job losses); Retail Trade (8.6% of job losses); and Real Estate and Rental (5.5% of job losses). Figure 2 also estimates that Accommodation and Food Services, Administrative and Waste Services, and Other Services, could also employ over 100,000 less people for one year as a result of the shortfall in water availability in the State of Colorado.

Figure 2: Estimated Job Losses by Sector for One Year in the State of Colorado



Source: Authors' Calculations

6.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: STATE OF NEVADA

Table 2 previously stated that 79% of all Municipal & Industrial water usage in the State of Nevada, but no Agricultural water, is supplied each year by the Colorado River.

Table 7 estimates the economic impact of a shortfall in water availability for the State of Nevada economy. The shortfall is assumed to be caused by the loss of the state's Colorado River water for one full year (2012). The estimated metrics (where appropriate) are expressed in 2014 dollars, and again assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in the State of Nevada for the study year.

The first line of Table 7 estimates the anticipated direct losses for the State of Nevada economy if Colorado River water is unavailable for one year.[43] This is estimated at almost $65.8 billion GSP, over 805,000 jobs, and approximately $41.2 billion labor income (2014 $).

The second line of Table 7 estimates the indirect losses sustained by the State of Nevada economy if Colorado River water is unavailable for one year.[44] This is estimated at almost $16.3 billion GSP, approximately 200,000 jobs, and over $9.9 billion labor income (2014 $).

Table 7: Estimated Impact of Colorado River Water Loss for the State of Nevada Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	65.80	805,491	41.19
Indirect Losses	16.28	199,458	9.93
Induced Losses	33.31	412,333	19.46
Total Estimated Economic Losses [45]	**115.39**	**1,417,283**	**70.57**

Source: Authors' Calculations

The third line of Table 7 estimates the induced losses sustained by the State of Nevada economy if Colorado River water is unavailable for one year.[46] This is estimated at $33.3 billion GSP, over 412,000 jobs, and approximately $19.5 billion labor income (2014 $).

[43] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.

[44] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.

[45] Columns may not correspond exactly to totals due to rounding.

[46] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

The total impact of the loss of Colorado River water for one year for the State of Nevada economy is estimated at $115.4 billion GSP, over 1.4 million jobs, and approximately $70.6 billion labor income (2014 $). To put this into perspective, an estimated 87.4% of the State of Nevada's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

Table 8: Estimated GSP Sector Losses by Order of Magnitude for One Year in the State of Nevada

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Real Estate and Rental	18.14
Public Administration and Other	16.60
Healthcare and Social Services	13.13
Finance and Insurance	11.13
Retail Trade	9.41
Professional, Scientific and Technical Services	9.18
Accommodation and Food Services	5.59
Administrative and Waste Services	4.69
Wholesale Trade	4.67
Other Services	3.71
Transportation and Warehousing	3.12
Information	3.04
Utilities	2.96
Management of Companies	2.08
Arts, Entertainment, and Recreation	2.03
Construction	1.89
Manufacturing	1.56
Educational Services	1.45
Mining	0.86
Agriculture, Forestry, Fishing, and Hunting	0.15
Estimated Total GSP Losses	**115.39**

Source: Authors' Calculations

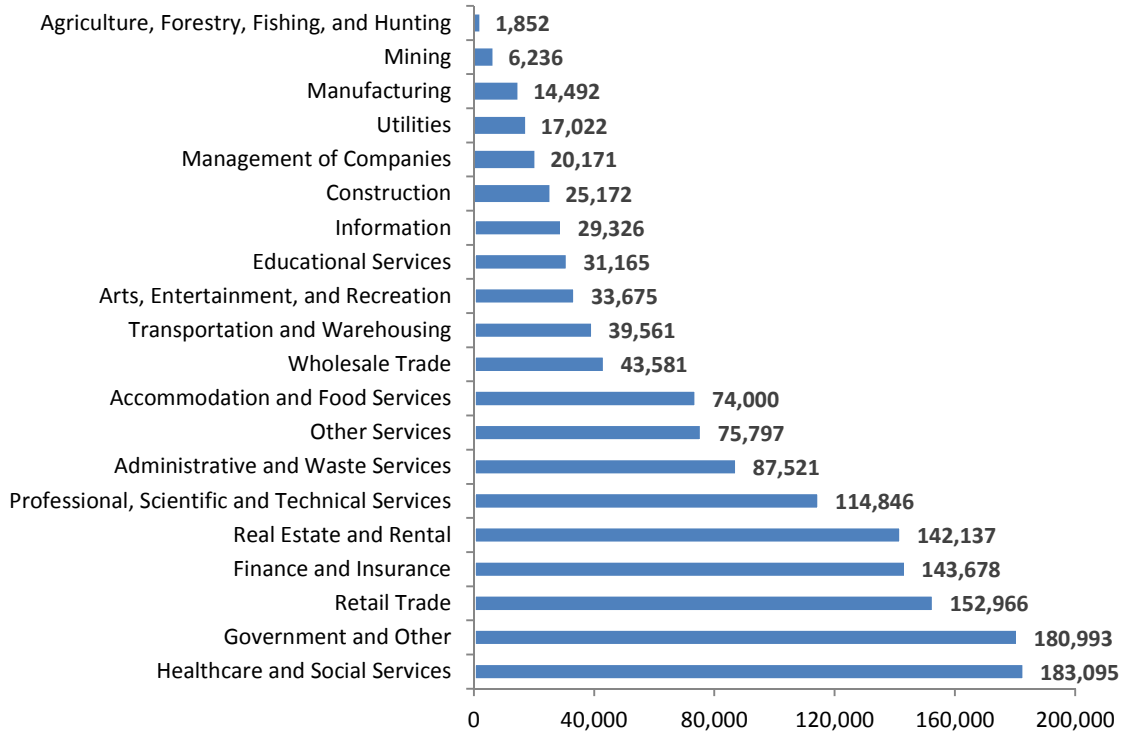
Table 8 estimates the total statewide GSP losses at a sectoral level in the State of Nevada, compared to a Business as Usual (BAU) scenario in which Colorado River water is assumed to be available at current levels. The GSP estimates encompass direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[47] An explanation of the categories of business activity included within each NAICS sector is provided in Appendix A.

[47] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Three private sector establishment categories are each estimated to contribute over $10 billion less to GSP in the State of Nevada if Colorado River water supply is unavailable. These sectors are Real Estate and Rental; Healthcare and Social Services; and Finance and Insurance. Public Administration and Other includes State and Local Government workers, and the Military. The Top 6 private and public sector categories listed in Table 8 account for approximately two-thirds of the estimated decrease in statewide GSP in Nevada.

Figure 3 estimates the total statewide employment losses at a sectoral level for one year in the State of Nevada. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in statewide employment are: Healthcare and Social Services (12% of job losses); Retail Trade (12% of job losses); Finance and Insurance (12% of job losses); Real Estate and Rental (12% of job losses); and Professional, Scientific and Technical Services (12% of job losses).

Figure 3: Estimated Job Losses by Sector for One Year in the State of Nevada



Source: Authors' Calculations

7.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: STATE OF NEW MEXICO

Table 2 previously stated that 15% of all Agricultural water consumption and 60% of all Municipal & Industrial water usage in the State of New Mexico is supplied each year by the Colorado River.

Table 9 estimates the economic impact of a shortfall in water availability for the State of New Mexico economy. The shortfall is assumed to be caused by the loss of the state's Colorado River water for one full year (2012). The estimated metrics (where appropriate) are expressed in 2014 dollars, and again assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in the State of New Mexico for the study year.

The first line of Table 9 estimates the anticipated direct losses for the State of New Mexico economy if Colorado River water is unavailable for one year.[48] This is estimated at approximately $38.3 billion GSP, over 497,000 jobs, and $22.7 billion labor income (2014 $).

The second line of Table 9 estimates the indirect losses sustained by the State of New Mexico economy if Colorado River water is unavailable for one year.[49] This is estimated at $6.8 billion GSP, over 77,000 jobs, and approximately $3.6 billion labor income (2014 $).

Table 9: Estimated Impact of Colorado River Water Loss for the State of New Mexico Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	38.33	497,093	22.70
Indirect Losses	6.81	77,285	3.59
Induced Losses	14.62	197,240	7.88
Total Estimated Economic Losses [50]	**59.76**	**771,618**	**34.17**

Source: Authors' Calculations

The third line of Table 9 estimates the induced losses sustained by the State of New Mexico economy if Colorado River water is unavailable for one year.[51] This is estimated at $14.6 billion GSP, over 197,000 jobs, and approximately $7.9 billion labor income (2014 $).

[48] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.

[49] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.

[50] Columns may not correspond exactly to totals due to rounding.

[51] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

The total impact of the loss of Colorado River water for one year for the State of New Mexico economy is estimated at approximately $59.8 billion GSP, almost 772,000 jobs, and nearly $34.2 billion labor income (2014 $). To put this into perspective, an estimated 65.8% of the State of New Mexico's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

Table 10: Estimated GSP Sector Losses by Order of Magnitude for One Year in the State of New Mexico

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Public Administration and Other	14.28
Real Estate and Rental	8.26
Healthcare and Social Services	7.15
Retail Trade	4.43
Professional, Scientific and Technical Services	3.78
Finance and Insurance	3.49
Accommodation and Food Services	2.24
Administrative and Waste Services	2.11
Other Services	2.01
Wholesale Trade	1.96
Information	1.87
Utilities	1.55
Transportation and Warehousing	1.21
Mining	1.10
Construction	0.99
Manufacturing	0.94
Educational Services	0.89
Arts, Entertainment, and Recreation	0.64
Management of Companies	0.44
Agriculture, Forestry, Fishing, and Hunting	0.42
Estimated Total GSP Losses	**59.76**

Source: Authors' Calculations

Table 10 estimates the total statewide GSP losses at a sectoral level in the State of New Mexico, compared to a Business as Usual (BAU) scenario in which Colorado River water is assumed to be available at current levels. The GSP estimates encompass direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[52] An explanation of the categories of business activity included within each NAICS sector is provided in Appendix A.

[52] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Two private sector establishment categories are each estimated to contribute over $5 billion less to GSP in the State of New Mexico if Colorado River water supply is unavailable. These sectors are Real Estate and Rental; and Healthcare and Social Services. Public Administration and Other includes State and Local Government workers, and the Military. The Top 5 private and public sector categories listed in Table 10 account for over 63% of the estimated decrease in statewide GSP in New Mexico.

Figure 4 estimates the total statewide employment losses at a sectoral level for one year in the State of New Mexico. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in statewide employment are: Healthcare and Social Services (14.7% of job losses); Retail Trade (10.3% of job losses); Real Estate and Rental (6.7% of job losses); Accommodation and Food Services (6.6% of job losses); and Professional, Scientific, and Technical Services (6.2% of job losses).

Figure 4: Estimated Job Losses by Sector for One Year in the State of New Mexico

Source: Authors' Calculations

8.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: SOUTHERN CALIFORNIA COUNTIES

Seven counties in Southern California directly receive Colorado River water. These are: Imperial, LA, Orange, Riverside, San Bernardino, San Diego, and Ventura. 92% of all Agricultural water consumption and 37% of all Municipal & Industrial water usage in these seven counties is supplied each year by the Colorado River.

Using a customized IMPLAN that treats the seven contiguous Southern California counties as a single economy, Table 11 estimates the economic impact of a shortfall in water availability for the region. The shortfall is assumed to be caused by the loss of the seven counties' Colorado River water for one full year (2012). The estimated metrics (where appropriate) are expressed in 2014 dollars, and again assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in this Southern California region for the study year.

The first line of Table 11 estimates the anticipated direct losses for the combined economy of the seven-county region if Colorado River water is unavailable for one year.[53] This is estimated at over $325.7 billion GSP, approximately 3.5 million jobs, and $207.3 billion labor income (2014 $).

The second line of Table 11 estimates the indirect losses sustained by the combined economy of the seven-county region if Colorado River water is unavailable for one year.[54] This is estimated at over $105.8 billion GSP, approximately 1 million jobs, and almost $64.8 billion labor income (2014 $).

Table 11: Estimated Impact of Colorado River Water Loss for the Entire Southern California Seven Counties

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	325.73	3,535,222	207.30
Indirect Losses	105.83	1,032,954	64.79
Induced Losses	225.89	2,477,934	134.48
Total Estimated Economic Losses [55]	**657.45**	**7,046,110**	**406.58**

Source: Authors' Calculations

[53] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.
[54] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.
[55] Columns may not correspond exactly to totals due to rounding.

The third line of Table 11 estimates the induced losses sustained by the combined economy of the seven counties if Colorado River water is unavailable for one year.[56] This is estimated at almost $225.9 billion GSP, approximately 2.5 million jobs, and $134.5 billion labor income (2014 $).

The total impact of the loss of Colorado River water for one year for the combined economy of the seven counties in Southern California is estimated at approximately $657.5 billion GSP, over 7 million jobs, and almost $406.6 billion labor income (2014 $). To put this into perspective, an estimated 54.9% of the Southern California seven-county region's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

Table 12: Estimated GSP Sector Losses by Order of Magnitude for One Year for the Entire Southern California Seven Counties

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Real Estate and Rental	78.45
Public Administration and Other	77.71
Healthcare and Social Services	69.14
Finance and Insurance	63.26
Professional, Scientific and Technical Services	61.08
Manufacturing	52.75
Retail Trade	44.19
Wholesale Trade	31.18
Information	29.45
Administrative and Waste Services	27.04
Accommodation and Food Services	22.47
Other Services	22.23
Transportation and Warehousing	17.42
Educational Services	14.64
Management of Companies	11.57
Arts, Entertainment, and Recreation	10.63
Utilities	9.57
Construction	8.03
Mining	4.02
Agriculture, Forestry, Fishing, and Hunting	2.62
Estimated Total GSP Losses	**657.45**

Source: Authors' Calculations

[56] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

Table 12 estimates the total statewide GSP losses at a sectoral level in the Southern California seven-county economy, compared to a Business as Usual (BAU) scenario in which Colorado River water is assumed to be available at current levels. The GSP estimates encompass direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[57] An explanation of the categories of business activity included within each NAICS sector is provided in Appendix A.

Five private sector establishment categories are each estimated to contribute over $50 billion less to GSP in the combined Southern California seven-county economy if Colorado River water supply is unavailable. The sectors are Real Estate and Rental; Healthcare and Social Services; Finance and Insurance; Professional, Scientific and Technical Services; and Manufacturing. Public Administration and Other includes State and Local Government workers, and the Military. The Top 6 private and public sector categories listed in Table 12 account for over 61% of the estimated decrease in statewide GSP in the combined Southern California seven-county economy.

Figure 5: Estimated Job Losses by Sector for One Year for the Entire Southern California Seven Counties

Source: Authors' Calculations

[57] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Figure 5 estimates the total employment losses at a sectoral level for one year in the Southern California seven-county economy. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in employment are: Healthcare and Social Services (12.6% of job losses); Professional, Scientific, and Technical Services (9.3% of job losses); Retail Trade (9.0% of job losses); Finance and Insurance (7.7% of job losses); and Real Estate and Rental (6.9% of job losses). Four other private sectors are estimated to experience 5% or more of the job losses in the seven-county combined region. These are: Administrative and Waste Services; Manufacturing; Other Services; and Accommodation and Food Services.

9.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: STATE OF UTAH

Table 2 previously stated that 22% of all Agricultural water consumption and 34% of all Municipal & Industrial water usage in the State of Utah is supplied each year by the Colorado River.

Table 13 estimates the economic impact of a shortfall in water availability for the State of Utah economy. The shortfall is assumed to be caused by the loss of the state's Colorado River water for one full year (2012). The estimated metrics (where appropriate) are expressed in 2014 dollars, and again assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in the State of Utah for the study year.

The first line of Table 13 estimates the anticipated direct losses for the State of Utah economy if Colorado River water is unavailable for one year.[58] This is estimated at $34.6 billion GSP, approximately 483,000 jobs, and almost $22.2 billion labor income (2014 $).

The second line of Table 13 estimates the indirect losses sustained by the State of Utah economy if Colorado River water is unavailable for one year.[59] This is estimated at over $11.8 billion GSP, approximately 156,000 jobs, and $7.2 billion labor income (2014 $).

Table 13: Estimated Impact of Colorado River Water Loss for the State of Utah Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	34.58	482,908	22.15
Indirect Losses	11.84	155,663	7.20
Induced Losses	23.37	331,164	13.96
Total Estimated Economic Losses [60]	**69.79**	**969,735**	**43.30**

Source: Authors' Calculations

The third line of Table 13 estimates the induced losses sustained by the State of Utah economy if Colorado River water is unavailable for one year.[61] This is estimated at almost $23.4 billion GSP, over 331,000 jobs, and approximately $14 billion labor income (2014 $).

[58] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.

[59] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.

[60] Columns may not correspond exactly to totals due to rounding.

[61] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

The total impact of the loss of Colorado River water for one year for the State of Utah economy is estimated at $69.8 billion GSP, approximately 970,000 jobs, and around $43.3 billion labor income (2014 $). To put this into perspective, approximately half of the State of Utah's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

Table 14: Estimated GSP Sector Losses by Order of Magnitude for One Year in the State of Utah

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Public Administration and Other	9.36
Real Estate and Rental	8.94
Finance and Insurance	7.67
Healthcare and Social Services	7.17
Professional, Scientific and Technical Services	6.10
Retail Trade	4.58
Manufacturing	3.76
Wholesale Trade	3.46
Administrative and Waste Services	2.53
Other Services	2.46
Information	2.44
Transportation and Warehousing	2.12
Accommodation and Food Services	2.10
Management of Companies	1.45
Utilities	1.40
Educational Services	1.35
Construction	1.05
Mining	0.80
Arts, Entertainment, and Recreation	0.75
Agriculture, Forestry, Fishing, and Hunting	0.30
Estimated Total GSP Losses	**69.79**

Source: Authors' Calculations

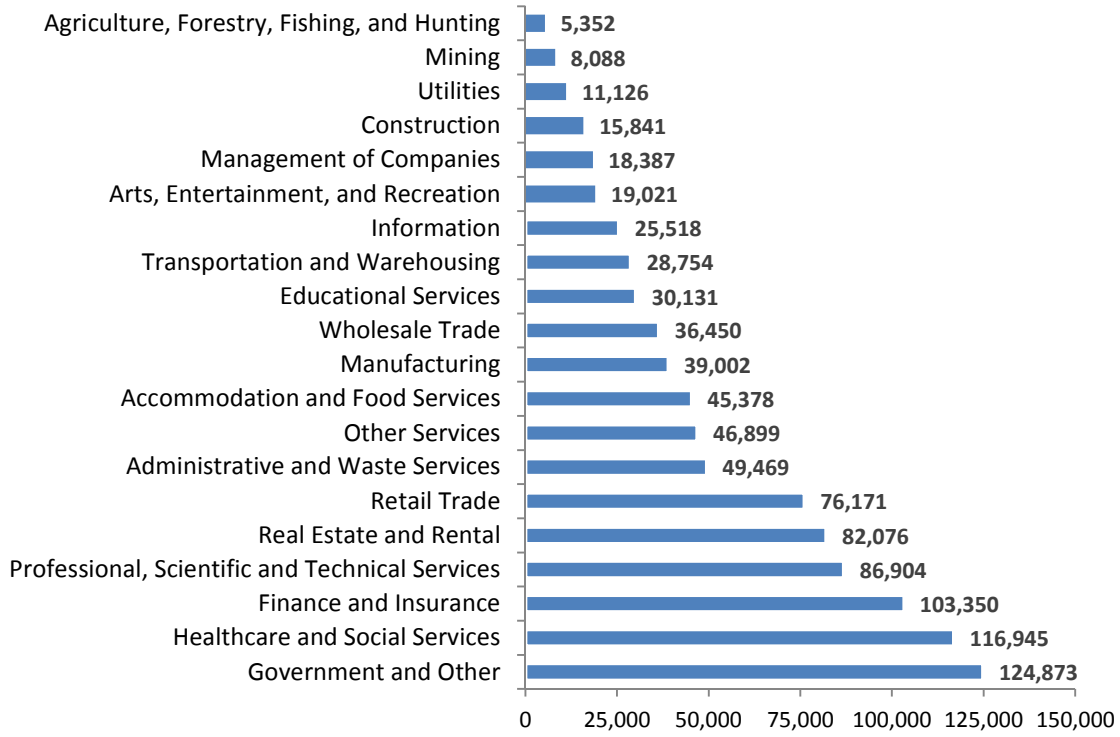
Table 14 estimates the total statewide GSP losses at a sectoral level in the State of Utah, compared to a Business as Usual (BAU) scenario in which Colorado River water is assumed to be available at current levels. This encompasses direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[62] An explanation of the categories of business activity included within each NAICS sector is provided in Appendix A.

[62] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Four private sector establishment categories are each estimated to contribute over $5 billion less to GSP in the State of Utah if Colorado River water supply is unavailable. These sectors are Real Estate and Rental; Finance and Insurance; Healthcare and Social Services; and Professional, Scientific and Technical Services. Public Administration and Other includes State and Local Government workers, and the Military. The Top 5 private and public sector categories listed in Table 14 account for over 56% of the estimated decrease in statewide GSP in Utah.

Figure 6 estimates the total statewide employment losses at a sectoral level for one year in the State of Utah. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in statewide employment are: Healthcare and Social Services (12.1% of job losses); Finance and Insurance (10.7% of job losses); Professional, Scientific and Technical Services (9.0% of job losses); Real Estate and Rental (8.5% of job losses); and Retail Trade (7.9% of job losses).

Figure 6: Estimated Job Losses by Sector for One Year in the State of Utah



Source: Authors' Calculations

10.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: STATE OF WYOMING

Table 2 previously stated that 20% of all Agricultural water consumption and 70% of all Municipal & Industrial water usage in the State of Wyoming is supplied each year by the Colorado River.

Table 15 estimates the economic impact of a shortfall in water availability for the State of Wyoming economy. The shortfall is assumed to be caused by the loss of the state's Colorado River water for one full year (2012). The estimated metrics (where appropriate) are expressed in 2014 dollars, and again assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in the State of Wyoming for the study year.

The first line of Table 15 estimates the anticipated direct losses for the State of Wyoming economy if Colorado River water is unavailable for one year.[63] This is estimated at approximately $14.3 billion GSP, over 191,000 jobs, and almost $9.1 billion labor income (2014 $).

The second line of Table 15 estimates the indirect losses sustained by the State of Wyoming economy if Colorado River water is unavailable for one year.[64] This is estimated at almost $2.4 billion GSP, approximately 29,000 jobs, and $1.3 billion labor income (2014 $).

Table 15: Estimated Impact of Colorado River Water Loss for the State of Wyoming Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	14.33	191,164	9.05
Indirect Losses	2.38	28,973	1.29
Induced Losses	4.96	64,139	2.84
Total Estimated Economic Losses [65]	**21.67**	**284,276**	**13.18**

Source: Authors' Calculations

The third line of Table 15 estimates the induced losses sustained by the State of Wyoming economy if Colorado River water is unavailable for one year.[66] This is estimated at almost $5 billion GSP, over 64,000 jobs, and in excess of $2.8 billion labor income (2014 $).

[63] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.

[64] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.

[65] Columns may not correspond exactly to totals due to rounding.

[66] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

The total impact of the loss of Colorado River water for one year for the State of Wyoming economy is estimated at $21.7 billion GSP, over 284,000 jobs, and around $13.2 billion labor income (2014 $). To put this into perspective, over 62% of the State of Wyoming's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

Table 16: Estimated GSP Sector Losses by Order of Magnitude for One Year in the State of Wyoming

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Public Administration and Other	4.86
Real Estate and Rental	3.26
Healthcare and Social Services	2.30
Retail Trade	1.50
Finance and Insurance	1.19
Professional, Scientific and Technical Services	1.09
Mining	1.09
Wholesale Trade	0.98
Utilities	0.84
Accommodation and Food Services	0.74
Construction	0.67
Transportation and Warehousing	0.63
Other Services	0.59
Administrative and Waste Services	0.52
Information	0.47
Educational Services	0.25
Arts, Entertainment, and Recreation	0.24
Manufacturing	0.18
Agriculture, Forestry, Fishing, and Hunting	0.14
Management of Companies	0.13
Estimated Total GSP Losses	**21.67**

Source: Authors' Calculations

Table 16 estimates the total statewide GSP losses at a sectoral level in the State of Wyoming, compared to a Business as Usual (BAU) scenario in which Colorado River water is assumed to be available at current levels. The GSP estimates encompass direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[67] An explanation of the categories of business activity included within each NAICS sector is provided in Appendix A.

[67] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Two private sector establishment categories are each estimated to contribute over $2 billion less to GSP in the State of Wyoming if Colorado River water supply is unavailable. These sectors are Real Estate and Rental; and Healthcare and Social Services. Public Administration and Other includes State and Local Government workers, and the Military. The Top 7 private and public sector categories listed in Table 16 account for over 70% of the estimated decrease in statewide GSP in Wyoming.

Figure 7 estimates the total statewide employment losses at a sectoral level for one year in the State of Wyoming. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in statewide employment are: Healthcare and Social Services (13.2% of job losses); Retail Trade (9.6% of job losses); Real Estate and Rental (8.7% of job losses); Professional, Scientific and Technical Services (5.9% of job losses); and Accommodation and Food Services (5.5% of job losses).

Figure 7: Estimated Job Year Losses by Sector for One Year in the State of Wyoming

Source: Authors' Calculations

11.0 ESTIMATED 12-MONTH ECONOMIC IMPACTS: ENTIRE BASIN REGION RECIPIENTS

The individual state-specific and Southern California seven-county estimates of economic impact presented in Sections 4-10 are based on the flow of dollars around their own respective economies alone. They do not take into account any transactions made with agents located outside their respective geographic boundaries - that is, when goods and services are purchased from individuals and firms located in other states and nations, or when residents and business pay federal taxes. These latter transactions are described as "leakages" in economic impact analyses, to reflect the fact that dollars are leaking out of the economy of the individual state or counties of study into the economies of other states or nations. This means, for example, that the economic impact estimates for the State of Arizona presented in Section 4 do not take into account any transactions made with other Basin Region states. They are entirely based on transactions occurring wholly within the State of Arizona. The same holds true for all other individual state-specific and Southern California estimates presented in Sections 5-10.

One major determinant of the size of leakages in economic impact analyses is the size of the study area - the bigger the geographical area of study, the less the potential for leakages because less transactions take place with entities outside of the area analyzed.

Consider a hypothetical scenario in which the three Lower Basin states are able to retain most of their economic activity within their three-state area. In this scenario, all three states also trade with one another but never engage in any form of economic activity with other states or nations outside the Lower Basin Region. An economic impact analysis of an individual Lower Basin state in this scenario will always have two geographical sets of leakages. For Arizona, the potential leakages are to California and Nevada. For California, the potential leakages are to Arizona and Nevada. For Nevada, the potential leakages are to Arizona and California. However, if the economies of all three Lower Basin states in this hypothetical scenario are combined into a single economy, there are no potential leakages because all of the economic activity described above always takes place within the Lower Basin states. For this very reason, a summation of actual economic impacts for the entire Basin Region has to be greater than a simple aggregation of the individual state-specific and Southern California county estimated impacts presented in Sections 4-10. That is, a Basin Region-wide IMPLAN model is required to take into account the total flow of dollars throughout the region, including expenditures made by each Basin Region state in any of the other Basin Region geographies.

Table 2 previously stated that 43% of all Agricultural water consumption and 41% of all Municipal & Industrial water usage in the Basin Region is supplied each year by the Colorado River.

Table 17 therefore estimates the economic impact of a shortfall in water availability for the Basin Region economy, based on a separate, region-wide IMPLAN run. The shortfall is assumed to be caused by the non-availability of Colorado River water in the Basin Region for one full year (2012). For the purpose of these estimates, the Basin Region economy encompasses Arizona, Colorado, Nevada, New Mexico, Utah,

Wyoming, and seven Southern California counties. The estimated metrics (where appropriate) are expressed in 2014 dollars, and assume non-substitutability. That is, no other sources of water are assumed to be available to compensate for the loss of Colorado River water deliveries in the Basin Region (as defined above) for the study year.

The first line of Table 17 estimates the anticipated direct losses for the Basin Region economy if Colorado River water is unavailable for one year.[68] This is estimated at almost $695 billion GSP, over 7.8 million jobs, and approximately $434.3 billion labor income (2014 $).

The second line of Table 17 estimates the indirect losses sustained by the Basin Region economy if Colorado River water is unavailable for one year.[69] This is estimated at $231.1 billion GSP, almost 2.4 million jobs, and approximately $139.4 billion labor income (2014 $).

Table 17: Estimated Impact of Colorado River Water Loss for the Entire Basin Region Economy

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Direct Losses	694.78	7,859,245	434.29
Indirect Losses	231.12	2,361,250	139.35
Induced Losses	508.22	5,780,501	297.81
Total Estimated Economic Losses [70]	**1,434.12**	**16,000,996**	**871.45**

Source: Authors' Calculations

The third line of Table 17 estimates the induced losses sustained by the Basin Region economy if Colorado River water is unavailable for one year.[71] This is estimated at over $508.2 billion GSP, approximately 5.8 million jobs, and $297.8 billion labor income (2014 $).

The total impact of the loss of Colorado River water for one year for the Basin Region economy is estimated at over $1.4 trillion GSP, approximately 16 million jobs, and almost $871.5 billion labor income (2014 $). To put this into perspective, an estimated 64.4% of the Basin Region's annual GSP could be lost if Colorado River water is no longer available to residents, businesses, industry, and agriculture.

[68] Direct effects refer to any activity directly associated with the availability of Colorado River water. They are usually defined in terms of the maximum level of production or output possible in each sector, and the number of people directly employed by all firms operating in each sector.

[69] Indirect effects capture the impact on the firms that directly and indirectly engage in production and employment as a result of the availability of Colorado River water; for example, through supplier purchases placed as part of the production process.

[70] Columns may not correspond exactly to totals due to rounding.

[71] Induced effects occur when workers either directly or indirectly associated with the level of production spend their incomes in the local economy, when suppliers place upstream demands on other producers, and when governments spend new tax revenues.

Table 18: Estimated GSP Sector Losses by Order of Magnitude for One Year in the Entire Basin Region

SECTOR	GROSS STATE PRODUCT *Billions 2014 $*
Public Administration and Other	176.59
Real Estate and Rental	174.32
Healthcare and Social Services	148.57
Finance and Insurance	137.10
Professional, Scientific and Technical Services	130.63
Retail Trade	96.24
Manufacturing	96.22
Wholesale Trade	67.26
Information	63.40
Administrative and Waste Services	59.75
Accommodation and Food Services	51.12
Other Services	47.69
Transportation and Warehousing	37.94
Utilities	28.52
Educational Services	28.29
Management of Companies	24.55
Arts, Entertainment, and Recreation	22.68
Construction	18.79
Mining	17.15
Agriculture, Forestry, Fishing, and Hunting	7.31
Estimated Total GSP Losses	**1,434.12**

Source: Authors' Calculations

Table 18 estimates the total GSP losses at a sectoral level for one year in the Basin Region compared to a Business as Usual (BAU) scenario in which the Colorado River water is assumed to be available at current levels. The GSP estimates encompass direct, indirect, and induced losses. The sectors are categorized according to the North American Industry Classification System (NAICS).[72] An explanation of the types of firm included within each NAICS category is provided in Appendix A.

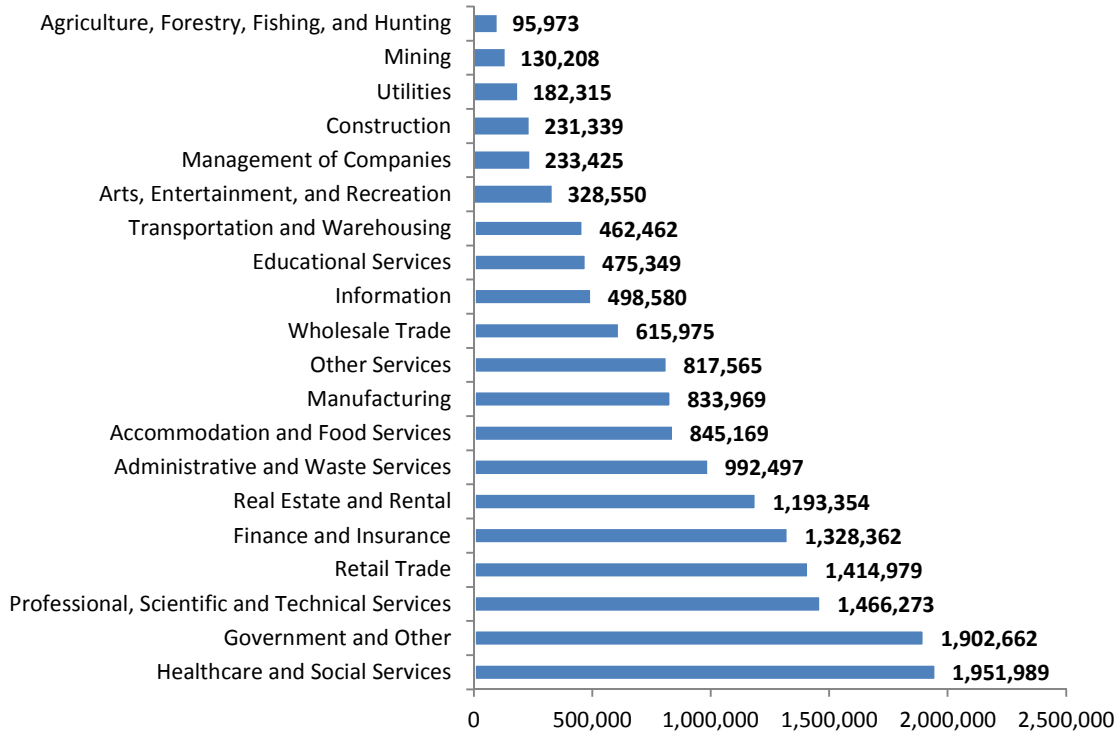
Four private sector establishment categories are each estimated to contribute over $100 billion less to GSP in the Basin Region if Colorado River water supply is unavailable. These sectors are Real Estate and Rental; Healthcare and Social Services; Finance and Insurance; and Professional, Scientific and Technical Services. Public Administration and Other includes State and Local Government workers, and the Military. Two additional sectors are estimated to lose over $95 billion each (Retail Trade; and Manufacturing). The

[72] NAICS is the standard used by Federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Top 7 private and public sector categories listed in Table 18 account for approximately 67% of the estimated decrease in total GSP in the Basin Region.

Figure 8 estimates the total employment losses at a sectoral level for one year in the Basin Region. The estimates consist of direct, indirect, and induced full-time (or equivalent) job losses for one calendar year. The Top 5 private sectors estimated to experience the largest losses in absolute terms in employment are: Healthcare and Social Services (12.2% of job losses); Professional, Scientific & Technical Services (9.2% of job losses); Retail Trade (8.8% of job losses); Finance and Insurance (8.3% of job losses); and Real Estate and Rental (7.5% of job losses).

Figure 8: Estimated Job Year Losses by Sector in the Entire Basin Region



Source: Authors' Calculations

12.0 CONCLUSIONS

The purpose of this study is to calculate the economic importance of the Colorado River to the economies of the Basin Region.

Based on an assumption that the current apportionment of Colorado River water is unavailable to the Upper and Lower Basin at a state level for six geographies, at a county level for seven affected Southern California counties, and also for the region as a whole, customized IMPLAN input-output models are used to estimate Gross State Product (GSP), employment, and labor income impacts for one full calendar year (2012).[73]

Central to this analysis is an assumption that the Colorado River's annual water deliveries cannot be sourced elsewhere.

A summary of total impacts are estimated in Table 19.

Table 19: Estimated Total Economic Impacts of Colorado River Water Loss by Geography

GEOGRAPHY	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Job Years*	LABOR INCOME *Billions 2014 $*
Arizona	185.01	2,147,770	107.80
Colorado	188.95	2,147,141	115.97
Nevada	115.39	1,417,283	70.57
New Mexico	59.76	771,618	34.17
Southern Cal. 7 Counties	657.45	7,046,110	406.58
Utah	69.79	969,735	43.30
Wyoming	21.67	284,276	13.18
Entire Basin Region	**1,434.12**	**16,000,996**	**871.45**

Source: Authors' Calculations

In excess of 16 million jobs in the Basin Region rely on the availability of Colorado River water at current availability levels each year. Over 14 million of these jobs are estimated to be in the private sector. This means that the Colorado River is estimated to help generate almost 12.2% of national private employment in the Basin Region.[74]

[73] The authors recognize that the total non-availability of Colorado River water for one full year is an unlikely scenario. However, it is the best way to arrive at a comprehensive estimate of the value of the Colorado River for the Basin Region economy.
[74] Total U.S. private employment in 2012 was 115,610,216. Source: U.S. Census Bureau, (2014). State and County Quick Facts, available at: http://quickfacts.census.gov/qfd/states/00000.html

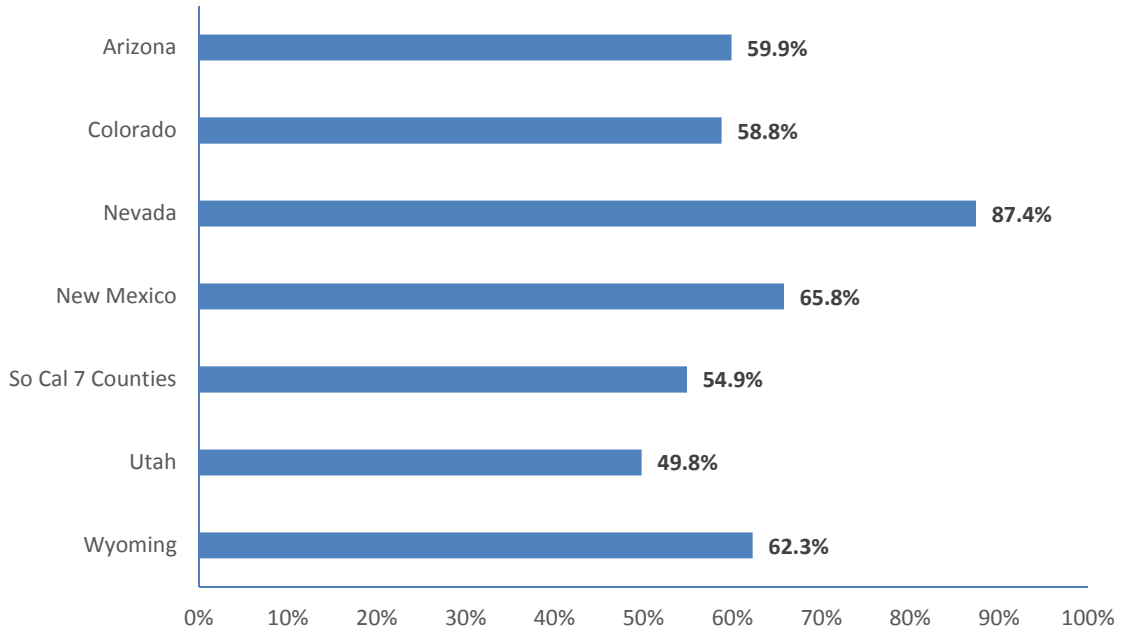
Over $871 billion (2014 $) in labor income relies on the current availability of Colorado River water throughout the Basin Region.

Without the full availability of Colorado River water at current levels, the combined economy of the Basin Region is estimated to fall by over $1.4 trillion (2014 $).

The top five private (non-Government) sectors estimated to experience the biggest shortfall in total GSP contributions if Colorado River water is unavailable for a year are:

- Real Estate and Rental (e.g. any establishment engaged in renting, leasing or allowing the use of property, motor vehicles, consumer goods, and nonfinancial intangible assets) - $174.3 billion.
- Healthcare and Social Services (e.g. ambulatory healthcare; child day care; hospitals; nursing; residential care; and vocational rehabilitation) - $148.6 billion.
- Finance and Insurance (e.g. banking; credit intermediation; insurance; securities, commodities and trusts) - $137.1 billion.
- Professional, Scientific and Technical Services (e.g. accounting and bookkeeping; advertising; architectural and engineering; computer services; consulting; legal; photography; research; translation services; veterinary services) - $130.6 billion.
- Retail Trade (e.g. any establishment engaged in retailing merchandise) - $96.2 billion.

Figure 9: Percent Losses to Current GSP in the Absence of Colorado River Water



Source: Authors' Calculations

The percentage falls in GSP resulting from the non-availability of Colorado River water for a full year are illustrated in Figure 9. Seidman estimates that State of Nevada could potentially lose the largest percentage of current GSP, and the State of Utah the least. However, for all geographies studied, Seidman estimates a loss of at least half the current rate of GSP is not unreasonable.

Applying a separate, single IMPLAN run for all geographies receiving Colorado River water, Seidman estimates that the total GSP of the combined Basin Region as a whole could fall by 64.4% in the absence of that water.

To put this into perspective, the annual contribution of the Colorado River to the combined GSP of the Basin Region is equivalent to approximately one twelfth of total U.S. gross domestic product (GDP) in fiscal year (FY) 2012.[75]

Given the linear nature of the IMPLAN models, an extrapolation of economic impacts based on uniform percentage declines in the availability of Colorado River water throughout the Basin Region's constituent geographies for one year, rather than its total absence, is possible.[76] The extrapolated estimates are shown in Table 20.

Table 20: Extrapolated Estimates of Total Economic Impacts of Different Amounts of Colorado River Water Loss for the Entire Basin Region

PERCENT DECLINE IN AVAILABILITY OF COLORADO RIVER WATER	GROSS STATE PRODUCT *Billions 2014 $*	EMPLOYMENT *Millions Job Years*	LABOR INCOME *Billions 2014 $*
10%	143.4	1.6	87.1
15%	215.1	2.4	130.7
20%	286.8	3.2	174.3
25%	358.5	4.0	217.9
30%	430.2	4.8	261.4
40%	573.6	6.4	348.6
50%	717.1	8.0	435.7
75%	1,075.6	12.0	653.6

Source: Authors' Calculations

[75] GDP is the national equivalent of GSP. The GDP of the U.S. in current dollars in FY 2012 is $16.16 trillion (current $). Source: http://www.statista.com/statistics/188105/annual-gdp-of-the-united-states-since-1990/

[76] This extrapolation is only possible if, for example, a 10% decline in Colorado River water availability applies equally throughout the six Basin Region states and the seven Southern California counties studied. If the decline in water availability is not shared at a uniform percentage rate between the constituent geographies, the level of trade between those geographies will decline at different percentage rates, which will have non-linear consequences for the estimated combined economic impacts in the entire Basin Region.

Table 20 estimates that a uniform 10% decline in the availability of Colorado River water throughout the Basin Region as defined by the authors could reduce the total GSP of the combined Basin Region economy by $143.4 billion (2014 $) in a single year, and result in the loss of 1.6 million jobs.

A 25% uniform decline in the availability of Colorado River water throughout the Basin Region as defined by the authors could reduce the total GSP of the combined Basin Region economy by $358.5 billion (2014 $) in a single year, and result in the loss of 4 million jobs.

A 75% uniform decline in the availability of Colorado River water throughout the Basin Region as defined by the authors could reduce the total GSP of the combined Basin Region economy by over $1 trillion (2014 $) in a single year, and result in the loss of approximately 12 million jobs.

Seidman's water supply analysis therefore clearly demonstrates the importance of the Colorado River to the economies of the Basin Region. The availability and delivery of Colorado River water to municipal, industrial, and agricultural customers has a crucial impact on the economic development of the region.

Nevertheless, two caveats are worth mentioning.

First the lack of consistency displayed by Federal agencies in the collection of water usage data, and the frequency with which they publish findings, is a real concern to researchers. The most current publicly available historical water data for the Basin Region States is for 2010, which is almost 4 years out of date; and the USGS and USBR have privately stated that their respective datasets cannot be compared or used in conjunction with one another due to a variety of differences in measurement methodology and categorical definitions. For example, the USGS focuses on water withdrawals, while the USBR collates consumptive use data. The USGS data is also published once every 5 years.

Given the importance of, and growing concerns about, water availability in the U.S., it is reasonable to expect a more frequent, reliable, and valid means of consistent water data on a par with the Annual Energy Outlook data collated by the U.S. Energy Information Administration (EIA). The EIA's projections in this annual publication focus on the factors that shape the U.S. energy system over the long term, based on an assumption that current laws and regulations remain unchanged throughout the study time horizon. Historical data in *Annual Energy Outlook 2014*, published by the EIA in December 2013, includes data for the 2012 calendar year. Focusing on energy production, consumption, technology, and market trends, the EIA's comprehensive work serves as an effective starting point for analysis of potential changes in energy policies. The USGS and USBR in private communications have expressed a long-term goal to collect water usage data in a more consistent manner, but until that happens, an annual water publication similar to the EIA's Energy Outlook will not be possible.

The EIA is also responsible for Electric Power Monthly, which provides net generation, consumption, and costs for a range of fuel sources by state no more than 2 months in arrears at any one time.

Secondly, it is also important to note that Seidman's economic impacts overlook the deliveries made to the Tribes in the Basin Region, and any leisure benefits associated with Colorado River water.[77] The inclusion of either or both of these latter dimensions to the current study will in all probability increase the economic value of the Colorado River for the Basin Region. Nevertheless, it would wrong to simply assume that Protect the Flow's key findings in a 2012 recreational report can be added to the current study's estimates, as this could potentially result in at least some double-counting of impacts. For example, the Arts, Entertainment, and Recreation sector features in all the GSP, employment, and labor income impacts estimated in the Seidman study.

[77] A 2012 report produced by Protect the Flows and Southwick Associates separately estimates the recreational value of the Colorado River at $26 billion. See: http://protectflows.com/wp-content/uploads/2013/09/PTF-Fact-Sheet-Colorado.pdf

APPENDIX A – NAICS CODES

The North American Industry Classification System (NAICS) is used by U.S. government and businesses to classify business establishments according to type of economic activity (process of production). The NAICS numbering system consists of two to six digits. The first two digits designate the largest business sector, the third digit designates the subsector, the fourth digit the industry group, the fifth digit the NAICS industries, and the sixth digit the national industries. A list of the 2012 two-digit NAICS categories, general descriptions, and examples of the type of firms or entities is shown below:

NAICS 2012 Sectors and Examples

SECTOR #	DESCRIPTION	EXAMPLES
11	Agriculture, Forestry, Fishing, and Hunting	Crop Production; Animal Production and Aquaculture; Forestry and Logging; Fishing, Hunting and Trapping; Support Activities for Agriculture and Forestry
21	Mining, Quarrying, and Oil and Gas Extraction	Oil and GAS Extraction; Mining (except Oil and Gas); Support Activities for Mining
22	Utilities	Electric Power Generation, Transmission and Distribution; Natural Gas Distribution; Water, Sewage and Other Systems
23	Construction	Construction of Buildings; Heavy and Civil Engineering Construction; Specialty Trade Contractors
31-33	Manufacturing	Food Manufacturing; Beverage and Tobacco Product Manufacturing; Textile Mills; Textile Product Mills; Apparel Manufacturing; Leather and Allied Product Manufacturing; Wood Product Manufacturing; Paper Manufacturing; Printing and Related Support Activities; Petroleum and Coal Products Manufacturing; Chemical Manufacturing; Plastics and Rubber Products Manufacturing; Nonmetallic Mineral Product Manufacturing; Primary Metal Manufacturing; Fabricated Metal Product Manufacturing; Machinery Manufacturing; Computer and Electronic Product Manufacturing; Electrical Equipment, Appliance, and Component Manufacturing; Transportation Equipment Manufacturing; Furniture and Related Product Manufacturing; Miscellaneous Manufacturing
42	Wholesale Trade	Merchant Wholesalers, Durable Goods; Merchant Wholesalers, Nondurable Goods; Wholesale Electronic Markets and Agents and Brokers
44-45	Retail Trade	Motor Vehicle and Parts Dealers; Furniture and Home Furnishings Stores; Electronics and Appliance Stores; Building Material and Garden Equipment and Supplies Dealers; Food and Beverage Stores; Health and Personal Care Stores; Gasoline Stations; Clothing and Clothing Accessories Stores; Sporting Goods, Hobby, Book, and Music Stores; General

		Merchandise Stores; Miscellaneous Store Retailers; Non-store Retailers
48-49	Transportation and Warehousing	Air Transportation; Rail Transportation; Water Transportation; Truck Transportation; Transit and Ground Passenger Transportation; Pipeline Transportation; Scenic and Sightseeing Transportation; Support Activities for Transportation; Postal Service; Couriers and Messengers; Warehousing and Storage
51	Information	Publishing Industries (except Internet); Motion Picture and Sound Recording Industries; Broadcasting (except Internet); Telecommunications; Data Processing, Hosting, and Related Services; Other Information Services
52	Finance and Insurance	Monetary Authorities - Central Bank; Credit Intermediation and Related Activities; Securities, Commodity Contracts, and Other Financial Investments and Related Activities; Insurance Carriers and Related Activities; Funds, Trusts, and Other Financial Vehicles
53	Real Estate, and Rental and Leasing	Real Estate; Rental and Leasing Services; Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
54	Professional, Scientific, and Technical Services	Publishing Industries (except Internet); Motion Picture and Sound Recording Industries; Broadcasting (except Internet); Telecommunications; Data Processing, Hosting, and Related Services; Other Information Services
55	Management of Companies and Enterprises	Establishments holding the securities of, or equity interests in, companies and enterprises to own a controlling interest or influence management decisions; Non-Government establishments administering, overseeing, and managing establishments that normally undertake strategic and organizational planning or decision-making
56	Administrative and Support, and Waste Management and Remediation	Administrative and Support Services; Waste Management and Remediation Services
61	Educational Services	Elementary and Secondary Schools; Junior Colleges; Colleges, Universities, and Professional Schools; Business Schools and Computer and Management Training; Technical and Trade Schools; Other Schools and Instruction; Educational Support Services
62	Healthcare and Social Assistance	Ambulatory Health Care Services; Hospitals; Nursing and Residential Care Facilities; Social Assistance
71	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries; Museums, Historical Sites, and Similar Institutions; Amusement, Gambling, and Recreation Industries
72	Accommodation and Food Services	Accommodation; Food Services and Drinking Places

81	Other Services (except Public Administration)	Repair and Maintenance; Personal and Laundry Services; Religious, Grantmaking, Civic, Professional, and Similar Organizations; Private Households
92	Public Administration	State and Local Government; Military

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