RECREATION AND RESERVOIRS

ECONOMIC ANALYSIS OF THE LARIMER COUNTY DEPARTMENT OF NATURAL RESOURCES RESERVOIR PARKS

EARTH ECONOMICS

C.A.S.T. 2010, *PHOTO COURTESY OF LARIMER COUNTY DEPARTMENT OF NATURAL RESOURCES (LCDNR)*

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EARTH ECONOMICS

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INTRODUCTION

For many Coloradans, outdoor recreation is an integral part of life. Whether spending time on the water, fishing the lakes and streams, hiking fourteeners, or spending the night outdoors—recreation is baked into our DNA. Time outside allows us to unplug from the daily grind, keeps us active, and creates community. All this outdoor recreation generates a significant amount of economic activity, which is important to the local economy of Larimer County. Because a large amount of recreation occurs at Larimer County reservoir parks, the management of these reservoirs has a direct influence on the economy of Larimer County.

In Colorado, 80 percent of the annual precipitation falls on the western slope[1] of the Continental Divide, while about 80 percent of the population lives on the eastern slope. To meet water needs for the State, the Colorado-Big Thompson Project (C-BT) collects and transports water from the west to the east via a 13.1–mile tunnel beneath Rocky Mountain National Park and stores the water in a series of 12 interconnected reservoirs. Water from the C-BT flows to more than 640,000 acres of irrigated farmland on the Front Range and supplies water to more than 900,000 people in northeastern Colorado.[2]

While the U.S. Bureau of Reclamation and Northern Water jointly manage the water levels in the C-BT for agricultural, municipal, and industrial water use, the Larimer County Department of Natural Resources (LCDNR) administers recreation on four of the reservoirs in the system. These four LCDNR reservoir parks are Horsetooth Reservoir, Carter Lake, Flatiron Reservoir, and Pinewood Reservoir.

In 2018 residents of Larimer County and non-residents alike made one and a half million visits to the County's reservoir parks. With each trip, dollars spent at grocery stores, restaurants, and hotels go on to support the regional economy in the form of jobs, income, and taxes. These dollars ripple throughout the economy as they are spent and re-spent, creating additional economic effects. This report estimates the total dollars spent on outdoor recreation on trips to LCDNR reservoir parks, and the broader economic effects that result from those expenditures.

STRUCTURE OF THE REPORT

In this report, we estimate the economic contribution of the four LCDNR reservoir parks to the Larimer County economy. This estimation requires the following steps:

- Define economic contribution—what it is and what it isn't.
- Estimate reservoir visitation—how many people visit the reservoirs each year?
- Create an expenditure profile—how does a typical LCDNR reservoir park visitor spend money?
- Estimate the economic contribution—how does the spending of recreational users at LCDNR reservoir parks directly and indirectly influence the broader Larimer County economy?

ABOUT **ECONOMIC CONTRIBUTION MODELING**

ECONOMIC OUTPUT | VALUE ADDED TO GDP | JOBS | LABOR INCOME | TAX REVENUE

As local and non-local recreational users visit LCDNR reservoir parks, they spend money in the community that helps drive the local and regional economy. These economic effects are the sales, tax revenues, jobs, and income that are generated by spending in the economy. We can measure these effects through an economic contribution analysis. An economic contribution analysis demonstrates the contribution of a given industry to the surrounding economy at a particular point in time, and allows policy makers to compare the magnitude of the economic contribution of LCDNR reservoir parks against other highly visible industries such as healthcare or construction.

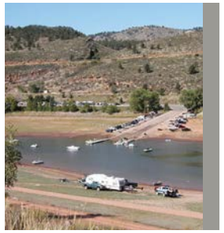
To conduct an economic contribution analysis, Earth Economics uses input-output (I-O) modeling, which measures the financial linkages between industries within a regional economy. Simply put, it shows how spending in one industry affects the economy. This analysis uses an industry standard I-O software called IMPLAN. An IMPLAN model calculates effects of expenditures on economic output, value added to GDP, jobs, labor income, and tax revenue.

With the exception of tax revenue, each of the categories in the IMPLAN model are broken into direct and secondary economic effects. Direct effects measure the economic activity of industries directly supported by consumer spending, such as hotels, retail stores, recreation services, and restaurants. Secondary economic effects are the corresponding shifts in the economy due to the initial infusion of money (i.e., the direct effect), and are further categorized as either indirect or induced effects.

Indirect effects represent the impact on the industries that support those which fall under the umbrella of direct effects. For example, restaurants are one of the industries directly affected by consumer spending; ranchers supply beef and growers supply produce to the restaurants that are patronized by recreational users. Increased spending at the restaurants provokes additional orders of beef and produce by the restaurants to keep up with demand; in this way, the agricultural industry indirectly benefits from the outdoor recreation activity.

Induced effects measure the effects of employee spending. Employees who work in the industries directly and indirectly affected by recreational expenditures spend their wages on goods and services in the regional economy. For instance, if a marina employee spends her paycheck on rent, gas, and groceries, this benefits local business and the regional economy—to the extent that this spending remains local.[i] Depending on the extent of connectivity in the regional economy, these economic effects can circulate throughout the economy numerous times before the dollars finally leave the region.

[i] As consumers inject money into industries related to reservoir park recreation, businesses and employees then re-spend this income on goods and services. The proportion of this income that is re-spent within the region is determined by each industries' Regional Purchase Coefficients (RPCs), representing the proportion of local demand for a commodity that is supplied from within the region.

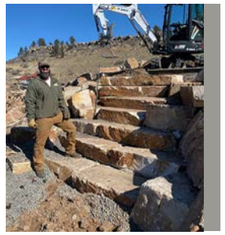


ECONOMIC OUTPUT

Visitor expenditures at the LCDNR reservoir parks lead to significant economic contributions in Larimer County. The total value of all sales in industries that are directly and indirectly supported by recreation at the reservoir parks can be understood as total economic output. The magnitude of total economic output is useful for understanding the size of the recreation sector relative to other sectors—like agriculture or higher education, for example—within the Larimer County economy. Additionally, comparing total direct expenditures by recreationists against total economic output shows how much economic activity is generated in the Larimer County economy for every dollar spent by recreational users.

VALUE ADDED TO GDP

Value added to GDP is a subset of total economic output. The value added to GDP is calculated by removing the value of intermediate production inputs—like raw materials, semi-finished goods, and business-to-business services—from the total economic output, representing the wealth or value created by an industry within the regional economy.

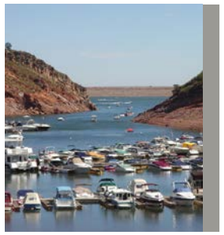


JOBS

Visitor expenditures at LCDNR reservoir parks directly and indirectly support jobs in Larimer County. Visitor spending allows restaurants, bars, coffee shops, hotels, and recreation agencies and businesses to provide full- and part-time work for staff. Visitor expenditures also indirectly support jobs in industries such as maintenance, government services, real estate, and medicine, which provide necessary services for the people who work in the directly impacted sectors.

LABOR INCOME

Visitor expenditures at LCDNR reservoir parks directly and indirectly support wages paid to workers in Larimer County. Visitor spending largely supports retail and hospitality businesses like restaurants, bars, coffee shops, hotels, as well as recreation agencies and businesses, whose workers are paid for their labor. Visitor expenditures also support wages in industries such as maintenance, government services, real estate, and medicine, which provide necessary services for the people who work in the directly impacted sectors.



TAX REVENUE

Visitor expenditures at LCDNR reservoir parks generate income for Larimer County and the state, through taxes on production and imports, which are typically characterized by sales tax and property tax.

PHOTOS COURTESY OF LARIMER COUNTY DEPARTMENT OF NATURAL RESOURCES

HORSETOOTH RESERVOIR, *PHOTO COURTESY OF JEANIE SUMRALL-AJERO*

ESTIMATING **RESERVOIR VISITATION**

To determine the economic contribution of each LCDNR reservoir to the local economy, it is first necessary to determine the number of visitors. Because visitation to the four reservoirs is not consistently tracked, an estimate of visitation was required. Fortunately, Horsetooth Reservoir recently underwent a visitor study that estimated the number of visitors to the reservoir. This data can then be used to estimate visitation at the other three reservoirs using permit sales as a proxy. The main draw of this approach to estimation is that it is based largely on observed data; if we understand what proportion of total visitors to all four reservoirs visit Horsetooth, we can identify total visitation across the LCDNR reservoir parks.

Other attempts were made to estimate visitation using both permits sales data and camping reservations data, but results were found to be unreliable. For more information, contact us at *info@eartheconomics.org*.

EXTRAPOLATING VISITATION

In 2019, Larimer County published its 2017/2018 Visitor Use Study that estimated the number of visitors to Horsetooth Reservoir over a year-long period. This estimation used data from vehicle counters at the six parking areas at Horsetooth Reservoir, combined with peak and off-peak estimates of number of people per vehicle based on human observational and statistical analysis from Colorado State University. Visitation over the period of June, 2017 to May, 2018 was estimated at 853,500, with the margin for error as low as 789,000 and as high as 918,000.[3]

At first glance, using the middle estimation of 853,500 seems most justifiable. However, understanding how the estimate for Horsetooth Reservoir was calculated, we have chosen to use the estimate of 918,000 visitors to Horsetooth Reservoir given the following factors:

- The Visitor Use Study counts vehicles, which means the visitor estimation does not capture people who enter the park in other ways. For instance, Horsetooth is a popular destination for road cyclists, and this important user group is not accounted for in the Visitor Use Study visitation estimate. While the Visitor Use Study provides an estimate spanning two years (June 2017 to May 2018), we are interested in estimating visitation for 2018. Permit sales, which have been shown to be correlated with visitation, have shown an upward trend. Permit sales for LCDNR reservoir parks increased 5 percent from 2017 to 2018. All else equal, visitation in 2018 would be expected to be greater than in the study period.

- There is a demonstrated trend in population growth in both Larimer County and Colorado. From 2017 to 2018, the County grew by 1.9 percent, and the State by 1.4 percent.[4] More people in the area likely means more visitors looking for recreation opportunities, especially with the exploding popularity of water-based activities such as stand-up paddleboarding.

While we have determined a visitation estimate of 918,000 is best for Horsetooth, there are no visitor count studies for Carter Lake, Pinewood Reservoir, or Flatiron Reservoir. To understand total visitation across the LCDNR reservoir park system, we must turn to the proxy of permit sales. Permits are required for each vehicle entering the park, but permits do not directly give us visitation numbers because a vehicle may contain any number of people. This is the reason that extrapolating from the Visitor Use Study is useful: it is based, in part, on observations of the number of people per vehicle at both peak and non-peak times.

Permit sales are tracked according to where they are sold: either at Horsetooth District, or at Carter Lake District. Horsetooth Reservoir is relatively isolated from the other three reservoirs, and represents its own district. Carter Lake District is located about 10 miles from Horsetooth Reservoir, and encompasses Carter Lake, Pinewood, and Flatiron. These three reservoirs are grouped tightly together and are accessed using the same road and entrance station. We assume that because the places to buy permits at Horsetooth District are not conveniently located for people accessing Carter Lake District that all permits purchased at the Horsetooth District are for visitors to Horsetooth Reservoir. Likewise, we assume that day permits bought at Carter Lake District are used to visit Carter Lake, Pinewood, or Flatiron.

LCDNR provided data for annual and day use permit sales from 2012 through 2018. On average over this seven-year period, 62 percent of all day permits were sold at the Horsetooth District. While annual pass holders have the flexibility to visit different reservoirs, we are forced to assume that if an annual pass is purchased at Horsetooth District, that pass holder only visits Horsetooth Reservoir; likewise for Carter Lake District. Based on this information, we can say that 62% of visitors to the LCDNR parks visit Horsetooth Reservoir, and 38% visit Carter Lake District. Based on conversations with LCDNR staff, of the visitors that go to Carter Lake District (38% of total), 60% go to Carter Lake, 20% to Pinewood, and 20% to Flatiron.

Using the number of permits sold within each district, and information on the distribution of visitors to the three Carter Lake District reservoirs, we can extrapolate from the 2017/2018 Visitor Use Study estimate of 918,000 visitors to Horsetooth Reservoir and estimate visitation at the Carter Lake District (see Figure 1).

FIGURE 1 RESERVOIR VISITATION ESTIMATES

RESERVOIR EXPENDITURE PROFILES

With visitation established, the next step in estimating the economic contribution of each LCDNR reservoir to the local economy is to identify expenditure profiles. An expenditure profile shows how much a typical visitor will spend, broken down by spending category. We selected expenditure profiles for each of the four reservoirs, based on existing data. Though the expenditure profiles are several years old, we expect them to be reflective of current expenditure patterns. This assumption is based on a report from the U.S. Forest Service, which notes that while future changes to expenditure profiles are possible due to changes in technology, economic conditions, or preferences, expenditure profiles don't fluctuate wildly:

> "The current patterns in the expenditures for goods and services by federal recreation visitors have appeared stable in recent years. For example, after accounting for inflation, there has been relatively little change in the relative amounts that visitors spend on food versus gasoline versus lodging."[5]

The data displayed in Figure 2 has been converted from per vehicle/group to per capita spending, and to USD 2018. These total estimates are the sum of expenditures across a variety of categories, each of which are key inputs for the IMPLAN analysis that combines visitation and expenditures to model the estimated total economic contribution of recreation.

FIGURE 2 SUMMARY OF TOTAL PER CAPITA EXPENDITURES, 2018$

HORSETOOTH **$112.64**

CARTER **$106.46**

PINEWOOD **$109.36**

FLATIRON **$109.36**

The expenditure profiles for Horsetooth and Carter are sourced from the 2005 Economic Study, which reported total expenditures per group. We calculated per-capita estimates using average group sizes listed in the report—5.6 at Horsetooth and 5.1 at Carter—and converted to USD 2018.[6]

Expenditures for Flatiron and Pinewood were not generated by the 2005 Economic Study, so it is necessary to identify expenditure profiles from comparable recreation sites. We identified expenditure profiles for all Colorado state parks in a 2009 report produced for Colorado Parks and Wildlife by Corona Research, and sorted them according to their characteristics to determine which park(s) made the best comparators.[7]

To identify the park(s) that offered comparable rustic camping and recreation experiences to those offered by Flatiron and Pinewood Reservoirs, the characteristics of each state park were reviewed in the Colorado Parks and Wildlife Boatable Waters Directory.[8]

Parks were eliminated as possible comparators according to the type of recreational experience offered. First, state parks without water were eliminated. Next, parks that offered unrestricted powerboating were eliminated. Next, two river parks were eliminated—one features rafting as a primary activity, and the other is composed of five non-contiguous river-adjacent lakes. Finally, two more parks were eliminated that allow powerboating with loose restrictions on motor size; 10 and 20 horsepower are still relatively large.

This process of elimination reduced the number of parks from the roster in the 2009 Corona Research report from 42 to four parks: Pearl Lake, St. Vrain, State Forest, and Sylvan Lake. Three of these offer wakeless boating, and the fourth (Sylvan Lake) does not allow any gas motors whatsoever. Due to variations in location and activities offered across these four parks, we adopt the mean expenditure profile of these four state parks as a proxy for Flatiron and Pinewood. The mean expenditure profile has been converted from per vehicle/group to per capita spending, and to USD 2018.

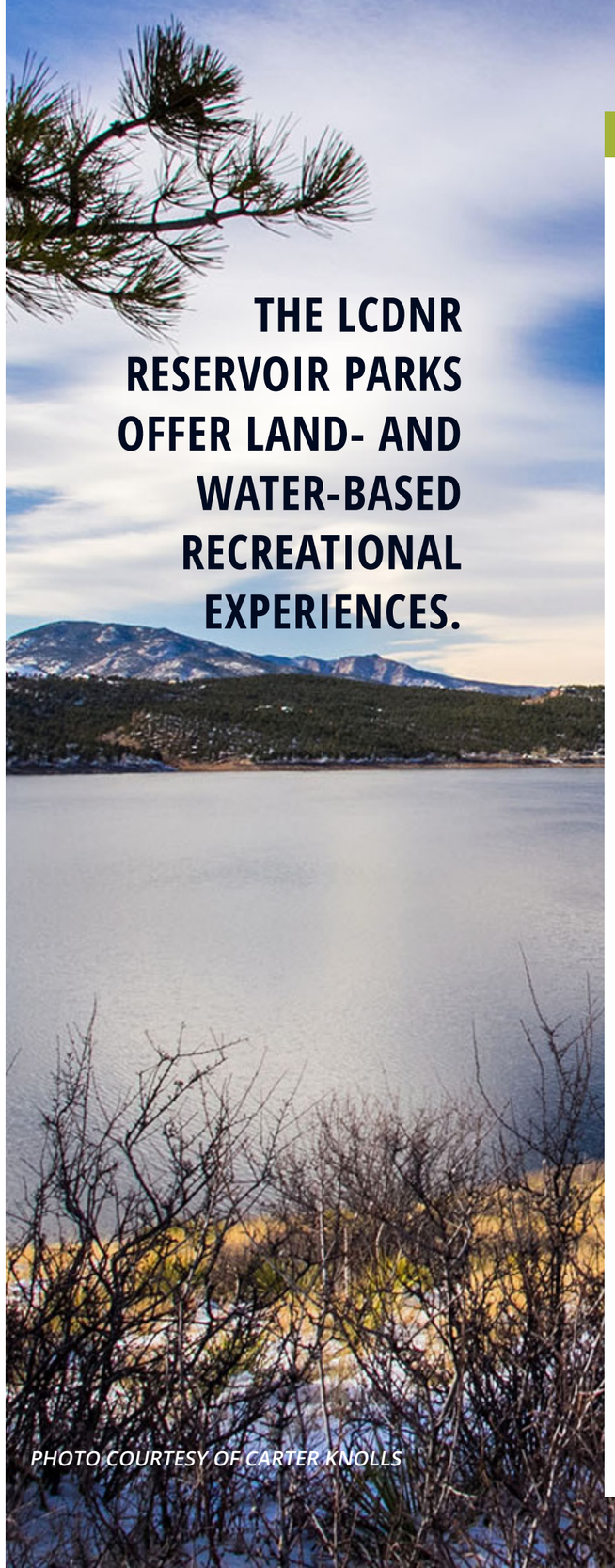


PHOTO COURTESY OF CARTER KNOLLS

ECONOMIC CONTRIBUTION OF LARIMER COUNTY RESERVOIR PARKS

Summing together visitation to the four LCDNR reservoir parks, 1.48 million visits were made in 2018. While the largest amount of visitation is seen at Horsetooth Reservoir, the Carter Lake District receives significant visitation and plays an integral role in offering unique recreation activities to the community.

Visitation to the four reservoir parks supports spending on food, lodging (both at hotels and campsites), park entrance fees, and miscellaneous camping supplies, totaling $164 million of sales within the county. Total economic output, including secondary effects, is estimated to be $285 million in Larimer County. This means for every dollar spent on reservoir related recreation, an additional $0.74 is re-spent within the county through secondary effects, for a total of $1.74 per dollar spent.

These expenditures also support 3,576 full- and part-time jobs.[ii] That means that outdoor recreation at the reservoir parks is responsible for just under 2 percent of total employment in the county.[9] Finally, reservoir parks support $154 million in GDP contributions to the county GDP, in a year when Larimer County boasted a regional GDP of $15.8 billion.

FIGURE 3 RECREATIONAL OFFERINGS OF LCDNR RESERVOIR PARKS

	Motorized Boating	Non-Motorized Boating	Stand Up Paddle Boarding	Camping	Swimming	Fishing	Picnicking	Hiking	Mountain Biking	Rock Climbing and Bouldering	Horseback Riding	SCUBA
Horsetooth Reservoir	•	•	•	•	•	•	•	•	•	•	•	•
Carter Lake	•	•	•	•	•	•	•	•	•	•	•	•
Pinewood Reservoir		•	•	•		•	•	•	•		•	
Flatiron Reservoir				•		•	•	•				

TOTAL ECONOMIC EFFECTS
ALL FOUR LCDNR RESERVOIR PARKS IN 2018

VISITOR SPENDING $163,957,042 • **JOBS 3,575.5**

WAGES $106,276,613 • **TAX REVENUE $17,844,686** in local and state taxes

TOTAL ECONOMIC OUTPUT $284,972,178 in economic activity supported by recreation-related visitor spending.

CONTRIBUTION TO COUNTY GDP $154,288,752 of recreation.

[ii] Calculated in terms of "job years," or the total number of full- and part-time jobs annualized over the course of the year (e.g., one employee working twelve months or two employees working six months each equal one job year). Includes wages and benefits.

RESERVOIR PROFILE

HORSETOOTH RESERVOIR

Spanning nearly 2,000 surface acres, Horsetooth is the largest of the four LCDNR reservoirs. Boating is popular on the reservoir, which offers three boat launches and a marina. The reservoir park extends beyond the lake area, including six day use areas, 151 campsites, and multi-use trails snaking through the surrounding 2,000 acres of public lands. Horsetooth offers the most comprehensive suite of land-based and water-based recreational offerings of the four reservoirs, which makes it the most-visited of the four LCDNR.

In 2018, approximately 918,000 visitors came to the reservoir, and each visit is associated with average expenditures of $113 in the community. This means that each year, Horsetooth Reservoir drives over $103 million in visitor expenditures.

The $103 million in expenditures leads to significant economic contributions in Larimer County. The industries that are directly and indirectly supported by these expenditures produce goods and services worth a total of $180 million. Put another way, this is the total spending—both the primary visitor expenditures and the secondary effects—associated with recreation at Horsetooth Reservoir in Larimer County. This means that for every $1.00 spent by recreational users, $1.74 in economic activity is generated in the regional economy. The value of these goods and services is the total economic output, which is useful for understanding the size of the recreation sector relative to other sectors—like agriculture or higher education, for example—within the Larimer County economy.

A subset of the total economic output is the value added to the economy by these goods and services. The value added to GDP is calculated by removing the value of intermediate production inputs—like raw materials, semi-finished goods, and business-to-business services—from the total economic output, which represents the wealth or value created by the industry. In Larimer County, the contribution of recreation to GDP is $97 million per year.

Visitor expenditures and the economic activity they generate support 2,296 full- and part-time jobs, and $67 million in wages in the region. The jobs that are directly related to visitor spending are service-related jobs in restaurants, bars, coffee shops, hotels, etc. Secondary employment effects are experienced in industries such as maintenance, government services, real estate, and medicine.

Finally, spending by visitors to Horsetooth Reservoir contributes significantly to local and state taxes. Taxes on production and imports are by far the largest contributors, with sales tax being the dominant force. Recreation at Horsetooth Reservoir generates more than $11 million in local and state tax revenue.

TOTAL ECONOMIC EFFECTS **HORSETOOTH RESERVOIR**

VISITOR SPENDING $103,405,135 • JOBS 2,296.1
WAGES $67,221,501 • TAX REVENUE $11,025,672 in local and state taxes

TOTAL ECONOMIC OUTPUT $179,903,165 in economic activity supported by recreation-related visitor spending.
CONTRIBUTION TO COUNTY GDP $96,585,245 of recreation.

HORSETOOTH RESERVOIR PROFILE

Number	Units	Description
1,900	acres	of flatwater, at full pool
1,900	acres	of surrounding public land
25	miles	of total shoreline
156,735	acre-feet	reservoir storage capacity
188	feet	maximum reservoir depth
5,420	feet	in elevation
6	day use areas at Duncan's Ridge, Torture Chamber, Rotary Park, Sunrise, Skyline, South Bay	
2	group pavilions	
1	information center at South Bay	
3	boat launches at Inlet Bay, South Bay, Satanka Bay	
1	marina at Inlet Bay	
250	slips at Inlet Bay Marina	
50	moorings at Inlet Bay Marina	
2	campgrounds at South Bay, Inlet Bay	

RESERVOIR PROFILE

CARTER LAKE

Nestled to the southwest of Loveland, Carter Lake is Larimer County's second largest reservoir by surface area. Though about half the size of Horsetooth, the lake—at 1,100 acres—still provides sufficient opportunity for excellent motorized boating. Additional lakeside fishing, camping, and day use is also a strong driver of visitation.

In 2018, approximately 338,000 visitors came to the reservoir, and each visit is associated with average expenditures of $106 in the community. This means that each year, Carter Lake drives about $36 million in visitor expenditures.

The $36 million in expenditures leads to significant economic contributions in Larimer County. The industries that are directly and indirectly supported by these expenditures produce goods and services worth a total of $62 million. Put another way, this is the total spending—both the primary visitor expenditures and the secondary effects—associated with recreation at Carter Lake in Larimer County. This means that for every $1.00 spent by recreational users, $1.72 in economic activity is generated in the regional economy. The value of these goods and services is the total economic activity, which is useful for understanding the size of the recreation sector relative to other sectors—like agriculture or higher education, for example—within the Larimer County economy.

A subset of the total economic output is the value added to the economy by these goods and services. The value added to GDP is calculated by removing the value of intermediate production inputs—like raw materials, semi-finished goods, and business-to-business services—from the total economic output, which represents the wealth or value created by the industry. In Larimer County, the contribution of recreation to GDP is $33 million per year.

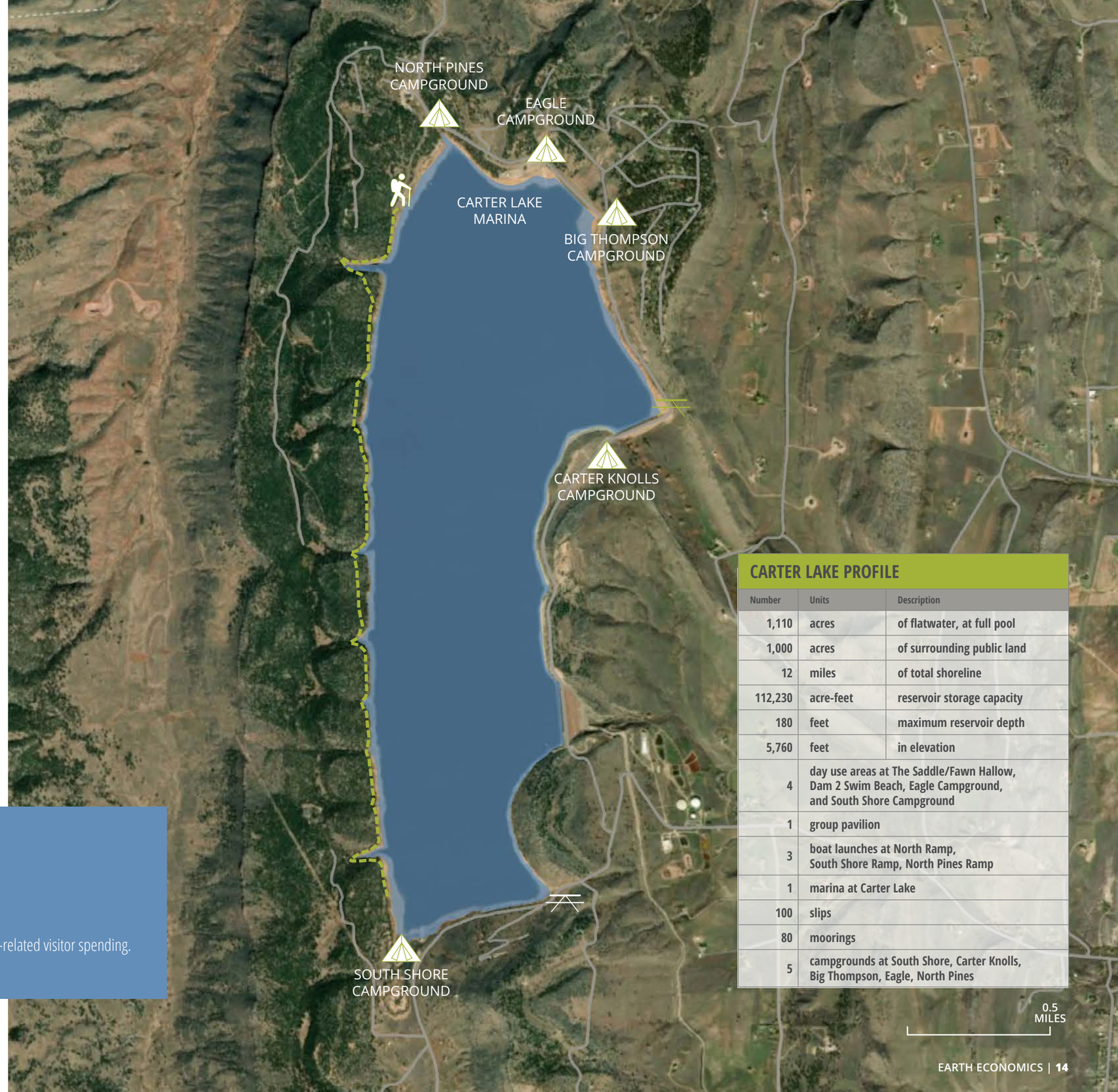
Visitor expenditures and the economic activity they generate support 807 full- and part-time jobs, and $23 million in wages in the region. The jobs that are directly related to visitor spending are service-related jobs in restaurants, bars, coffee shops, hotels, etc. Secondary employment effects are experienced in industries such as maintenance, government services, real estate, and medicine.

Finally, spending by visitors to Carter Lake contributes significantly to local and state taxes. Taxes on production and imports are by far the largest contributors, with sales tax being the dominant force. Recreation at Carter Lake generates more than $4.3 million in local and state tax revenue.

TOTAL ECONOMIC EFFECTS **CARTER LAKE**

VISITOR SPENDING $35,940,290 • JOBS 807.3
WAGES $23,063,001 • TAX REVENUE $4,297,957 in local and state taxes

TOTAL ECONOMIC OUTPUT $61,982,185 in economic activity supported by recreation-related visitor spending.
CONTRIBUTION TO COUNTY GDP $33,473,642 of recreation.



CARTER LAKE PROFILE

Number	Units	Description
1,110	acres	of flatwater, at full pool
1,000	acres	of surrounding public land
12	miles	of total shoreline
112,230	acre-feet	reservoir storage capacity
180	feet	maximum reservoir depth
5,760	feet	in elevation
4	day use areas at The Saddle/Fawn Hallow, Dam 2 Swim Beach, Eagle Campground, and South Shore Campground	
1	group pavilion	
3	boat launches at North Ramp, South Shore Ramp, North Pines Ramp	
1	marina at Carter Lake	
100	slips	
80	moorings	
5	campgrounds at South Shore, Carter Knolls, Big Thompson, Eagle, North Pines	

RESERVOIR PROFILE

FLATIRON RESERVOIR

For a quieter recreation experience, the 47-acre Flatiron Reservoir is an ideal spot for camping and fishing. The reservoir is located about a mile north of Carter Lake. Unlike Horsetooth Reservoir and Carter Lake, boating and swimming are not allowed at Flatiron Reservoir. Shoreline fishing is allowed, and the reservoir is stocked with rainbow trout several times in the spring and fall months.

In 2018, approximately 113,000 visitors came to the reservoir, and each visit is associated with average expenditures of $109.36 in the community. This means that each year, Flatiron Reservoir drives over $12.3 million in visitor expenditures.

The $12.3 million in expenditures leads to significant economic contributions in Larimer County. The industries that are directly and indirectly supported by these expenditures produce goods and services worth a total of $21.5 million. Put another way, this is the total spending—both the primary visitor expenditures and the secondary effects—associated with recreation at Flatiron Reservoir in Larimer County. This means that for every $1.00 spent by recreational users, $1.75 in economic output is generated in the regional economy. The value of these goods and services is the total economic activity, which is useful for understanding the size of the recreation sector relative to other sectors—like agriculture or higher education, for example—within the Larimer County economy.

A subset of the total economic output is the value added to the economy by these goods and services. The value added to GDP is calculated by removing the value of intermediate production inputs—like raw materials, semi-finished goods, and business-to-business services—from the total economic output, which represents the wealth or value created by the industry. In Larimer County, the contribution of recreation to GDP is $12 million per year.

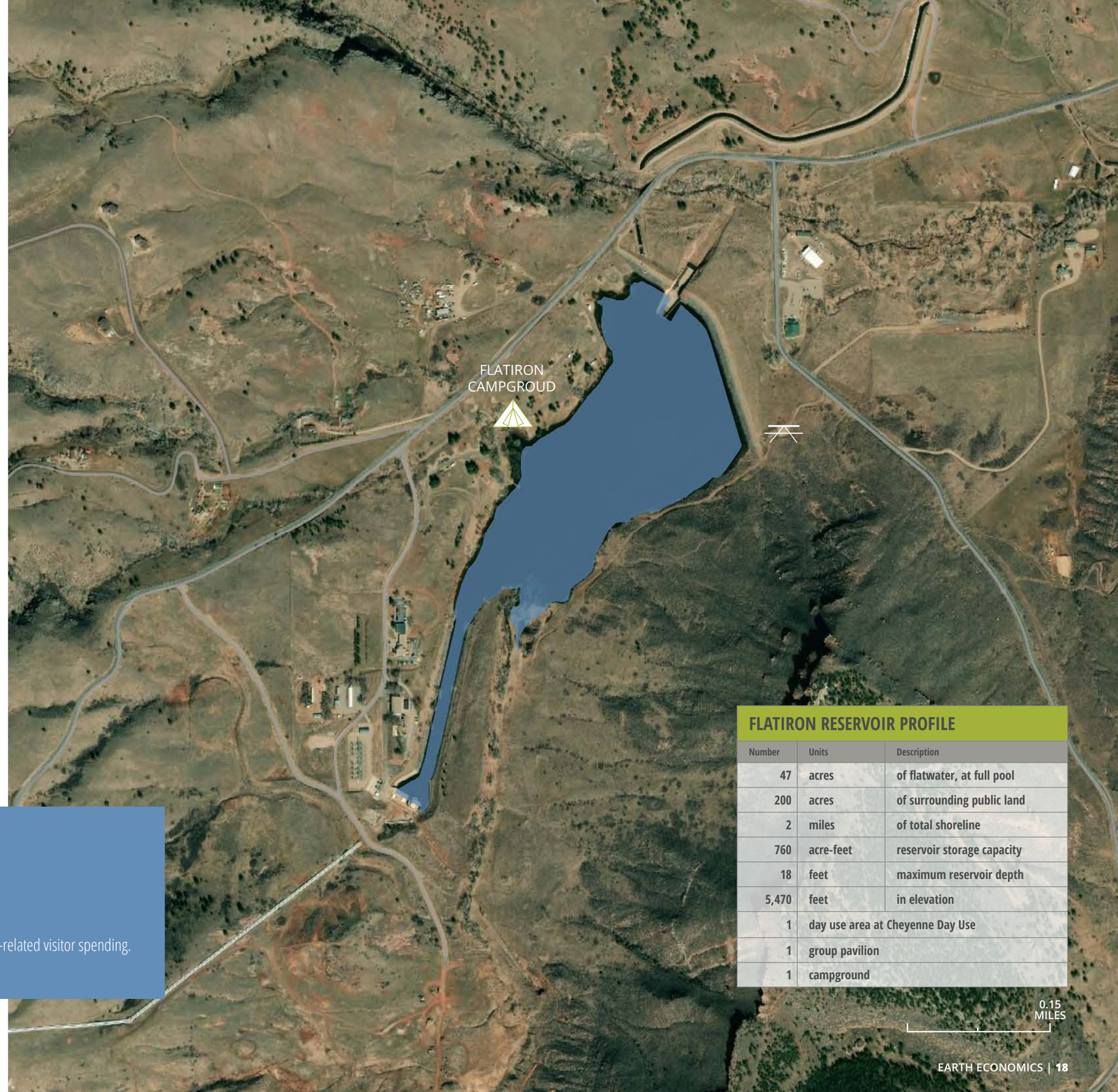
Visitor expenditures and the economic activity they generate support 236 full- and part-time jobs, and $8 million in wages in the region. The jobs that are directly related to visitor spending are service-related jobs in restaurants, bars, coffee shops, hotels, etc. Secondary employment effects are experienced in industries such as maintenance, government services, real estate, and medicine.

Finally, spending by visitors to Flatiron Reservoir contributes significantly to local and state taxes. Taxes on production and imports are by far the largest contributors, with sales tax being the dominant force. Recreation at Flatiron generates more than $1.2 million in local and state tax revenue.

TOTAL ECONOMIC EFFECTS **FLATIRON RESERVOIR**

VISITOR SPENDING $12,305,809 • JOBS 236.1
WAGES $7,996,055 • TAX REVENUE $1,260,528 in local and state taxes

TOTAL ECONOMIC OUTPUT $21,543,414 in economic activity supported by recreation-related visitor spending.
CONTRIBUTION TO COUNTY GDP $12,114,932 of recreation.



FLATIRON RESERVOIR PROFILE

Number	Units	Description
47	acres	of flatwater, at full pool
200	acres	of surrounding public land
2	miles	of total shoreline
760	acre-feet	reservoir storage capacity
18	feet	maximum reservoir depth
5,470	feet	in elevation
1	day use area at Cheyenne Day Use	
1	group pavilion	
1	campground	

RESERVOIR PROFILE

PINEWOOD RESERVOIR

Located five miles west of Flatiron Reservoir in the Carter Lake District, Pinewood Reservoir offers a peaceful escape where visitors come to fish, camp, picnic, and ride horses. Non-motorized boating is allowed on the 100-acre reservoir, and kayaking, canoeing, and the growing sport of stand-up paddle boarding are popular pursuits. Rainbow, brown, Snake River cutthroat, lake trout, and Tiger Muskie are fished at Pinewood.

Annually, approximately 113,000 visitors come to the reservoir, and each visit is associated with average expenditures of $109.36 in the local community. This means that each year, Pinewood Reservoir drives over $12.3 million in visitor expenditures.

The $12.3 million in expenditures leads to significant economic contributions in Larimer County. The industries that are directly and indirectly supported by these expenditures produce goods and services worth a total of $21.5 million. Put another way, this is the total spending associated with recreation at Pinewood Reservoir in Larimer County. This means that for every $1.00 spent by recreational users, $1.75 in economic activity is generated in the regional economy. The value of these goods and services is the total economic output, which is useful for understanding the size of the recreation sector relative to other sectors—like agriculture or higher education, for example—within the Larimer County economy.

A subset of the total economic output is the value added to the economy by these goods and services. The value added to GDP is calculated by removing the value of intermediate production inputs—like raw materials, semi-finished goods, and business-to-business services—from the total economic output, which represents the wealth or value created by the industry. In Larimer County, the contribution of recreation to GDP is $12 million per year.

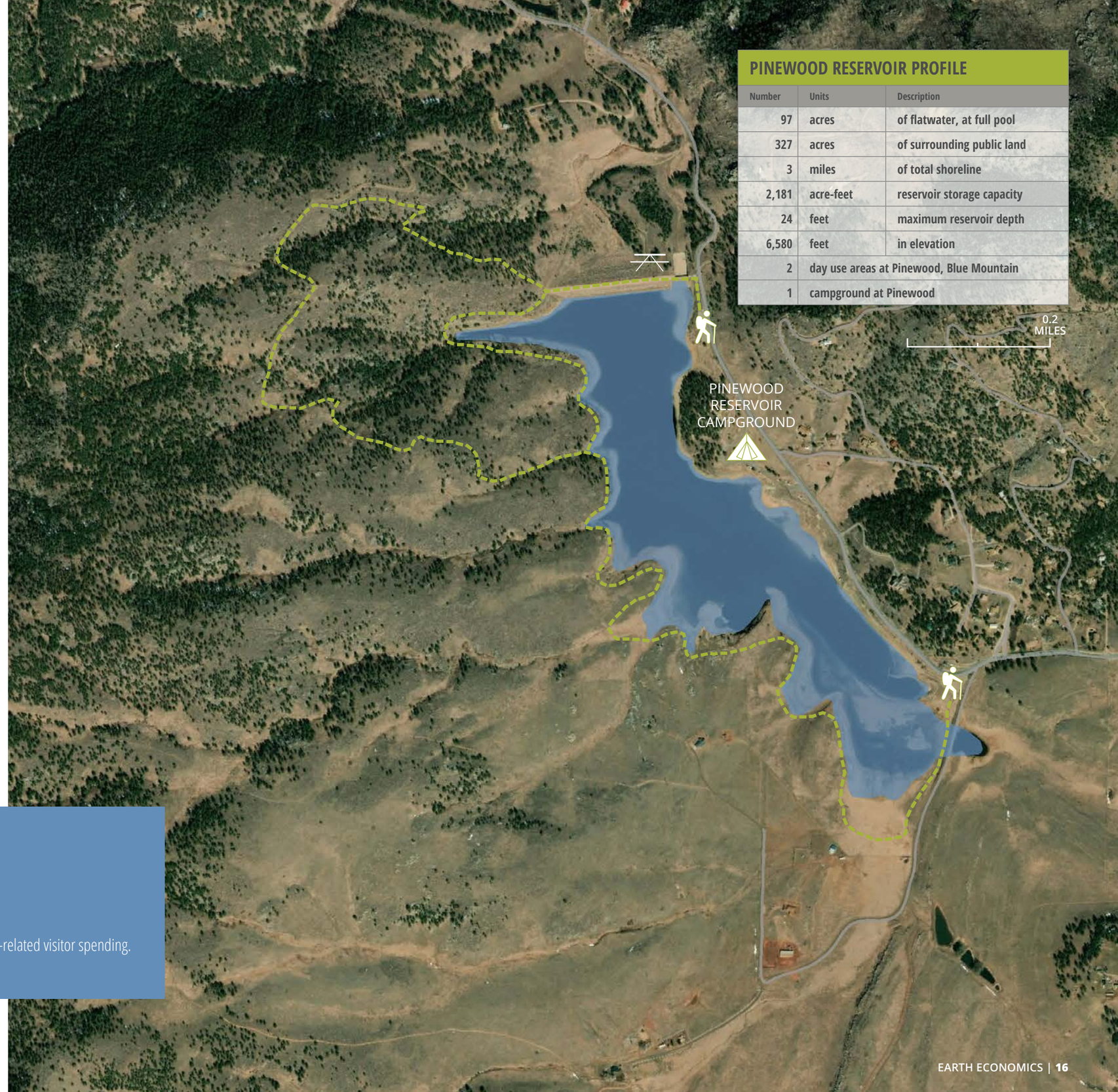
Visitor expenditures and the economic activity they generate support 236 full- and part-time jobs, and $8 million in wages in the region. The jobs that are directly related to visitor spending are service-related jobs in restaurants, bars, coffee shops, hotels, etc. Secondary employment effects are experienced in industries such as maintenance, government services, real estate, and medicine.

Finally, spending by visitors to Pinewood contributes significantly to local and state taxes. Taxes on production and imports are by far the largest contributors, with sales tax being the dominant force. Recreation at Pinewood generates more than $1.3 million in local and state tax revenue.

TOTAL ECONOMIC EFFECTS **PINEWOOD RESERVOIR**

VISITOR SPENDING $12,305,809 • JOBS 236.1
WAGES $7,996,055 • TAX REVENUE $1,260,528 in local and state taxes

TOTAL ECONOMIC OUTPUT $21,543,414 in economic activity supported by recreation-related visitor spending.
CONTRIBUTION TO COUNTY GDP $12,114,932 of recreation.



CONCLUSION

This report has demonstrated the significant economic value to Larimer County of recreational participation at LCDNR reservoir parks. Spending associated with reservoir park recreation totals $164 million per year and goes on to support $285 million in associated spending within Larimer County. An additional $0.74 is re-spent in the community.

Given the important role of recreation in the economy, it is in Larimer County's interest to continue to provide attractive recreation options to the public. However, reduced water deliveries threaten ongoing recreational participation at the LCDNR reservoir parks and, by extension, the economy of Larimer County.

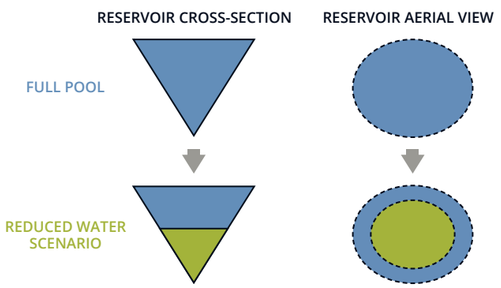
REDUCED WATER SUPPLY IS A THREAT TO THE ECONOMY OF LARIMER COUNTY

The LCDNR reservoir parks are a part of the interconnected C-BT system that supplies water to agricultural, commercial, and municipal users on the Colorado Front Range. Today, multiple factors are stressing the water supply, and water planners are working to ensure that everyone's water needs are met.

The Bureau of Reclamation, together with affected water authorities and stakeholders, is planning for less water system-wide while attempting to balance the needs of farmers, hydropower facilities, municipalities, industry, and recreational users. Lower water levels during peak recreation season combined with projected population growth in Larimer County and the greater Denver Metro area represent a one-two punch that threaten to hamper the recreational experience offered by the LCDNR reservoir parks. Low water affects recreation in a variety of ways, but one tangible way is by reducing the space available for recreation.

As shown in Figure 4, when reservoir volume falls (left column), surface area also falls (right column). This reduces the total number of boatable acres, which exacerbates crowded conditions. Overcrowding is already a disincentive to recreation at LCDNR reservoir parks. Indeed, the 2017 Larimer County Reservoir Parks Master Plan found that to maintain the same level of recreational service provision for the projected population in 2040, Larimer County would need to create an additional reservoir the size of Horsetooth. This projection is only concerned with population growth, and does not account for any potential reductions in water available from the C-BT system.

FIGURE 4 CONCEPTUAL MODEL OF REDUCED SURFACE AREA FOR RECREATION



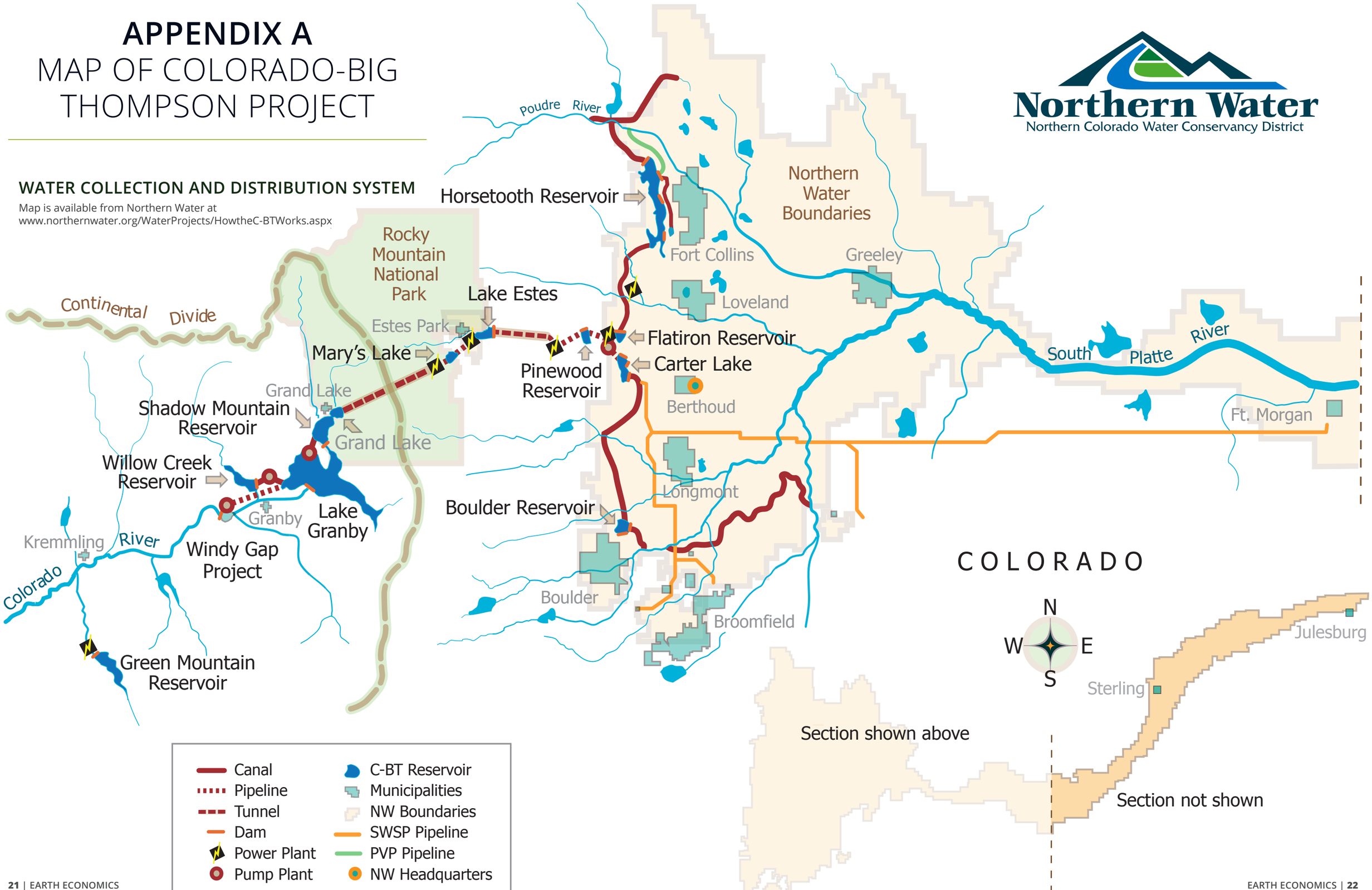
Should water deliveries to LCDNR reservoir parks be reduced, recreational participation at the parks would fall, reducing the economic benefits realized by the County (see Appendix B for details). As a civic agency, Larimer County is already reckoning with how to provide a similar level of recreational service provision—a public good—to its rapidly growing population. Overcrowding and the looming possibility of reduced water deliveries combine to threaten recreation, its economic benefits, and the health and quality of life benefits it provides.

APPENDIX A
MAP OF COLORADO-BIG THOMPSON PROJECT

Northern Water
Northern Colorado Water Conservancy District

WATER COLLECTION AND DISTRIBUTION SYSTEM

Map is available from Northern Water at
www.northernwater.org/WaterProjects/HowtheC-BTWorks.aspx



APPENDIX B ECONOMIC IMPACT OF CHANGING RESERVOIR LEVELS

SUMMARY

Based on day use permit sales information and reservoir storage data from 2013 to 2018, we find that visitation is responsive to water levels at Horsetooth Reservoir. More water in the reservoir is associated with more visitors, and less water is associated with fewer visitors; this finding mirrors the results from the literature. In a scenario where the monthly average storage at Horsetooth is reduced by 10,000 acre-feet, we estimate 7,747 fewer recreational users over the course of the year.

Reduced visitation results in reduced visitor expenditures, which reduces the economic contribution of recreation at Horsetooth to the Larimer County economy. With each visitor spending an estimated $112.64 per trip, $870,000 in direct visitor expenditures will not be supported by the reservoirs, which in turn drive more than $1.5 million in losses to the regional economy.

Due to data constraints, this exercise did not model the volume-visitation relationship at Carter Lake, Flatiron Reservoir, or Pinewood Reservoir. Based on theory and the existing literature, we have every reason to believe that reduced water deliveries would similarly result in reduced visitation, spending, and associated economic impact.

INTRODUCTION

In this report, we have demonstrated the contributions of the LCDNR reservoir parks to the Larimer County economy. Ongoing drought and increasing demand for water in the region signal less water in the C-BT, and water levels at reservoirs across the system—including LCDNR reservoir parks—are likely to be affected.

To explore the impact of fluctuating water levels at LCDNR reservoir parks on the Larimer County economy, we evaluate the relationship between reservoir water levels and a subset of recreational visitation—day use permit sales. Understanding likely changes in day use permit sales and the related economic impacts will help inform the Bureau of Reclamation's water allocation decisions and LCDNR planning initiatives going forward.

DATA

We use two different pieces of data for this analysis. To measure visitation, we use the proxy of day use permit sales at Horsetooth Reservoir. We focus on single-day permits because we hypothesize that these permit holders are induced to buy permits in response to current conditions, including water level. LCDNR provided aggregate day use permit sales by month from 2013 through 2018 at Horsetooth Reservoir.

To measure water levels, we use reservoir storage data available from the Reclamation Water Information System, a tool maintained by the Bureau of Reclamation. We used the query tool to acquire daily water storage data for the same period for which we have permit sales—2013 through 2018—and calculate monthly average storage.

DESCRIPTION OF THE MODEL

For this analysis, we follow a method developed in three studies that relate recreational visitation and water levels at lakes Mead and Powell (Johnson et al., 2016; Jiang et al., 2015; Neher et al., 2013). This method centers on building a regression model to correlate visitation with water level.

The generic model developed in these studies takes the form of:

$$\widehat{Y}_i = B_0 + B_{1x_{i_1}} + \ldots + B_{kx_{ik}} + e_i$$

In this model, $\underline{Y}$ is the estimated monthly average sales of day use permits at Horsetooth Reservoir in month $_i$; $x_{i_1} + \ldots x_{i_1}$ are the time of year and water level for month $_i$; $B_0 \ldots B_k$ represent the unknown parameters being estimated by the regression; and the error term is assumed to be independent.

MODEL DEVELOPMENT

All three studies on which we modeled this analysis choose reservoir storage volume rather than reservoir elevation as the primary explanatory variable in their statistical models. In Neher et al. (2013), the authors note a near-perfect correlation between the two variables, concluding that there is no statistical basis for choosing reservoir volume over elevation or vice-versa. As shown in Figure 5 (pg. 22), we observe a similar correlation in the six years of data used in this analysis, where r=.9987 (r=1 is a perfect correlation).

We have opted to follow the method established by the studies of lakes Mead and Powell and proceed with reservoir storage as our primary explanatory variable.

The next step in specifying our model is to choose an appropriate functional form and hypothesize the sign of the coefficient on reservoir storage—the key explanatory variable. Simply put, this means choosing the shape of the function to represent the relationship between storage and visitation. A common first step in econometrics when making these decisions is to identify what other studies have done; here, we again turn to the three studies of lakes Powell and Mead.

All three studies use a model that is linear both in the variables and in the coefficients. This means that the slope of the relationship between the dependent variable (permit sales) and explanatory variable (reservoir storage) is constant. Furthermore, these three studies hypothesize that the coefficient on storage will have a positive sign. Practically speaking, assuming a constant and positive relationship means that permit sales and reservoir volume will move together at the same rate: when reservoir volume increases, permit sales will

FIGURE 5 CORRELATION* BETWEEN RESERVOIR ELEVATION AND STORAGE, HORSETOOTH RESERVOIR, 2013—2108

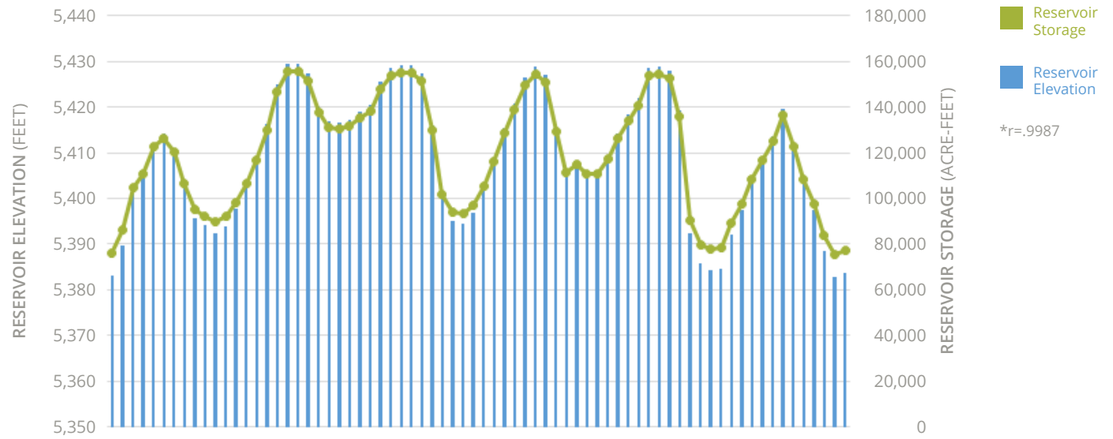
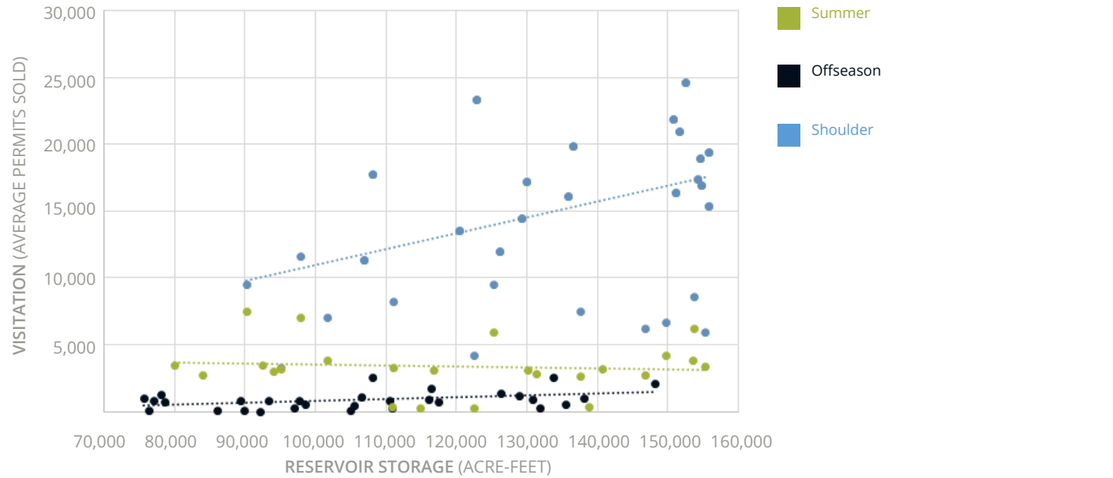


FIGURE 6 HORSETOOTH RESERVOIR AVERAGE MONTHLY PERMIT SALES BY WATER VOLUME AND SEASON



correspondingly increase; when volume decreases, likewise permit sales. The same logic holds true at Horsetooth Reservoir, and so we proceed with a linear model and an expected positive coefficient for our own analysis.

Neher et al. (2013) and Johnson et al. (2016) further refine this model by graphing both Lake Powell volume and visitation by month in a scatterplot. Examining this information, these authors identify a banding pattern in the data that shows different levels of visitation at the same water level, depending on the season[iii]. This illustrates an intuitive concept—high water levels may be attractive to recreational users in the hot summer months, but that same high water level does not induce recreational users to visit Lake Powell during the winter months, when average low temperatures routinely dip below freezing. The other result of this exercise is perhaps less expected. The authors also identify different slopes for seasonal visitation, meaning that the degree to which water level affects visitation changes based on the season. We recreated this plot using our own data, and it suggests that there may also be some seasonal effect at Horsetooth Reservoir (see Figure 6).

The difference between the steeply-sloping trend line of the summer season contrasts with the flat lines of the shoulder and winter seasons. This difference in slope suggests that in summer, permit sales are quite responsive to water levels, whereas the same cannot be said for the other seasons. On visual inspection, we also note a lack of distinction between the offseason and shoulder season "bands," as well as high variance within the summer "band."

Visual comparisons like this scatterplot can be helpful for building better regression models, but on their own do not allow for

[iii] Summer season is June–August; shoulder season is April–May and September–October; winter season is November–March

drawing conclusions. To mathematically isolate any differential seasonal impact of water level on visitation, Neher et al. (2013) use the base model that we have just presented, but include interaction terms of season and volume. These interaction terms are defined as:

- Summer*Volume = (June + July + August) * Volume
- Shoulder*Volume = (April + May + September + October) * Volume

Including these interaction terms along with the base model allows both the slope and intercept to vary—that is, the seasonal dummy variables from the base model allow for different starting points for visitation by season at each water level, and the interaction terms change the slope of the function, thereby modeling how visitation responds differently to water level changes during each season.

We mimicked this approach using the available data for permit sales and volume at Horsetooth Reservoir, and included an interaction term for the apparently unique summer season observed in the scatterplot of visitation and volume. However, we slightly adapted the Neher et al. (2013) model in two ways. First, at Horsetooth Reservoir, visitation during the shoulder season and winter season are virtually indistinguishable, so we did not include the shoulder season interaction term in Neher et al. (2013) that is used to explain the three clear "bands" of seasonal visitation. Second, whereas Neher et al. (2013) use the months of March through November in their model, we use April through October to reflect the relatively shorter recreation season at Horsetooth Reservoir (see Figure 7).

Whereas the Neher et al. (2013) model draws on 15 years of data, we are limited to only six years of data. The result is that the Neher et al. (2013) model produces a highly statistically significant result for the model as a whole and for the important explanatory variables (volume, and the summer and shoulder interaction terms); our model—constrained by a small sample size—produces a high level of statistical significance for the model as a whole and for the seasonal interaction term, but we do not see a statistically significant result for the primary explanatory variable, storage volume.

This result is somewhat expected due to the already small sample size. Adding another variable—the interaction term—further reduces the degrees of freedom that are necessary for producing significant results. This suggests that a model without the interaction term may be more appropriate.

MODELING PERMIT SALES AND WATER LEVELS—RESULTS

To identify the relationship between water level and recreational participation, we regress the average monthly sales of day use permits on monthly average reservoir storage and dummy variables for the months of April through October which control for the seasonality of recreation (which in turn in driven by factors like temperature, rainfall, cloud cover, and hours of daylight). We made no attempts to control for other factors, like broader economic conditions or gas prices. This model is based on observed water levels and visitation over the six year period of 2013–2018, and is designed to illuminate how both time of year and water level explain variation in observed average monthly sales of day use permits at Horsetooth Reservoir: The regression model as specified with monthly average reservoir storage and dummy variables for each month explains 93 percent of the observed variation in permit sales as indicated by the adjusted R^2 value of .934. The sample size for the model is 72, all coefficients have the expected signs, and the bulk of the variables in the model are statistically significant at the 90 percent confidence level or greater (see Figure 8, pg. 24).

In this specification, the coefficient of interest is on the 'Avg. Storage' variable (.024). This coefficient points to a positive and statistically significant relationship between the sales of day use permits and storage volume—that is, when there is more water in the reservoir, more day use permits are sold. The opposite is also true: less water means fewer day use permit sales. This coefficient indicates that if every month included in this specification had its average storage reduced by 10,000 acre-feet, we would expect there to be 240 fewer day use permits sold each month.

FIGURE 7 ESTIMATED HORSETOOTH RESERVOIR PERMIT SALES MODEL, WITH SEASONAL EFFECTS

	Dependent Variable: ("No. Permits")
'Avg. Storage'	0.013 (0.013)
factor(April)1	1,630.631* (873.618)
factor(May)1	5,524.619*** (935.409)
factor(June)1	5,352.221 (4,747.339)
factor(July)1	9,604.674** (4,613.945)
factor(August)1	5,793.574 (4,178.471)
factor(September)1	7,024.290*** (807.319)
factor(October)1	1,858.230** (812.842)
Summer Interaction Term	0.068** (0.033)
Constant	-550.491 (1,455.039)
Observations	72
R^2	0.945
Adjusted R^2	0.937
Residual Std. Error	1,804.941 (df=62)
F Statistic	118.830*** (df=9; 62)
Note	*p<0.1;**p<0.05***p<0.01


PHOTO COURTESY OF LCDNR

ECONOMIC RELATIONSHIP BETWEEN WATER LEVEL AND VISITATION

To illustrate the economic impact of reduced day use permit sales, we call upon the findings from the body of the paper that outline the impacts of current spending by recreational users at Horsetooth Reservoir. This simple math outlines what should be considered the absolute minimum estimated economic impact of a 10,000 acre-foot reduction scenario.

If the average storage in each month of the year is reduced by 10,000 acre-feet, this model predicts that each month would see 240 fewer day use permits sold, for a total of 2,880 fewer day use permits over the course of a full year (12 months*240 permits per month). An intercept survey of visitors to Colorado's state parks found that the average number of people per vehicle across all parks was 2.69 (Corona Research, 2009). Multiplying the average people per vehicle by the expected reduction in day use permit sales yields an estimated 7,747 fewer visitors to Horsetooth Reservoir. Referring to the body of the report, each visitor spends an estimated $112.64 per trip, which suggests that over $870,000 in direct visitor expenditures would be lost in this water reduction scenario. Recall that every dollar of direct visitor expenditure is associated with $1.73 in value to the regional economy, which means that this loss of expenditures would result in approximately $1,510,000 in lost regional economic activity associated with the reservoir, per 10,000 acre-foot reduction in water level in a given year.

DISCUSSION

This estimate does not account for any changes in visitation by annual pass holders. These day use permit holders may also be inclined to visit less often—as with day use permit holders—in response to subpar recreational conditions generated by lower water levels. With enough prior information about anticipated low water levels in the coming recreational year, some people who would otherwise consider buying an annual pass may choose not to. Finally, there may also be a lagged effect where low water levels in one year create poor recreational conditions, leading to people choosing not to renew the annual pass in the next year. In this way, the $1.5 million in lost regional economic activity can be considered an absolute minimum in this water reduction scenario.

Though no data exist to measure how many trips to Horsetooth are made by an annual pass holder, the number is likely significant. In the 2017 Reservoir Parks Master Plan, LCDNR looks at the state park visitor intercept survey (Corona Insights, 2009) and selects two comparable state parks: Boyd Lake and Chatfield Reservoir. The intercept survey found that annual pass holders at these sites visited an average of 10.97 and 42.38 times, respectively. Multiplying the 5,680 annual passes sold at the Horsetooth District in 2018 by the average group size of visitors to Colorado state parks of 2.69 results in a total of 15,279 individuals. If these individuals visit 10.97 times per year (as with Boyd Lake), that is a total of 167,611 individual visits; visiting 42.38 times per year (as with Chatfield Reservoir) results in a total of 647,524 individual visits. Even assuming an extremely conservative 5 percent reduction in visits by annual pass holders, that would translate to 8,380–32,376 fewer visits. The lower end of this range is comparable to the findings of our regression model for day use permit holders—an estimated reduction of 7,747 in visits from day use permit holders, suggesting that the likely magnitude of economic impacts from reduced annual pass holder visitation is, at minimum, on par with what we have estimated for the day use permit user group.

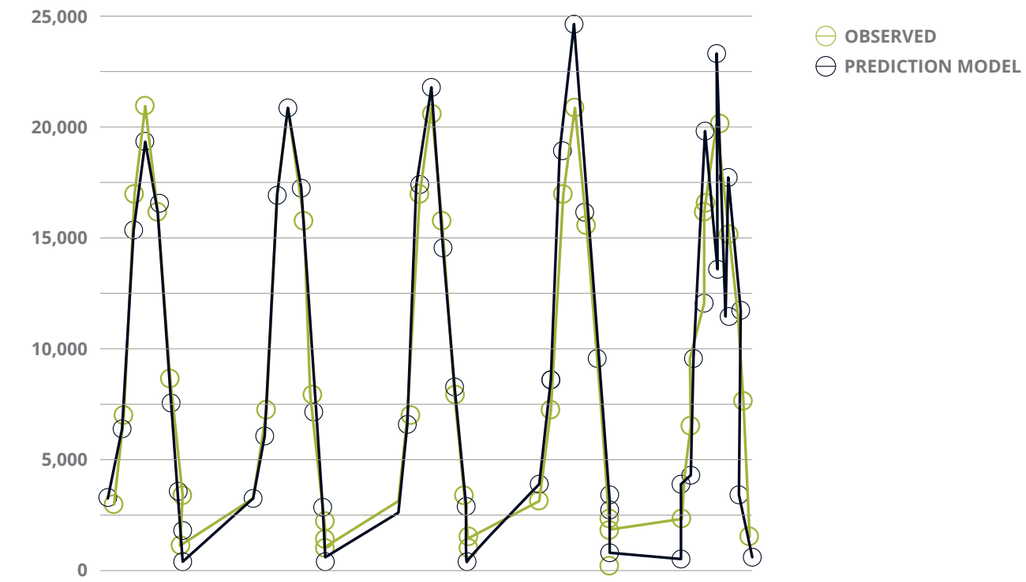
For this analysis we modeled the relationship between volume and visitation as linear, but theory suggests that this approach would underestimate the true economic impact of reduced water deliveries.

FIGURE 8 ESTIMATED HORSETOOTH RESERVOIR PERMIT SALES MODEL

	Dependent Variable: ("No. Permits")
'Avg. Storage'	0.024* (0.012)
factor(April)1	1,355.030 (885.074)
factor(May)1	5,134.742*** (939.112)
factor(June)1	14,913.450*** (968.809)
factor(July)1	18,898.010*** (939.696)
factor(August)1	14,204.000*** (865.136)
factor(September)1	7,036.998*** (827.695)
factor(October)1	1,937.126** (832.448)
Constant	-1,719.452 (1,373.093)
Observations	72
R^2	0.941
Adjusted R^2	0.934
Residual Std. Error	1,850.543 (df=63)
F Statistic	126.674*** (df=8; 63)
Note	*p<0.1;**p<0.05***p<0.01


PHOTO COURTESY OF LCDNR

FIGURE 9 OBSERVED VS. PREDICTED VISITATION TO HORSETOOTH RESERVOIR



The reason is that when water levels cross certain thresholds, boat ramps become unusable and boaters cannot access the water. To make this example concrete, if a 10,000 acre-foot reduction in average monthly storage made a boat ramp unusable, we would expect the associated 240 fewer day use permit sales that month plus an additional reduction in visitation due to the loss of an important recreational facility. It is important to bear this hidden additional cost in mind if future water reductions would threaten accessibility of any of Horsetooth Reservoir's six boat ramps.

This analysis only captures the expected economic impacts of lower water levels at Horsetooth Reservoir, and omits the impacts on the other three reservoirs in the LCDNR reservoir park system. Based on the available literature, we would expect to also see a positive relationship between reservoir volume and visitation at Carter Lake, Pinewood Reservoir, and Flatiron Reservoir. That is, visitation should fall—to some degree—as water level falls. We opted not to measure these hypothesized losses because daily use sales are tracked by district, which makes it impossible to precisely measure the volume–visitation relationship at each reservoir. Aggregating the three reservoirs and modeling at the district level was not an option, because the water volume and bathymetry is so different at each of the three. Particularly in the case of Flatiron Reservoir where there is no water-based recreation and the reservoir is quite shallow, the relationship between volume and visitation may be much different than at Horsetooth and Pinewood and Carter Lake.

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APPENDIX C ESTIMATING RESERVOIR VISITATION

We estimate that 1.48 million people visited the four reservoir parks in 2018.
This estimate was generated using the method below:

EXTRAPOLATION FROM OBSERVED VISITATION AT HORSETOOTH RESERVOIR

- The 2017/2018 Visitor Study estimated total annual visitation at Horsetooth Reservoir using vehicle count data.
- The 2017/2018 Visitor Study estimates 789,000 to 918,000 (average of 853,000) visitors.
- Data provided by LCDNR on permit sales (both annual and day) by location from 2012–2018 shows that 62% of all permits sold during this 7-year period were sold at Horsetooth.
- Assuming that 62% of total visitation across the four LCDNR reservoir parks happens at Horsetooth, between 1.27 and 1.48 (mean 1.38) million visitors in total is expected across all four reservoirs, extrapolating out from the 2017/2018 Visitor Study Estimate.
- Sample calculation of low estimate: 789,000 Horsetooth visitors divided by 62% = 1.27 million total visitors to all four LCDNR reservoir parks.

Earth Economics estimates that total reservoir visitation for 2018 will fall at the high end of this range, at 1,480,645 people. This is because this extrapolation is based on a year-long period that spans both 2017 and 2018; it is reasonable to expect that any estimate of visitation in 2018 will be closer to this high estimate since there is a trend of increasing reservoir visitation (as observed through increased sales of day use permits and annual passes) through the years. Additionally, these estimates exclude users who do not enter the parks by vehicle; both Horsetooth and Carter Lake are popular destinations for cyclists, providing further justification for choosing the greater visitation estimate.

The remaining visitors—38%—belong to the Carter Lake District, and are distributed to Carter (60%), Pinewood (20%), and Horsetooth (20%) per consultation with LCDNR staff on likely distributions. Visitation estimates by reservoir:

FIGURE 10 RECREATIONAL OFFERINGS OF LCDNR RESERVOIR PARKS

	Low	High	Average
Horsetooth Reservoir	789,000	918,000	853,500
Carter Reservoir	290,148	337,587	313,868
Flatiron Reservoir	96,716	112,529	104,623
Pinewood Reservoir	96,716	112,529	104,623
Total	**1,272,581**	**1,480,645**	**1,376,613**


PHOTO COURTESY OF LCDNR

APPENDIX D EXPENDITURE PROFILES

HORSETOOTH RESERVOIR AND CARTER LAKE

The expenditure profiles for Horsetooth Reservoir and Carter Lake are sourced from the 2005 Economic Study. The per capita estimates are calculated using average group sizes from the report—5.6 at Horsetooth and 5.1 at Carter.

In total, the average visitor to Horsetooth spends $112.64, and the average visitor to Carter Lake spends $106.46 per trip.

FIGURE 11 HORSETOOTH/CARTER EXPENDITURE PROFILES BY CATEGORY

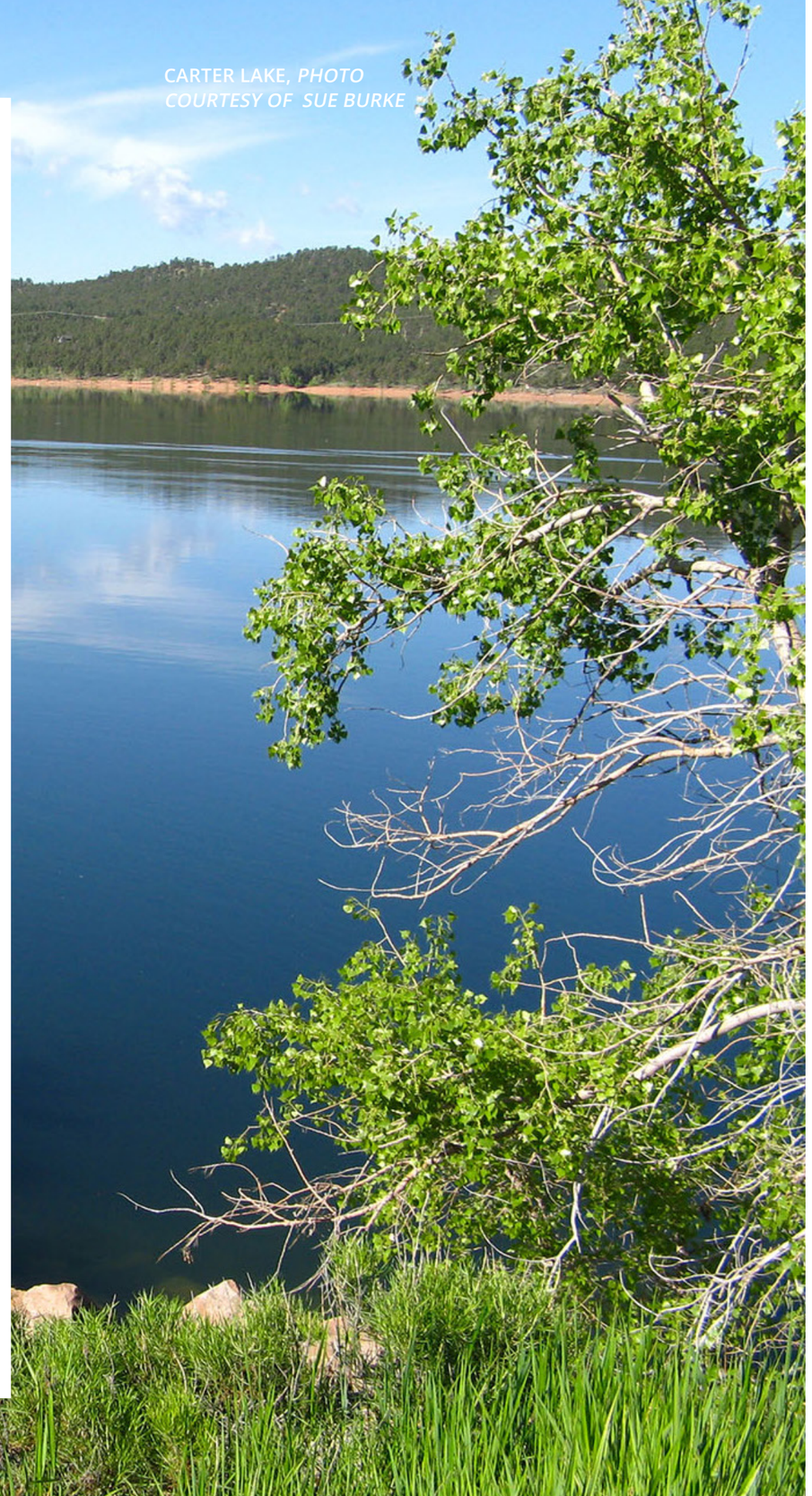
	HORSETOOTH RESERVOIR			CARTER LAKE		
	Group Average (given)	Per Capita (2005 USD)	Per Capita (2018 USD)	Group Average (given)	Per Capita (2005 USD)	Per Capita (2018 USD)
Camping	$44.76	$7.99	$10.23	$44.54	$8.73	$11.18
F&B (on-site)	$55.00	$9.82	$12.58	$67.83	$13.30	$17.03
F&B (off-site)	$91.02	$16.25	$20.81	$63.54	$12.46	$15.95
Fuel	$44.52	$7.95	$10.18	$44.52	$8.73	$11.18
Guided activities	$14.00	$2.50	$3.20	$50.00	$9.80	$12.55
Licenses	$68.22	$12.18	$15.60	$32.37	$6.35	$8.13
Hotel	$100.00	$17.86	$22.86	$75.00	$14.71	$18.83
Area Shopping	$75.13	$13.42	$17.18	$46.25	$9.07	$11.61
TOTAL	$492.65	$87.97	$112.64	$424.05	$83.15	$106.46

PINEWOOD AND FLATIRON RESERVOIRS

The 2009 Corona Research report provides expenditures per vehicle as well as average people per vehicle, which was used to standardize into per person expenditures. For reference, average people per vehicle at Pearl Lake was 3.01; at St. Vrain, 2.37; at State Forest, 3.18; and at Sylvan Lake, 3.09. For this analysis, we assume that the average visitor to each reservoir will spend $109.36.

FIGURE 12 PINEWOOD/FLATIRON EXPENDITURE PROFILES BY CATEGORY

	Pearl Lake	St. Vrain	State Forest	Sylvan Lake	Average (2008 USD)	Average (2018 USD)
OUTSIDE THE PARK						
Lodging	$7.29	$1.62	$5.38	$2.72	$4.25	$ 4.94
Gas and vehicle expenses	$27.48	$30.65	$18.05	$25.07	$ 25.31	$ 29.40
Food at restaurants	$11.54	$32.55	$5.97	$7.87	$ 14.48	$ 16.82
Supplies and groceries	$22.03	$28.01	$12.93	$18.07	$ 20.26	$ 23.53
Other expenditures	$9.73	$12.57	$3.55	$7.32	$ 8.29	$ 9.63
INSIDE THE PARK						
All expenditures	$17.26	$25.86	$14.13	$28.95	$ 21.55	$ 25.03
TOTAL	$95.34	$131.27	$60.01	$90.01	$ 94.16	$ 109.36



CARTER LAKE, *PHOTO COURTESY OF SUE BURKE*

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