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2023 COLORADO SCHOOL DISTRICT COST OF LIVING ANALYSIS

Colorado Legislative Council

CONTENTS

2023 COLORADO SCHOOL DISTRICT COST OF LIVING ANALYSIS

CONDUCTED FOR THE COLORADO LEGISLATIVE COUNCIL

SECTION 1: OVERVIEW OF THE STUDY

Corona Insights is pleased to present the 2023 Colorado School District Cost of Living Analysis to the Colorado Legislative Council. The purpose of this study is to create a cost of living index for each of the 178 school districts in Colorado to be utilized in the per pupil funding formula for K-12 education, as mandated by the Public School Finance Act of 1994.

A cost of living index is a tool for comparing how expensive it is to live in one school district rather than another. We start by assuming that the same family buys the same items while living in different districts, and then determine how much it would cost to buy those things in each district.

For the 2023 Colorado School District Cost of Living Study, our family (i.e., "benchmark household") is a family of three people with a total household income of $63,822, which is the average salary of a Colorado teacher with a bachelor's degree and 10 or more years of experience.

The research process involves the following steps, which are described in greater detail in Section 3:

1. We assume that the benchmark household purchases the same goods and services as a typical family of that size and income, according to the national Consumer Expenditure Survey (CES) conducted by the Bureau of Labor Statistics (BLS).

2. We select a variety of specific items to represent categories of spending. For example, we select a banana to represent purchases of fruits and vegetables. These items comprise our market basket.

3. Then we collect prices for the items in the market basket from businesses or service providers (such as a utility) in each district.

4. We then account for geographic patterns in where people shop for retail items in the market basket, which may be in their own district or in different districts.

5. Based on where people typically shop, and how much items cost in each place, we figure out how much residents of each district typically pay for the total market basket. This allows us to compare how expensive it would be for the benchmark family to live in each district.

Section 2 of this report provides the results of this study, with maps and tables showing the relative cost of living in each school district in Colorado. Section 3 of this report provides in-depth information on the methodology for the study. Appendices A-E provide additional results, raw data, research instruments and products, additional documentation on changes from the previous study, and statistical procedures used.

SECTION 2: 2023 COLORADO SCHOOL DISTRICT COST OF LIVING RESULTS

The table that extends across the following several pages provides the overall cost of living in each of Colorado's 178 school districts, as calculated in 2023. Figures are reported in order by District number (and alphabetically by County name), along with associated rankings, ratings, and comparisons.

Cost of living figures relate to the cost of buying a market basket of goods and services that represents the spending patterns in the United States of the average 3-person household earning $63,822. (See Section 3.1 for more discussion of the archetypal household.) More detailed results by expense category may be seen in Appendix A. Raw data for selected goods may be seen in Appendix D.

The findings are largely consistent with previous years. Aspen continues to have the highest cost of living, however the disparity in cost of living is larger in 2023 than it was in 2021, particularly for Aspen, Summit, and Steamboat Springs primarily due to the huge inflation seen in housing costs. Other mountain resort districts make up the top of the list, including Summit County, Steamboat Springs, Telluride, Eagle County, and Roaring Fork districts. Denver and Boulder remain near the top at #6 and #8, respectively. The districts with the lowest costs of living are primarily located in the Eastern Plains and the San Luis Valley.

Below, two maps provide a visual summary of the cost of living index for the 178 school districts. The first map is a statewide view and the second is a detailed view of the Denver and Colorado Springs metro areas. Statewide maps for each major expenditure category are provided in Appendix A.
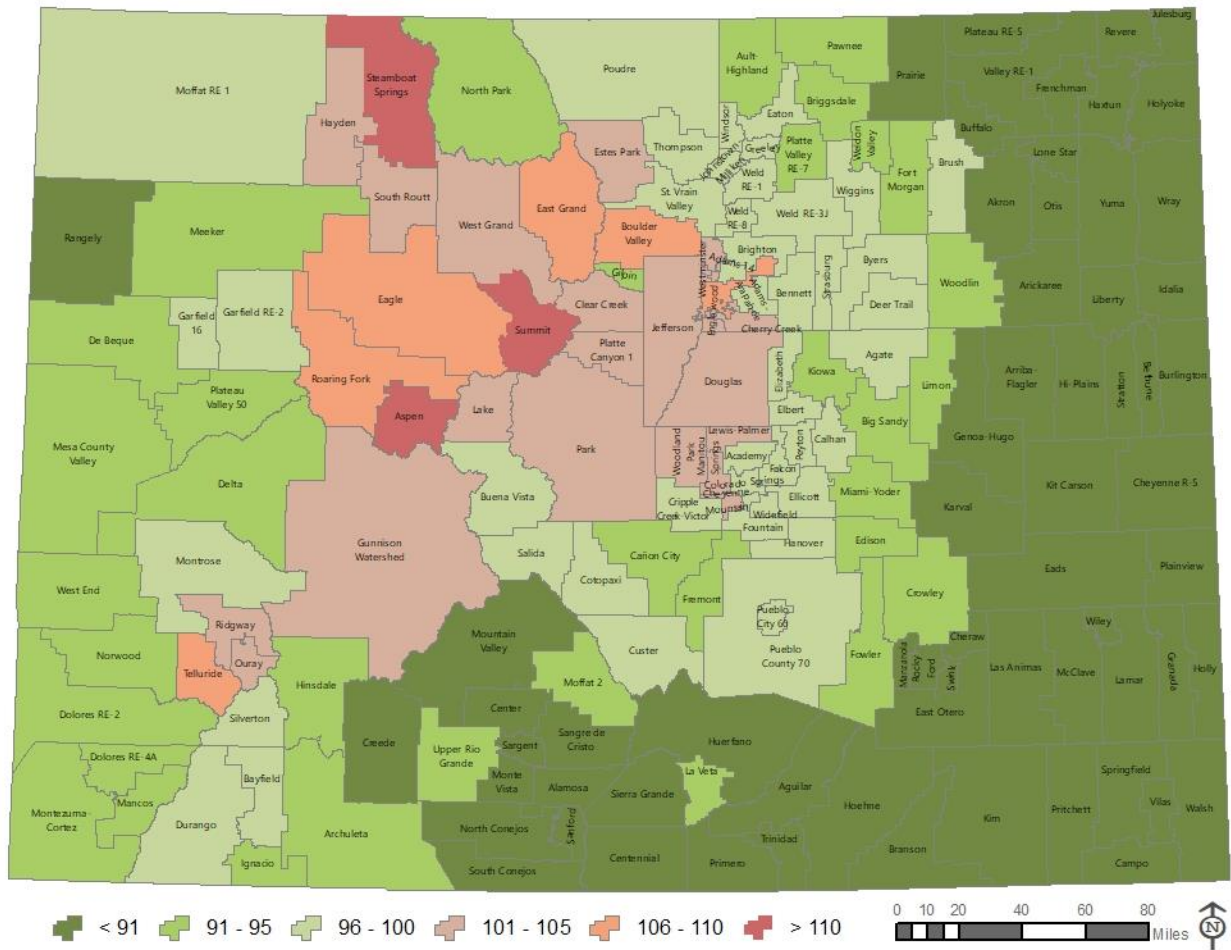
Note. The index value is the ratio of the cost of the market basket in each district to the statewide average cost of the market basket. An index value that is greater than 100 means that district is more expensive than average, while a value less than 100 means that district is less expensive than average. In this map, shades of green depict less expensive districts, while shades of orange depict more expensive districts.
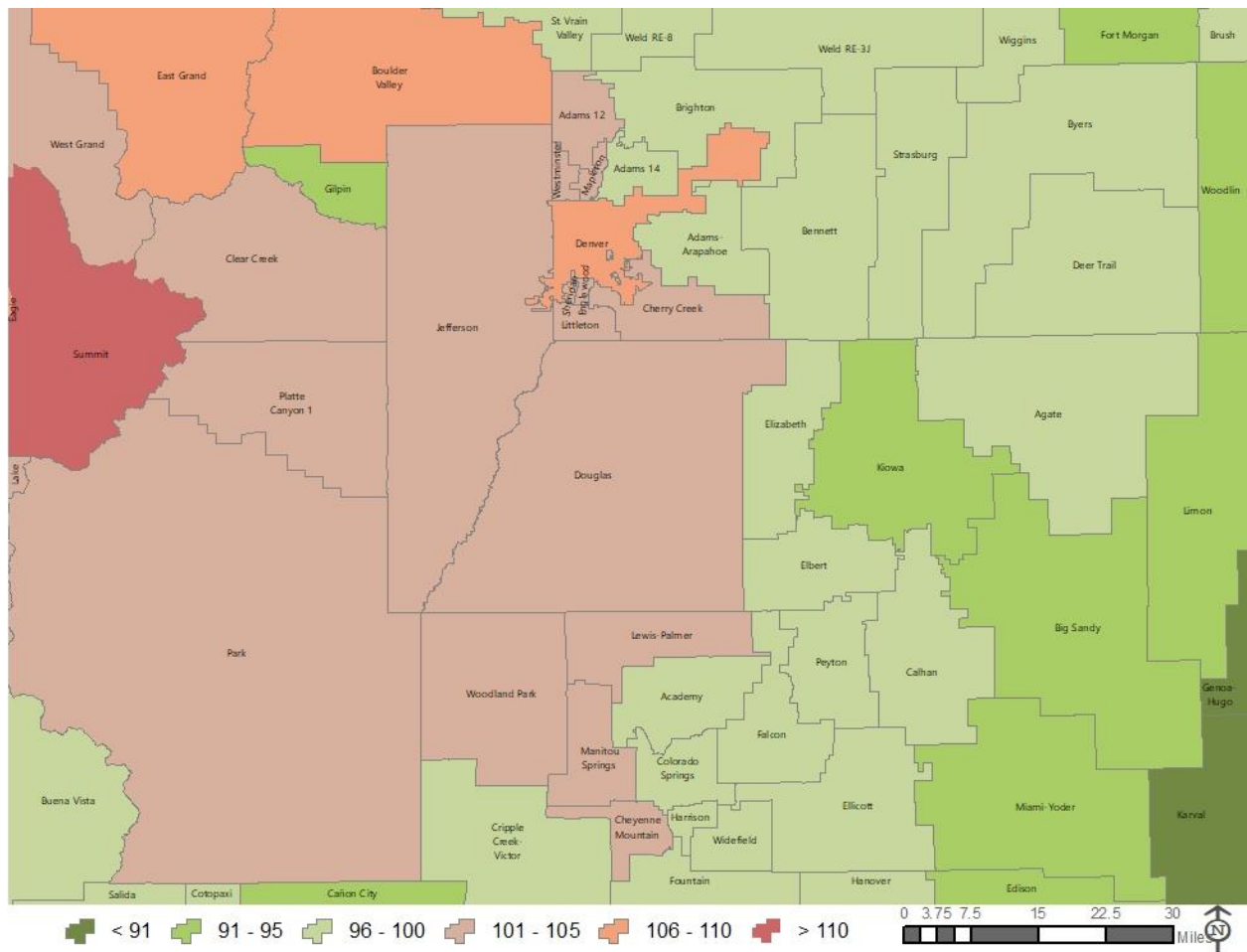
2023 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2023
		State Average	$63,822	100	
10	Adams	Mapleton 1	$64,062	100.4	31
20	Adams	Adams 12 Five Star Schools	$64,390	100.9	24
30	Adams	Adams County 14	$62,662	98.2	49
40	Adams	School District 27J	$62,632	98.1	50
50	Adams	Bennett 29J	$62,103	97.3	60
60	Adams	Strasburg 31J	$62,061	97.2	62
70	Adams	Westminster Public Schools	$64,680	101.3	19
100	Alamosa	Alamosa RE-11J	$55,171	86.4	149
110	Alamosa	Sangre De Cristo Re-22J	$56,080	87.9	141
120	Arapahoe	Englewood 1	$66,644	104.4	11
123	Arapahoe	Sheridan 2	$64,455	101.0	22
130	Arapahoe	Cherry Creek 5	$64,125	100.5	28
140	Arapahoe	Littleton 6	$66,855	104.8	10
170	Arapahoe	Deer Trail 26J	$60,689	95.1	78
180	Arapahoe	Adams-Arapahoe 28J	$63,653	99.7	35
190	Arapahoe	Byers 32J	$62,037	97.2	64
220	Archuleta	Archuleta County 50 Jt	$60,377	94.6	85
230	Baca	Walsh RE-1	$53,642	84.0	170
240	Baca	Pritchett RE-3	$53,427	83.7	172
250	Baca	Springfield RE-4	$52,110	81.6	178
260	Baca	Vilas RE-5	$52,732	82.6	176
270	Baca	Campo RE-6	$53,595	84.0	171
290	Bent	Las Animas RE-1	$54,852	85.9	153
310	Bent	McClave Re-2	$55,158	86.4	150
470	Boulder	St Vrain Valley RE1J	$62,342	97.7	57
480	Boulder	Boulder Valley Re 2	$67,447	105.7	8
490	Chaffee	Buena Vista R-31	$63,308	99.2	41
500	Chaffee	Salida R-32	$62,928	98.6	46
510	Cheyenne	Kit Carson R-1	$54,716	85.7	155
520	Cheyenne	Cheyenne County Re-5	$54,392	85.2	159
540	Clear Creek	Clear Creek RE-1	$64,212	100.6	26
550	Conejos	North Conejos RE-1J	$54,567	85.5	156
560	Conejos	Sanford 6J	$54,401	85.2	158
580	Conejos	South Conejos RE-10	$54,357	85.2	161
640	Costilla	Centennial R-1	$54,987	86.2	152
740	Costilla	Sierra Grande R-30	$55,818	87.5	144
770	Crowley	Crowley County RE-1-J	$57,881	90.7	113
860	Custer	Custer County School District C-1	$60,809	95.3	76
870	Delta	Delta County 50(J)	$58,522	91.7	104
880	Denver	Denver County 1	$68,473	107.3	6
890	Dolores	Dolores County RE No.2	$58,947	92.4	101
900	Douglas	Douglas County Re 1	$64,112	100.5	29
910	Eagle	Eagle County RE 50	$69,154	108.4	5
920	Elbert	Elizabeth School District	$62,465	97.9	53
930	Elbert	Kiowa C-2	$60,509	94.8	80
940	Elbert	Big Sandy 100J	$59,690	93.5	95
950	Elbert	Elbert 200	$62,478	97.9	52
960	Elbert	Agate 300	$61,774	96.8	65

2023 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2023
		State Average	$63,822	100	
970	El Paso	Calhan RJ-1	$61,217	95.9	70
980	El Paso	Harrison 2	$62,213	97.5	58
990	El Paso	Widefield 3	$63,499	99.5	40
1000	El Paso	Fountain 8	$63,596	99.6	37
1010	El Paso	Colorado Springs 11	$62,361	97.7	56
1020	El Paso	Cheyenne Mountain 12	$64,210	100.6	27
1030	El Paso	Manitou Springs 14	$64,447	101.0	23
1040	El Paso	Academy 20	$63,517	99.5	39
1050	El Paso	Ellicott 22	$61,210	95.9	71
1060	El Paso	Peyton 23 Jt	$63,610	99.7	36
1070	El Paso	Hanover 28	$60,739	95.2	77
1080	El Paso	Lewis-Palmer 38	$63,919	100.2	33
1110	El Paso	District 49	$63,299	99.2	42
1120	El Paso	Edison 54 JT	$60,231	94.4	88
1130	El Paso	Miami/Yoder 60 JT	$60,421	94.7	84
1140	Fremont	Canon City RE-1	$59,608	93.4	98
1150	Fremont	Fremont RE-2	$60,223	94.4	89
1160	Fremont	Cotopaxi RE-3	$61,393	96.2	69
1180	Garfield	Roaring Fork RE-1	$68,409	107.2	7
1195	Garfield	Garfield Re-2	$63,811	100.0	34
1220	Garfield	Garfield 16	$61,409	96.2	68
1330	Gilpin	Gilpin County RE-1	$59,644	93.5	97
1340	Grand	West Grand 1-JT	$64,483	101.0	21
1350	Grand	East Grand 2	$67,107	105.1	9
1360	Gunnison	Gunnison Watershed RE1J	$65,136	102.1	17
1380	Hinsdale	Hinsdale County RE 1	$60,360	94.6	86
1390	Huerfano	Huerfano Re-1	$57,469	90.0	116
1400	Huerfano	La Veta Re-2	$58,761	92.1	103
1410	Jackson	North Park R-1	$57,799	90.6	114
1420	Jefferson	Jefferson County R-1	$64,107	100.4	30
1430	Kiowa	Eads RE-1	$53,818	84.3	168
1440	Kiowa	Plainview RE-2	$55,265	86.6	146
1450	Kit Carson	Arriba-Flagler C-20	$57,103	89.5	120
1460	Kit Carson	Hi-Plains R-23	$56,850	89.1	124
1480	Kit Carson	Stratton R-4	$57,144	89.5	119
1490	Kit Carson	Bethune R-5	$56,905	89.2	122
1500	Kit Carson	Burlington RE-6J	$56,638	88.7	131
1510	Lake	Lake County R-1	$65,589	102.8	15
1520	La Plata	Durango 9-R	$63,560	99.6	38
1530	La Plata	Bayfield 10 Jt-R	$62,046	97.2	63
1540	La Plata	Ignacio 11 JT	$60,109	94.2	91
1550	Larimer	Poudre R-1	$62,106	97.3	59
1560	Larimer	Thompson R2-J	$62,064	97.2	61
1570	Larimer	Estes Park R-3	$65,422	102.5	16
1580	Las Animas	Trinidad 1	$54,383	85.2	160
1590	Las Animas	Primero Reorganized 2	$56,736	88.9	127
1600	Las Animas	Hoehne Reorganized 3	$55,107	86.3	151
1620	Las Animas	Aguilar Reorganized 6	$56,744	88.9	126

2023 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2023
		State Average	$63,822	100	
1750	Las Animas	Branson Reorganized 82	$56,708	88.9	128
1760	Las Animas	Kim Reorganized 88	$56,338	88.3	135
1780	Lincoln	Genoa-Hugo C113	$56,871	89.1	123
1790	Lincoln	Limon RE-4J	$58,221	91.2	107
1810	Lincoln	Karval RE-23	$57,564	90.2	115
1828	Logan	Valley RE-1	$56,389	88.4	134
1850	Logan	Frenchman RE-3	$56,298	88.2	137
1860	Logan	Buffalo RE-4J	$56,401	88.4	133
1870	Logan	Plateau RE-5	$56,157	88.0	139
1980	Mesa	De Beque 49JT	$59,039	92.5	100
1990	Mesa	Plateau Valley 50	$58,428	91.5	105
2000	Mesa	Mesa County Valley 51	$58,019	90.9	110
2010	Mineral	Creede School District	$56,761	88.9	125
2020	Moffat	Moffat County RE: No 1	$60,986	95.6	73
2035	Montezuma	Montezuma-Cortez RE-1	$58,852	92.2	102
2055	Montezuma	Dolores RE-4A	$60,429	94.7	83
2070	Montezuma	Mancos Re-6	$60,490	94.8	82
2180	Montrose	Montrose County RE-1J	$60,943	95.5	74
2190	Montrose	West End RE-2	$59,083	92.6	99
2395	Morgan	Brush RE-2(J)	$61,170	95.8	72
2405	Morgan	Fort Morgan Re-3	$60,036	94.1	93
2505	Morgan	Weldon Valley RE-20(J)	$60,061	94.1	92
2515	Morgan	Wiggins RE-50(J)	$62,895	98.5	47
2520	Otero	East Otero R-1	$53,287	83.5	174
2530	Otero	Rocky Ford R-2	$54,275	85.0	162
2535	Otero	Manzanola 3J	$55,242	86.6	147
2540	Otero	Fowler R-4J	$58,026	90.9	109
2560	Otero	Cheraw 31	$53,836	84.4	167
2570	Otero	Swink 33	$52,853	82.8	175
2580	Ouray	Ouray R-1	$64,658	101.3	20
2590	Ouray	Ridgway R-2	$66,531	104.2	12
2600	Park	Platte Canyon 1	$65,856	103.2	14
2610	Park	Park County RE-2	$64,361	100.8	25
2620	Phillips	Holyoke Re-1J	$55,196	86.5	148
2630	Phillips	Haxtun RE-2J	$55,558	87.1	145
2640	Pitkin	Aspen 1	$88,305	138.4	1
2650	Prowers	Granada RE-1	$53,334	83.6	173
2660	Prowers	Lamar Re-2	$53,999	84.6	165
2670	Prowers	Holly RE-3	$53,955	84.5	166
2680	Prowers	Wiley RE-13 Jt	$54,030	84.7	164
2690	Pueblo	Pueblo City 60	$60,892	95.4	75
2700	Pueblo	Pueblo County 70	$62,708	98.3	48
2710	Rio Blanco	Meeker RE-1	$57,980	90.8	111
2720	Rio Blanco	Rangely RE-4	$56,033	87.8	142
2730	Rio Grande	Upper Rio Grande School District C-7	$57,957	90.8	112
2740	Rio Grande	Monte Vista C-8	$56,324	88.3	136
2750	Rio Grande	Sargent RE-33J	$56,158	88.0	138
2760	Routt	Hayden RE-1	$64,768	101.5	18

2023 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2023
		State Average	$63,822	100	
2770	Routt	Steamboat Springs RE-2	$70,887	111.1	3
2780	Routt	South Routt RE 3	$66,294	103.9	13
2790	Saguache	Mountain Valley RE 1	$57,322	89.8	117
2800	Saguache	Moffat 2	$60,306	94.5	87
2810	Saguache	Center 26 JT	$52,265	81.9	177
2820	San Juan	Silverton 1	$63,001	98.7	45
2830	San Miguel	Telluride R-1	$69,884	109.5	4
2840	San Miguel	Norwood R-2J	$59,648	93.5	96
2862	Sedgwick	Julesburg Re-1	$53,789	84.3	169
2865	Sedgwick	Revere School District	$54,209	84.9	163
3000	Summit	Summit RE-1	$76,090	119.2	2
3010	Teller	Cripple Creek-Victor RE-1	$63,094	98.9	44
3020	Teller	Woodland Park Re-2	$63,952	100.2	32
3030	Washington	Akron R-1	$56,645	88.8	130
3040	Washington	Arickaree R-2	$57,242	89.7	118
3050	Washington	Otis R-3	$57,102	89.5	121
3060	Washington	Lone Star 101	$56,453	88.5	132
3070	Washington	Woodlin R-104	$58,211	91.2	108
3080	Weld	Weld County RE-1	$61,569	96.5	67
3085	Weld	Eaton RE-2	$60,688	95.1	79
3090	Weld	Weld County School District RE-3J	$61,698	96.7	66
3100	Weld	Weld RE-4	$62,572	98.0	51
3110	Weld	Johnstown-Milliken RE-5J	$62,416	97.8	55
3120	Weld	Greeley 6	$62,445	97.8	54
3130	Weld	Platte Valley RE-7	$60,500	94.8	81
3140	Weld	Weld Re-8 Schools	$63,178	99.0	43
3145	Weld	Ault-Highland RE-9	$60,034	94.1	94
3146	Weld	Briggsdale RE-10	$60,125	94.2	90
3147	Weld	Prairie RE-11	$56,117	87.9	140
3148	Weld	Pawnee RE-12	$58,227	91.2	106
3200	Yuma	Yuma 1	$54,469	85.3	157
3210	Yuma	Wray RD-2	$54,844	85.9	154
3220	Yuma	Idalia RJ-3	$56,701	88.8	129
3230	Yuma	Liberty J-4	$55,968	87.7	143

SECTION 3: METHODOLOGY

3.1 IDENTIFYING THE BENCHMARK HOUSEHOLD

The first step in a cost of living study is to determine whose cost of living the index will reflect. This entity is referred to as the "benchmark household". The 2023 benchmark household was defined by the Colorado Legislative Council to be a three-person household with a total annual household income of $63,822, which is the average salary in 2022 of a Colorado teacher with a bachelor's degree and 10 or more years of experience. A three-person household is the average household size in Colorado (US Census Bureau, 2017-2021). This benchmark household was defined in the same way as in prior studies since 2015. (Prior to 2015, the benchmark household was defined using the average teacher salary, overall, without specifying a level of education and experience.)

Over the past studies, the household size has remained constant, and the household income has increased at a moderate rate. The table below summarizes the history of benchmark household income values used for the study.

Household Income Definition for 3-Person Benchmark Household		
Year	Household Income	Percent Change
2023	63,822	6.7%
2021	59,834	5.8%
2019	56,547	6.5%
2017	53,115	2.3%
2015[a]	51,930	5.3%
2013[b]	49,300	0.2%
2011	49,200	3.6%
2009	47,500	6.7%
2007	44,500	3.5%
2005	43,000	7.5%
2003	40,000	5.3%
2001	38,000	

[a] Since 2015, the household income definition has specified the average salary of a Colorado teacher with a bachelor's degree and 10 or more years of experience. [b] The 2013 salary was revised to be consistent with the 2015 household income definition. The 2013 study originally used a salary of $49,100.

3.2 IDENTIFYING THE MARKET BASKET OF GOODS AND SERVICES

The next step in a cost of living study is to determine what the benchmark household will buy. The goal of this step is to develop a list of goods and services that, in combination, can represent the full range of typical annual purchases for the benchmark household. To begin, we obtain a list of spending categories from the Consumer Expenditure

Survey (CES), which is conducted by the Bureau of Labor Statistics (BLS). The CES gathers information on the buying habits of American consumer households and then provides summary data about what households spend their money on and how much of their spending goes to each category. In particular, the CES provides data on the spending habits of 3-person households at different income levels that we use to calculate typical expenditures for our benchmark family earning $63,822. The table below shows the proportion of spending in major expenditure categories over the past four study periods, sorted from largest to smallest expenditures.

Consumer Expenditures for a 3-Person Household Earning $63,822				
Expenditure Category	% of Income 2017	% of Income 2019	% of Income 2021	% of Income 2023
Housing	32.8%	32.3%	30.4%	33.4%
Transportation	17.8%	16.9%	20.5%	18.5%
Food	13.1%	13.5%	13.4%	12.7%
Healthcare	8.3%	8.9%	8.1%	9.3%
Personal taxes	4.9%	5.2%	4.9%	4.7%
Entertainment	3.8%	4.1%	4.1%	3.6%
Apparel and services	3.0%	2.7%	2.7%	2.3%
Personal care products and services	1.1%	1.2%	1.1%	1.1%
Tobacco	1.0%	0.9%	0.7%	0.9%
Alcoholic beverages	0.6%	0.5%	0.4%	0.5%
Other	13.6%	13.8%	13.7%	13.1%
Total	*100%*	*100%*	*100%*	*100%*

Spending patterns for the benchmark household in 2023 were largely similar to spending patterns in 2021. The largest changes (housing increased by 3.0%, transportation declined by 2.0%) both reflect corrections from the previous year-over-year changes from 2019-2021.

Starting from the detailed expenditure categories (provided in the table below), Corona Insights and the Colorado Legislative Council developed a list of specific goods and services to represent the expenditures of our benchmark household. This list of goods and services comprise the "market basket" for the cost of living study. An effort was made to retain market basket items from the previous study, while selecting items that: a) are representative of the expenditure category, b) are widely available statewide in a substantially similar form, and c) represent a minimum proportion of spending (e.g., at least 0.5%). More information on the selection criteria for 2023 can be found in Appendix B.

Consumer Expenditure Survey Categories and Specific Weights Utilized in Cost of Living Index
(Weight as a percentage of income)

Expenditure Category	% of Income	Representative Market Basket Items 2023
Food	**12.66%**	
Food at home	8.83%	
Cereals and bakery products	1.12%	Cheerios
Meats, poultry, fish, and eggs	2.05%	Ground Beef
Dairy products	0.76%	Milk
Fruits and vegetables	1.83%	Bananas
Other food at home	3.07%	Coke
Food away from home	3.84%	Pizza
Housing	**33.39%**	
Owned Dwellings	9.93%	
Mortgage interest and charges	4.46%	Mortgage Payment
Property taxes	2.91%	Property Taxes
Maintenance, repairs, insurance, other expenses	2.56%	Homeowner's Insurance
Rented Dwellings	8.82%	Rent & Renter's Insurance Payment
Utilities, fuels, and public services	7.81%	
Natural gas	0.73%	Natural Gas
Electricity	3.08%	Electric
Telephone services	2.85%	Telephone
Water and other public services	1.14%	Water & Sewer
Household operations	2.25%	Day Care Services, Internet
Household furnishings and equipment & Housekeeping supplies	4.59%	Smoke Detector
Transportation	**18.51%**	
Vehicle purchases (net outlay) & vehicle finance charges	9.21%	Car Payment (Interest rate, bank financing fees, taxes, title, registration)
Gasoline and motor oil	3.74%	Gasoline: 85 Unleaded
Other vehicle expenses	5.56%	
Maintenance and repairs	1.79%	Oil and Filter Change, Front-End Alignment
Vehicle insurance	3.77%	Insurance Premiums
Healthcare	**9.33%**	Health Insurance Premium
Entertainment	**3.59%**	Pet Food
Personal care products and services	**1.07%**	Woman's Haircut, Man's Haircut
Personal taxes (not including stimulus)	**4.66%**	Income Tax with Itemized Deductions for Mortgage Interest
Other *[assumed not to vary between districts]*	**16.78%**	
Alcoholic beverages	0.54%	
Apparel and services	2.26%	
Reading	0.13%	
Education	1.04%	
Tobacco products and smoking supplies	0.87%	
Miscellaneous	1.26%	
Cash contributions	1.85%	
Personal insurance and pensions	8.84%	
Total	*100.00%*	

3.3 DETERMINING WHERE, WHEN, AND HOW TO COLLECT COSTS OF MARKET BASKET ITEMS

Market basket items can be divided into two main categories for data collection. In the first category are retail goods and services that can be purchased from many shopping locations throughout the state. These items include groceries, restaurant meals, household items, auto services, and haircuts. In the second category are items most people think of as bills: mortgage and rent payments, car payments, insurance, utilities, and taxes. In 2023, prices for most of the retail goods and services were obtained by making telephone calls to individual businesses as well as visits to select websites of retailers. In contrast, prices for most of the bills were calculated from information provided in government publications, other publicly available data, and through municipal authorities (either via telephone calls or online, where published).

RETAIL ITEMS

The table below provides the data source and data collection method for each of the retail items.

	CES Category	Market Basket Item	Data Source	Collection Method
Food	Cereals and bakery products	Cheerios	Sample from commercial list provider for Grocery, General Stores, and Convenience Stores	Phone calls to businesses
Food	Fruits and vegetables	Bananas		
Food	Meats, poultry, fish, and eggs	Ground beef		
Food	Dairy	Milk		
Food	Other food at home	Coke		
Food	Food away from home	Pizza	Sample from commercial list provider for Pizza Restaurants	
Housing	Housekeeping supplies, furnishings, & equipment	Smoke detector	Sample from commercial list provider for Hardware, Department Stores, Grocery, General Stores, Drugstores	
Housing	Entertainment	Pet food		
	Personal care	Man's haircut	Sample from commercial list provider for Beauty & Barber Shops	
	Personal care	Woman's haircut		
Transportation	Maintenance and repairs	Oil and filter change	Sample from commercial list provider for Auto Repair Shops	
Transportation	Maintenance and repairs	Front-end alignment		

For each of the retail items, we identified a set of Standard Industrial Classification (SIC) codes that correspond to businesses that are likely to sell the item. We then purchased a list of all businesses associated with those SIC codes from a commercial list vendor. To select a sample of businesses to collect prices from, we first used ArcGIS software to map the latitude and longitude coordinates for each business to the school district for each business using school district shape files available from the Census Bureau. As in the previous study, we determined that a sample of 10 businesses per item per school district was the minimum target. Because not all businesses would answer their phones or provide pricing information, we determined to start with a sample of 15 businesses per item per district in order to obtain 10 prices. In many districts, there were fewer than 15 businesses available for some items. In those cases, all known businesses in those districts were included in the sample. In districts with more than 15 businesses available, a weighted random sample of businesses was selected where weights were used to ensure that the sample of businesses reflects the market share of businesses in the community.

From a statistical perspective, if all stores selling a given product have an equal market share, meaning people are just as likely to buy the product at any store as any other store, then taking a simple random sample of stores would be appropriate, and calculating simple averages of the prices available at those stores would give a reasonably accurate measure of what people pay and how confident we are in that estimate as a function of the sample size within the universe of stores. However, because people tend to shop more at some stores than others (or more people shop at some stores than others), the average amount paid isn't a simple average of the prices available across stores but is a weighted average of prices available by how many people buy at each location (i.e., the market share of the location). Rather than weighting the prices obtained on the back end, we instead sampled businesses according to market share in order to account for this complexity. However, this methodology was most flawed in small districts where we were likely to gather prices from all businesses selling a product and weight them equally in calculating a district price, even though there may be one particular business in that district that is responsible for a disproportionate percentage of sales of that item in that district.

To gather data from the sample of businesses selected, we primarily made phone calls to the individual businesses. We also gathered some pricing online, where pricing for individual business locations was available. In addition, we used online sources to verify business addresses, search for missing or alternate phone numbers, verify business closures, and search for additional businesses in districts where no businesses existed in the sample. We also used online sources if businesses in the district did not provide pricing.

To execute the phone survey, we recruited temporary contractors. A Corona Insights Principal who has been involved in past data collection for this project served as the phone research manager in charge of training and overseeing the staff. All hires were screened, interviewed, and background checked by our staffing agency prior to employment. Data collectors were paid hourly. Phone calls and online searches were made from Corona's office.

We developed an overview and training guide for data collectors. We then conducted training with all data collectors. Training focused on the importance of collecting data in the exact same manner from all businesses contacted and included how to record prices and how to enter data. Data collectors focused on one product at a time, and prior to starting data collection for a specific item, a thorough review of that market basket item, including relevant details, common questions and allowed substitutions, was provided. The research manager and other Corona staff were available for questions during the entire data collection period. The research manager also made periodic check-ins with the data collectors to answer questions and monitor progress. Data was entered directly into an Excel spreadsheet. Most of the phone data collection was completed in a two-week period to minimize variability in pricing due to timing. The research manager conducted random data checks to ensure the correct prices were collected.

NON-RETAIL ITEMS ("BILLS")

The table below provides the data source and data collection method for each of the non-retail items.

	CES Category	Market Basket Item	Data Source	Collection Method
Housing	Shelter	Mortgage Interest Payment	Housing values from outside consultant; interest rate from Zillow	Secondary Data & Online Source
		Property Taxes	Colorado Dept of Local Affairs - 2022 Annual Report & Final Residential Rate Study for 2019-2020	Online sources
		Homeowners' Insurance	Colorado Dept of Regulatory Agencies, Division of Insurance (HO-3 policy)	Online source
		Rent Payment & Renter's Insurance	American Community Survey (ACS) Colorado Dept of Regulatory Agencies, Division of Insurance (HO-4 policy)	Online sources
	Utilities	Electric	Colorado Association of Municipal Utilities, U.S. Dept of Homeland Security, National Oceanic and Atmospheric Administration, Colorado Public Utilities Commission	Online sources Phone calls to providers
		Natural gas	Colorado Public Utilities Commission National Oceanic and Atmospheric Administration U.S. Energy Information Administration	Online sources Phone calls to providers
		Telephone	Colorado Public Utilities Commission The Tax Foundation	Online sources
		Water and Wastewater	Water and wastewater utilities across the state. Homeguide.com and Homeadvisor.com.	Online sources Phone calls to providers
	Household Operations	Day Care Services	The Self-Sufficiency Standard for Colorado US Office of Child Care	Online sources
		Internet Service	BroadbandNow Research and the Federal Communication Commission	Online source
Transportation	Vehicle purchases & vehicle finance charges	Vehicle Payment	Sample from commercial list provider for banks and credit unions; Kelley Blue Book; Colorado Dept of Revenue; Colorado Legislative Council	Online sources Phone calls to providers
	Gasoline and motor oil	Gasoline: 85 unleaded	Oil Price Information Service American Community Survey (ACS)	Purchase database
	Vehicle insurance	Auto Insurance Premium	Colorado Dept of Regulatory Agencies, Division of Insurance (Plan 2, Driver C)	Online source
Healthcare		Health Insurance Premium	Colorado Dept of Regulatory Agencies, Division of Insurance (Individual Min/Max Premiums for Silver and Bronze Tiers)	Online source

Data collection for non-retail items was tailored to each item, but in most cases involved locating some publicly available information and supplementing with phone calls to specific providers or municipal authorities to fill in missing information. Corona staff executed the data collection for these items, with the exception of bank rates and fees for the vehicle payment calculation, which were collected by phone calls to banks and credit unions by the temporary staff, as described in the previous section on phone calls for retail items. More information about the data collection for each of these items is provided in the next section of the report.

3.4 DATA COLLECTION DETAILS

PROCESS OVERVIEW

| Gather Data | Validation & Cleaning | Outliers & Interpolation | Add Taxes | Compute Average Price for District |

For the retail items identified above, the data collection process followed the same steps, so we describe those as a group, below. For each of the non-retail items, we describe their data collection process individually.

RETAIL ITEMS

Retail item prices were collected by telephone for every district. The sample for telephone calls was prepared following the protocol described in the previous section of the report. Detailed item descriptions for each of these items and the number of prices obtained for each item are provided in the table below.

CES Category	Market Basket Item	Description	N Obs 2023
Cereals and bakery products	Cheerios	Price of General Mills Cheerios Toasted Whole Grain Oat Cereal plain, 8.9 oz. If size not available, note difference in size and record price.	383
Fruits and vegetables	Bananas	Price per pound. If bananas are priced by the bag or by the banana, note that in the file. Do not price organic.	424
Meats, poultry, fish and eggs	Ground beef	Price per pound of prepackaged, regular ground beef, 80% lean or most comparable, from a 1 to 2-pound package of loose ground beef. Note if different percent lean. Do not price family pack, pre-formed patties, or tube packaging.	365
Dairy	Milk	Price for one gallon (128 Fl. oz.) 2% milk, collect cheapest price. If no 2%, then price (in order of preference) 1%, skim, whole. Note if not 2%. Do not price organic, soy, or flavored milks (e.g. chocolate, etc.). Do not price half gallon.	468
Other food at home	Coke	Price for a 2L bottle of regular Coca-Cola. Do not price diet, caffeine free, cherry, or other varieties.	423
Food away from home	Pizza	Price for a cheese pizza, regular or thin crust, 14" diameter (note size if other).	350

The "Food" category label spans the rows from "Meats, poultry, fish and eggs" through "Food away from home."

Housing	Housekeeping supplies, furnishings, & equipment	Smoke detector	Price of most basic smoke detector offered. Preferably no carbon monoxide, dual sensor, 10 year, or similar. Note any premium features on model priced.	345
Entertainment		Pet food	Price of Friskies Cat Food, 5.5 oz. single can, not multi-pack.	466
Personal care		Man's haircut	Price of man's wash, cut, and dry.	285
		Woman's haircut	Price of woman's wash, cut, and dry without styling.	304
Transportation	Maintenance and repairs	Oil and filter change	Price of an oil and filter change for a 2019 Ford F-150 pickup with a 3.3 liter, V6 engine. Price includes new filter, 6 qts of 5w-30 full synthetic oil, and disposal of old oil. Do not price with tax.	298
	Maintenance and repairs	Front-end alignment	Price of front-end alignment for a 2019 Ford F-150 pickup with rear wheel drive.	161

After all data was collected, we validated and cleaned the data. Data collectors included notes next to any price where the item diverged from the market basket description. We reviewed those notes and adjusted any prices accordingly (typically scaling prices for differently sized items or multi-packs) and scanned for any obvious data entry errors. Next, outliers were identified and removed, using the same rule as the previous study. Specifically, we used box and whisker plots and truncated extreme values to the boxplot whisker (i.e., the 25th or 75th percentile plus 1.5 times the inter-quartile range).

Finally, appropriate taxes for each item in each location were added to each price, and an average price was calculated for each district. For food at home items, appropriate grocery taxes were applied; for food away from home items, appropriate dining out taxes were applied; and normal sales taxes were applied to the smoke detector and pet food as well as 40% of the oil change price (which reflects the portion of the cost covering materials as opposed to labor). No tax was applied to haircut prices or front-end alignment prices as they are not considered taxable goods.

NON-RETAIL ITEMS SUMMARY

Detailed item descriptions for each of the non-retail items and the number of prices obtained for each item are provided in the table below.

CES Category	Market Basket Item	Description	N Obs 2023
Housing	Shelter	Mortgage Interest Payment	Mortgage interest payment interest, based on housing values provided by outside consultant. Mortgage payment interest rate for 30-year fixed, 20% down, credit score over 720 (as of 11/28/2023)	1 per district
		Property Taxes	Property taxes based on district home value, residential assessment rate, and mill levies	1 per district, 1 per county
		Homeowners' Insurance	Insurance premium for HO-3 policy with limits of $500,000 dwelling replacement, $350,000 contents replacement (frame structure type), $100,000 personal liability, $1,000 medical expense, $1,000 deductible	37 cities from 16 providers

	Rent Payment & Renter's Insurance	Median gross rent paid for a three-bedroom home Insurance premium for HO-4 policy for frame structure type with limits of $40,000 contents replacement, $100,000 personal liability,$1,000 medical expense, $500 deductible	Rent estimates for 170 districts ins for 37 cities from 15 providers
Utilities	Electric	Price for 700 kWh per month, adjusted for use by climate, plus utility sales tax	55 electric utilities
	Natural gas	Price for 62.5 therm per month, adjusted for use by climate, plus utility sales tax	73 service areas
	Telephone	Taxes, surcharges, and fees associated with monthly mobile phone service	N/A
	Water and Wastewater	Annual average bill for water service using 11,000 gallons per month and wastewater service using 5,000 gallons per month. Well and septic systems were priced based on item cost and installation, operation, and maintenance divided by the life expectancy of a system.	291 utilities
Household Operations	Day Care Services	Weekly cost of child day care	3 per county
	Internet Service	Monthly cost of the lowest regular priced terrestrial (wired + fixed wireless) residential standalone-internet broadband plan with a minimum speed of 25 mbps download and 3 mbps upload and the average cost for comparable satellite internet from three provider.	Estimates for 376 ZIP codes
Transportation	Vehicle purchases & vehicle finance charges	Vehicle Payment	Payment calculated using Blue Book purchase value and interest rate on loan for full purchase price and bank charges, taxes and registration fees for 2021 Honda Civic for four years. (2021 Honda Civic LX Sedan, 4-door. Engine: 4-cyl. 2.0L. Trans: Automatic/CVT. Mileage: 24,000. Amenities: air conditioning, pwr. steering, cruise control, air bags - front & side, stability control/traction control).	278 banks/ credit unions
	Gasoline and motor oil	Gasoline: 85 unleaded	Price per gallon of self-serve, 85 Octane, unleaded gasoline.	1,928
	Vehicle insurance	Auto Insurance Premium	Insurance premiums for 2019 Toyota Camry LE Automatic with liability policy limits of $50,000/$100,000 for bodily injury, $25,000 property damage, $50,000/$100,000 for uninsured motorist coverage, $5,000 for medical payments, and a $500 deductible. For a 45-yr old male driver, married, principal operator, drives less than 15 miles to work each way, no accidents or traffic convictions in three years.	37 cities from 14 providers
Healthcare	Health Insurance Premium	Prices of health care insurance premiums for a 40-year old. Average price of "Bronze" and "Silver" health insurance premiums.	9 regions from up to 6 providers/ region

HOUSING – SHELTER – MORTGAGE INTEREST PAYMENT

Home values were provided to Corona Insights by the Colorado Legislative Council via a study by an outside consultant, and they were based on a specified home size of 1,500 square feet. This is the same approach used in previous years. We calculated an annual mortgage interest payment based on a 30-year fixed rate mortgage for 80 percent of the home value.

In previous years, interest calculations have been based on the same mortgage rate in all districts. However, recent studies show that the average credit score varies by geography, which results in average interest rates varying by geography. (See Appendix B for details and references.) Colorado has 16 counties in the highest credit score range (740+), 45 counties in the next tier (680-740), and 3 counties in the lowest tier (less than 680). We utilized the average credit score category for each county in Colorado to determine the mortgage interest rate available at that credit score level as of December 18, 2023 using data from myFICO.com (https://www.myfico.com/loan-center/home-mortgage-rate-comparison/).

Final average interest rates were reapportioned from the county level to the school district level by calculating the proportion of households within each district and county combination, then weighting the average interest rate by those proportions. For example, in the Adams-Arapahoe 28J District, 80% of households are located in Arapahoe County while 20% of households are located in Adams County. The mortgage interest rate estimate for the Adams-Arapahoe District is the sum of 80% of the Arapahoe County interest rate average and 20% of the Adams County average.

HOUSING – SHELTER – PROPERTY TAXES

Owners of residential homes are subject to property tax on their dwelling. The entire value of the home is not taxed; only the assessed value of the home can be taxed. The assessed value of a home is the actual home value multiplied by an assessment percentage. This assessment percentage is the same for the entire state of Colorado and is 7.15% for 2023. In 2020, Colorado Amendment B, Gallagher Amendment Repeal and Property Tax Assessment Rates Measure passed allowing the CO State Legislature to freeze property tax assessment rates at the current rate of 7.15% for residential property. The assessed value of the home is then multiplied by the decimal equivalent of the total mill levy. The total mill levy is the sum of the mill levies from the county, city, school district, and any other special levies an area may have. To get the decimal equivalent of a mill levy, the levy is multiplied by .001.

Mill levies were obtained from the 2022 annual report for the Department of Local Affairs. This report was the most recent report available from the Division of Property Taxation. The report included mill levies for every county, city, school district, and any other applicable levy in the state of Colorado. The mill levies were summed by school district. The stated home price for each school district was multiplied by the assessment percentage to get the assessed value. The assessed value was multiplied by the total of all applicable mill levies for the district (county, school district, average municipal value in the county, and any special levy) to calculate the property tax. This process was repeated for all school districts.

HOUSING – SHELTER – HOMEOWNER'S INSURANCE

Homeowner insurance rates were collected from the most recent Homeowner's Insurance Premiums Report provided by the Colorado Department of Regulatory Agencies, Division of Insurance. Rates in this report were drawn from a survey of insurance providers that the Division of Insurance conducts annually; data in the report was current as of

July 2022. Premiums were for a coverage period of one year and were based on full replacement cost coverage. Premiums were calculated based on a HO-3 policy, which is the most commonly written policy for a homeowner. The HO-3 policy assumed the home was a 2,000 square foot frame structure, 10 years old, with a composite shingle roof, equipped with dead-bolt locks and smoke detectors, was within 5 miles of a fire station, and was within 1,000 feet of a fire hydrant. The policy limits were based on a dwelling replacement cost of $500,000, a contents replacement of $350,000, personal liability of $100,000, medical expense of $1,000 and a $1,000 deductible. The dwelling replacement, content replacement, and deductible costs all increased compared to the 2021 study.

The Homeowner's Insurance Premiums Report included premiums from 60 insurance companies for 37 cities across Colorado. To better represent "typical" homeowner insurance rates, insurance companies that made up less than one percent of the Direct Written Premium market share in Colorado were excluded. Thus, our analysis included premiums from the 16 largest homeowner insurance providers, which in aggregate, made up 70 percent of the Colorado homeowner insurance market. We calculated the median premium from these 16 insurance providers for each of the 37 Colorado cities in the report. The median was used, rather than a mean, to reduce the influence of price outliers in some markets. Lastly, to derive homeowner insurance premiums for each school district, premium rates at each district's weighted population center were predicted, based on spatial insurance cost patterns for the 37 cities from which we did have insurance data. This equal interval interpolation method was also employed to predict homeowner insurance rates in prior studies.

These homeowner insurance rates—which specify the rates for a home valued at $500,000 in each district—are then scaled to the actual home values for the cost of a 1,500 square foot home in each district.

HOUSING – SHELTER – RENT

Home rental costs were primarily based on median gross rent estimates, for the universe of renter-occupied housing units paying cash rent, which were collected from the U.S. Census Bureau's 2017–2021 American Community Survey (ACS) 5-year estimates (e.g., table B25031). This dataset was chosen because it provided rent cost estimates by number of bedrooms in each housing unit (e.g., studio, 1 bedroom, 2 bedrooms, etc.), which allows for more consistent comparison of the 3-bedroom model household across school districts. However, rent estimates were not available for all housing unit types across all districts, and further, the margin of error of the estimate was very high in some cases. Estimates associated with high margins of error may not be reliable.

We therefore used a multi-step process to refine and increase the reliability of rental estimates. First, we classified school districts into one of five regions: Eastern Plains, Front Range, Mountain Resort, Non-resort Mountains, or the San Luis Valley. We collected median rent estimates for 3-bedroom housing units within each school district, then we calculated the interquartile range (i.e., the 75th percentile minus the 25th percentile) of these estimates within each region. Separately, we calculated the average percentage increase from 2-bedroom to 3-bedroom estimates within each region. For example, on average, a typical 3-bedroom home rents for 22% more than a typical 2-bedroom home in Eastern Plains school districts, whereas it rents for 25% more in Front Range districts. We calculated a second estimate to rent a 3-bedroom home by inflating the 2-bedroom estimate by the average percentage increase within its region. For example, rental estimates for 2-bedroom homes in Eastern Plains districts were inflated by 22% while 2-bedroom homes in Front Range districts were inflated by 25%. Thus, we obtained two estimates for a 3-bedroom home in each district—one direct and one derived. When the direct 3-bedroom estimate fell within 1.5 times the interquartile range for all 3-bedroom estimates within its region, and, when the 2-bedroom inflated estimate fell within 1.5 times the interquartile range for all 2-bedroom inflated estimates within its region, the final estimate was

the average of the two estimates. When estimates fell below or above 1.5 times the interquartile range for its region, a region-specific low cap or high cap, based on the 25th and 75th quartiles, was used as a proxy estimate.

The above approach worked well for all districts in the Front Range and Mountain Resort regions, and almost all districts in the Non-resort Mountains and San Luis Valley. However, the median rental estimates in the Eastern Plains varied notably by district, and this variation may have been the result of lower reliability in the ACS estimates for very small and rural school districts. Therefore, for 53 school districts primarily located in 15 Eastern Plains counties, the countywide 3-bedroom estimate was additionally used in the average rent estimate, along with the direct and indirect measures mentioned above. Most Eastern Plains districts are completely contained in their county; for the few that span county boundaries, their rent estimate was calculated as the proportion of the households within the district and each county (akin to how daycare costs were calculated). This approach increased the reliability of small district rental estimates and decreased district to district variability in the Eastern Plains region.

After this, five districts still did not have any rental estimate, and three additional districts had outlier estimates. To calculate rental estimates for these remaining eight districts, we used an interpolation technique that predicted rental costs at the center of the district based on spatial cost of rent patterns within the districts for which we had rent estimates. This was the same technique used to estimate insurance and gasoline costs.

Finally, monthly rental insurance costs were added to rent estimates to produce a final rent estimate for each district. Renter insurance rates were collected from the 2022 Homeowners Insurance Premiums Report provided by the Colorado Department of Regulatory Agencies, Division of Insurance. Premiums were calculated based on a HO-4 policy, which is commonly referred to as "renter's insurance" or "renter's coverage." The HO-4 policy covers the insured's personal property but does not cover the property belonging to the owner of the rental unit (i.e., the house or apartment). Premiums were for a coverage period of one year and were based on full replacement cost coverage.

The Homeowner's Insurance Premiums Report included premiums from 63 insurance companies for 37 cities across Colorado. To better represent "typical" renter insurance rates, insurance companies with less than one percent of the Direct Written Premium market share in Colorado were excluded. Thus, our analysis included premiums from the 15 largest insurance providers, which in aggregate, made up 63 percent of the Colorado homeowner insurance market. We calculated the median premium from these 15 insurance providers for each of the 37 Colorado cities in the report. The median was calculated, rather than a mean, to reduce the influence of price outliers in some markets. Lastly, to derive homeowner insurance premiums for each school district, we predicted (i.e., interpolated) premium rates at each district's weighted population center based on spatial insurance cost patterns of the 37 cities from which we did have insurance data.

HOUSING – UTILITIES – ELECTRIC

To estimate an average monthly electric bill within each school district, we calculated standardized electric rates by provider, allocated those rates to census blocks in each provider's service area, adjusted electric use based on local climate, applied location specific utility taxes, and then calculated an average electric bill within each school district.

Electric utility rates were collected from the 2023 survey of electric utility providers, which was conducted by the Colorado Association of Municipal Utilities (CAMU). CAMU collected billing rates, based on 700-megawatt usage, from Colorado electric utilities in July 2023. These rates included tax equivalents, either the exact PILOT (payment in lieu of taxes) or transfer to the municipal general fund but did not include county or municipal sales tax. The CAMU dataset did not include rates from five towns (i.e., Center, Fleming, Granada, Julesburg, Yuma) or from three rural

electric (i.e., Grand Valley, Mountain Parks, Sangre De Cristo), so we collected rates from these utilities online or by phone.

Next, using the Electric Retail Service Territories global information system (GIS) shapefile from the United States Department of Homeland Security, Homeland Infrastructure Foundation – Level Data (HIFLD), we appended the CAMU electric rates to each electric provider service area.

Electricity usage in Colorado varies across geographies based on climate. For example, households in Southeast Colorado, where average summer temperatures are higher than elsewhere in the state, use more electricity for home cooling. We accounted for this disproportionate use by applying an upward adjustment factor for households in counties where the average June to September temperature was higher than the average statewide June to September temperature, as reported by the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. For example, we applied a 1.11 use adjustment factor for households in Pueblo County, where the average summer temperature was warmer than the statewide average.

Leveraging GIS, we then overlaid the electric utility provider and rate map with the climate map and a map including every census block (with number of household counts), town/city, county, and school district in Colorado. We then calculated aggregate electric bills within each block based on utility rates, use adjustments for four summer months, and local utility sales taxes. Lastly, we calculated average electric bills for each school district based on the aggregate electric bills and number of households within each district.

HOUSING – UTILITIES – GAS

To calculate the average monthly natural gas bill within each district, we used a methodology foundationally similar to that described above for electric providers. We calculated standardized natural gas cost rates by utility provider, calculated propane equivalent rate, allocated the appropriate gas or propane rate to every census block in Colorado, adjusted natural gas use based on local climate, applied location specific utility taxes, and then calculated an average natural gas bill within each school district. Specific details are described below.

Natural gas costs were collected from the most recent annual reports that utilities had filed with the Colorado Public Utility Commission. These reports contain annual residential revenues collected in 2022, the number of residential customers for each of the providers' service areas, and the amount of natural gas delivered to residential customers in 2022. We used the revenue data and the amount of gas delivered data to calculate the amount of dollars paid per therm of natural gas delivered. Then we calculated the cost to receive 62.5 therms per month, which is a typical amount of natural gas for a single-family home. By standardizing the rate to dollars per therm, rather than dollars per customer, we were able to accurately calculate and compare the cost for equivalent service.

After calculating natural gas rates by provider service area, we acquired and used the natural gas utility provider territory log from the Colorado Department of Regulatory Agencies, Public Utilities Commission to assign natural gas utility service areas and rates to 329 census designated places (e.g., cities, towns, and other housing developments) throughout Colorado. In a few cases, two natural gas providers were assigned to one census designated place, in which case we averaged the rates of the two providers.

Many households in Colorado, especially in rural areas, do not have access to natural gas services, and these households typically rely on propane (a type of liquid petroleum) for home heating. In this study, we assumed that households within a census designated place received natural gas service and households outside a census

designated place used propane. We used data from the Energy Information Administration to calculate the cost for propane relative to the cost of natural gas, based on the average residential prices for natural gas and propane in Colorado, the total amount of natural gas and propane consumed in Colorado, and the actual energy output for each fuel type in British Thermal Units. The relative conversion factor was 2.01 (a decrease from 2.92 in 2021), meaning for each dollar spent for natural gas would require $2.01 for an equivalent amount of propane. The final cost of propane service was calculated by county as the average natural gas rate within each county multiplied by the statewide conversion factor. Each census block outside a census designated place was assigned a local propane rate.

Natural gas usage varies across geographies based on climate. For example, households in mountains or valleys, where winter temperatures are typically much lower than elsewhere in the state, likely use more natural gas for home heating. In this study, we accounted for this disproportionate use by applying an upward adjustment factor for households based on their county's average November to February temperature relative to the average statewide November to February temperature, as reported by the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. For example, we applied a 1.16 use adjustment factor for households in Alamosa County, where the average winter temperature was cooler than the statewide average.

Leveraging GIS, we then overlaid the natural gas utility provider and rate map with the climate map and a map including every census block (with number of household counts), town/city, county, and school district in Colorado. We then calculated aggregate natural gas bills within each block based on the dollar per therm rates, use adjustments for climate, and local utility sales taxes. Lastly, we calculated average natural gas/propane bills for each school district based on the aggregate electric natural gas/propane bills and number of households within each district.

HOUSING – UTILITIES – TELEPHONE

Consistent with previous cost of living studies, telephone service pricing was assumed to be essentially constant across the state and the variance between districts comes from the taxes and fees. As such, we began with a constant cost of $152 per month, which was the typical spending amount from the CES data. As with other taxable services, applicable taxes were applied for each census block in Colorado. First, we applied state and county normal sales taxes, and city sales taxes where applicable. Next, we applied county/local 911 surcharges (obtained from the Public Utilities Commission). Then we applied flat state and federal Universal Service Fund taxes, a flat state 911 charge, a flat state 988 charge, and a flat TDD tax (obtained from the Tax Foundation, Fiscal Fact No. 805, Dec. 2022).

Leveraging GIS, we applied the appropriate total phone tax to the flat bill of $152 for every census block (with number of household counts) in Colorado. We then calculated aggregate phone bills within each block, and from that calculated an average household phone bill within each district.

HOUSING – UTILITIES – WATER/WASTEWATER

To estimate an average monthly water and wastewater bill within each school district, we calculated standardized water and wastewater cost rates by utility provider, calculated well and septic equivalent rates, allocated those rates to every census block throughout Colorado, applied location specific utility taxes, and then calculated an average water and wastewater bill within each school district. Specific details follow.

Water and wastewater rates were gathered by calling water and wastewater utilities or by searching for their rates online. Where applicable, rates were for three-quarter inch pipe size, and we used one single family equivalent (SFE) when rates were determined by house size. We collected rate information from 296 utilities throughout the state,

providing water or wastewater to 291 of Colorado's Census designated places (e.g., cities, towns, and other housing developments). Most water utilities are municipal, but some are water and sanitation districts. For places that did not appear to have a water or sanitation service provider we used well and septic estimates (described below).

After rates were collected, a monthly water and wastewater bill was calculated for each utility based on a home that uses 11,000 gallons of water per month and produces 5,000 gallons of wastewater for processing per month. The usage level for water was based on data for Colorado domestic per capita water use, reported by the USGS (Estimated Use of Water in the United States, 2015). The usage level for wastewater was based on data reported by Denver Water. We then assigned utilities and their average bill to census designated places. In a few cases, more than one water or wastewater provider was assigned to one census designated place, in which case we averaged the rates of the providers.

Many households in Colorado, especially in rural areas, do not have access to utility water or wastewater services, and these households typically rely on private well water and septic systems. In this study, we assumed that households within a census designated place received utility water and wastewater service and households outside a census designated place relied on wells and septic systems. Additionally, when no contact information could be found or we received no response from a utility, or when municipal officials told us households in their area used only wells and septic systems, we applied a well and septic rate. Well water costs were calculated based on well installation, operation, and maintenance costs described online (https://homeguide.com/costs/well-pump-cost#repair). We assumed a pump and installation (not including drilling) would cost $2,000 and last 15 years, resulting in an annual cost of $133. Additionally, we calculated operation, maintenance, and testing costs of $166 per year, for an annual total of $300 and a $25 monthly cost. Septic system costs were calculated based on installation, operation, and maintenance costs described online (https://www.homeadvisor.com/cost/plumbing/install-a-septic-tank/). We assumed a tank would last 20 years and would cost $4,000 to install and $2,000 to maintain during that time span, resulting in a $300 annual cost, or $25 monthly cost.

Leveraging GIS, we overlaid a map of census designated places, and each place's appropriate water and wastewater bill, with a map including every census block (with number of household counts), county, and school district in Colorado. We then calculated aggregate water and wastewater bills within each block based on the average utility rate for blocks within census designated places or by the well and septic estimates for the remaining blocks. We applied local utility sales taxes as applicable. Lastly, we calculated average water and wastewater bills for each school district based on the aggregate district bill and number of households within each district.

HOUSING – HOUSEHOLD OPERATIONS – DAYCARE

Daycare costs incorporated in this study were based on information provided in The Self-Sufficiency Standard for Colorado 2022. This study was prepared by the Center for Women's Welfare at the University of Washington School of Social Work. Specific childcare costs for an infant (ages 0 to <3), a preschooler (ages 3 to <6), and a school-aged child (ages 6 to <13) were collected for each county in Colorado and then weighted by the proportion of children in care for each grouping, as reported by the Department of Health and Human Services data on children participating in Child Care and Development Fund (CCDF)-funded programs (Table 9 in their Fiscal Year 2020 publication).

Final average daycare costs were reapportioned from the county level to the school district level by calculating the proportion of households within each district and county combination, then weighting the average daycare costs by those proportions. For example, in the Adams-Arapahoe 28J District, 80% of households are located in Arapahoe

County while 20% of households are located in Adams County. The daycare estimate for the Adams-Arapahoe District is the sum of 80% of the Arapahoe County daycare average and 20% of the Adams County average.

HOUSING – HOUSEHOLD OPERATIONS – INTERNET SERVICE

Internet service cost was incorporated into the cost-of-living assessment for the first time in 2023. Because internet service is not regulated by the Colorado Public Utilities Commission, provider service areas and the price for internet is primarily proprietary and not readily available. However, the Governor's Office of Information Technology Colorado Broadband Office referred us to several relevant data sources, including broadband service mapping conducted by the Federal Communication Commission (FCC) as well as publicly available information from BroadbandNow Research. We chose to leverage the Zip Code Competition & Pricing Data from BroadbandNow Research, which included their "proprietary plans and pricing data of over 4000 terrestrial broadband providers and the FCC's latest Form 477 data." This dataset was selected primarily because it included reliable price and coverage estimates for standardized internet service at high geographic resolution. The data included two key elements. First, it included the lowest priced terrestrial broadband plan by ZIP code. Specifically, this was the lowest regular monthly priced terrestrial (wired + fixed wireless) residential standalone-internet broadband plan with a minimum speed of 25 mbps download and 3 mbps upload. Prices were available in 376 out of the 433 Colorado ZIP codes with population. Second, the data contained estimates of access to terrestrial broadband; specifically, the percentage of the ZIP code's population that had access to terrestrial (wired + fixed wireless) broadband with minimum speeds of 25 mbps download and 3 mbps upload.

Among the 433 ZIP codes with any population, 123 ZIP codes contained 100% of households with access to terrestrial broadband, 297 Zip codes contained between 1% and 99% of households with access to terrestrial broadband, and 13 ZIP codes contained zero households with access to terrestrial broadband. We assumed that households with no access to terrestrial broadband may purchase satellite internet service. Since the cost of satellite service does not differ by location, we averaged the monthly cost of satellite internet from three providers: HughesNet, ViaSat, and Starlink. The average satellite internet cost was estimated at $88.33 per month.

To estimate the average cost of internet within each ZIP code, we multiplied the cost for terrestrial broadband by the percentage of households with access to terrestrial broadband and then added to it the product of the cost for satellite internet and the percentage of households without access to terrestrial broadband. In some ZIP codes, there was no direct estimate for the cost of terrestrial broadband or the coverage of terrestrial broadband available. In these cases, we assigned the average cost and/or coverage for terrestrial broadband in the ZIP code's primary county. For ZIP codes in Gilpin, San Juan, and Dolores counties, we had no reliable countywide estimates for cost and coverage, so we used the statewide estimates as proxies.

Finally, to estimate the average cost of internet within each school district, we leveraged GIS to overlap census blocks by ZIP codes by school districts. Each block received the estimated internet cost of its overlapping ZIP code. Then we calculated the average internet cost among all blocks within each school district weighted by the proportion of households within each block.

TRANSPORTATION – VEHICLE PAYMENTS

Vehicle pricing was gathered for a 2021 Honda Civic LX Sedan. The purchase price of the 2021 Honda Civic was $21,846 (per Kelley Blue Book information on the fair purchase price from a dealer in November 2023, assuming the vehicle had 24,000 miles at the time of purchase). This was the base price used to determine annual car payments for

a four-year loan. This price was assumed to be constant throughout the state, which ensures that the identical vehicle is being purchased in each district. With a used car purchase, not only is availability of a specific model limited across districts, but the specific condition and features on each available vehicle can vary widely making it impossible to compare available pricing for a specific vehicle. Instead, the vehicle value is held constant at the KBB value, and the variance between districts comes from the sales and registration taxes and fees, as well as the financing rates and fees available. Ownership taxes, registration & licensing fees, other fees (title) are obtained from the "Colorado Motor Vehicle Law Resource Book" from the Colorado Legislative Council. The vehicle weight is also required for calculating taxes; this was obtained from the vehicle manufacturer's website. Sales taxes were calculated for each taxing jurisdiction and averaged for each district, weighted to the proportion of households within each taxing jurisdiction.

Financing rates for vehicle loans were obtained from telephone surveys of 278 banking institutions and credit unions throughout the state. The list of banking institutions to survey was obtained from a commercial list vendor and a sample was drawn as described in the previous section of the report. Banking institutions were mapped to the bank's physical location, and each bank's finance rate was appended to that location. Then, we used a spatial interpolation technique to predict financing rates for every school district based on spatial patterns across the 278 institutions. Average monthly car payments were then calculated for each district, given the total amount financed (including the purchase price, any applicable sales tax, specific ownership tax, title, and registration fees) and the interest rate charged by the bank or credit union.

TRANSPORTATION – GASOLINE

Gasoline costs were calculated as a factor of the price of gasoline in each district and an estimated amount of driving for commuting and shopping in each district. Gasoline prices from 1,928 gas stations across Colorado were purchased from the Oil Price Information Service, which gathers and compiles daily data on gas prices from individual locations. Prices were collected on Wednesday, September 13, 2023. The minimum price was $2.599, and the maximum price was $5.769. Prices were collected for 150 districts, and shopping patterns were applied to calculate a final gas price for each district. However, annual total spending on gasoline depends on both the price of gas and the amount of gas used; the latter we estimated from secondary sources. First, we accessed commute time data from the U.S Census Bureau, American Community Survey (table B08012) 2022 5-year dataset, and we calculated an average commute time for each school district, which ranged from 9-minutes to 62-minutes. We then converted commute minutes into commute miles per year by assuming an average driving speed of 40 miles per hour. Next, we calculated average distance for grocery shopping by calculating the miles from each block in every district to the nearest grocery or department store with at least two employees. Then we calculate annual miles driven by someone who commutes to work five days per week, 50 weeks each year, and makes two shopping trips per week, 52 weeks each year. We then calculate the gallons of gasoline needed for that amount of driving, based on the fuel efficiency for the benchmark household's primary vehicle, which is a 2021 Honda Civic that gets 33 miles per gallon. Finally, we multiplied the gallons needed by the average price per gallon of gasoline for that district.

TRANSPORTATION – VEHICLE INSURANCE

Vehicle insurance rates were collected from the most recent Auto Insurance Premiums Report from the Colorado Department of Regulatory Agencies, Division of Insurance. Rates in this report were drawn from a survey of insurance providers that the Division of Insurance conducts annually; data in the report was current as of July 2022. Premiums were for a coverage period of six months (which we adjusted to represent monthly costs) and were based on a basic model vehicle 2019 Toyota Camry LE Automatic. Premiums were based on a hypothetical driver who was a 45-year-

old male, married, principal operator, driving less than 15 miles to work each way, who had no accidents or traffic convictions in the past three years, and drove 15,000 miles annually. The policy included coverage for property damage of $25,000, bodily injury of $50,000 per person or $100,000 per occurrence, uninsured or underinsured motorist coverage of $50,000 per person or $100,000 per occurrence, $5,000 for medical payments, and a $500 deductible. All policy specifications, including car make and model, were pre-determined by the Division of Insurance. Aside from the vehicle make and model, the driver and program definitions were also used in the 2019 and 2021 cost of living study.

The Auto Insurance Premiums Report included premiums in 37 cities spread throughout Colorado from 58 insurance companies. To better represent "typical" vehicle insurance rates, insurance companies that made up less than one percent of the market share in Colorado were excluded. Thus, our analysis included premiums from the 14 largest vehicle insurance providers, which in aggregate, made up 66 percent of the Colorado vehicle insurance market. We averaged the premiums from these 14 insurance providers for each of the 37 Colorado cities in the report. Lastly, to derive vehicle insurance premiums for each school district, we used a spatial interpolation technique to predict premium rates at the districts' mean population centers, based on spatial vehicle insurance rate patterns of premium rates among the 37 cities in the report. This interpolation method was similarly employed to predict vehicle insurance rates in prior cost of living studies.

HEALTHCARE

Healthcare insurance premiums for 2023 were provided by the Colorado Department of Regulatory Agencies, Division of Insurance. All premiums were based on a 40-year-old person. Low and high premiums were provided by six insurance companies for each of nine geographic "rating" areas they served. We first calculated the midpoint between the low and high costs for each company in each rating area. Then we averaged these mid-points for all "Silver" and "Bronze" plans, both on-exchange and off-exchange. Averages by rating area were then assigned to appropriate counties, without overlap. This approach was consistent with previous years.

Final average health insurance premiums were reapportioned from the county level to the school district level by calculating the proportion of population within each district and county combination, then weighting the average premium by those proportions.

PERSONAL (INCOME) TAXES

Personal income taxes were calculated for the benchmark family in each district using the IRS Form 1040 for 2022 for federal income tax and adding state income tax and occupational/head taxes for relevant local jurisdictions. For federal income taxes, the standard deduction was compared to the itemized deduction calculated using mortgage interest (recognizing allowable limits), as well as specific ownership taxes from the vehicles, state income taxes, and cash contributions based on the CES, and the higher of the two deductions was used for each district. IRS Publication 936 was used to calculate the allowable limits on home mortgage interest deductions for high home value districts (e.g., Aspen). Specific ownership taxes were calculated from the original Manufacturer's Suggested Retail Price (MSRP) value for each vehicle, and the tax formula from the Colorado Motor Vehicle Law Resource Book. Colorado state income taxes were calculated from the formulas in publication, DR 1098 "Colorado Income Tax Withholding Tables for Employers".

Major federal tax reform was enacted for 2018, which included lowering tax rates, increasing the standard deduction, suspending personal exemptions, increasing the child tax credit, and limiting or discontinuing certain deductions. As a

result, for all districts except Aspen 1 (which has the highest deduction for mortgage interest, even recognizing allowable limits), our calculation found the standard deduction to be greater than itemized deductions. The new tax rules have greatly reduced variability in the index due to income taxes. Of note this year (though it does not impact variability between districts), the Colorado state income tax withholding rate was reduced to 4.40% for tax year 2022 and later per the passage of Proposition 121.

ALCOHOL, TOBACCO, APPAREL, READING, EDUCATION, MISCELLANEOUS EXPENSES, CASH CONTRIBUTIONS, AND PERSONAL INSURANCE AND PENSIONS

Mirroring previous cost of living studies, the major expenditure categories for Reading, Education, Miscellaneous Expenses, Cash Contributions, and Personal Insurance and Pensions were not sampled in this 2023 Cost of Living study. Similar to the previous studies, these expenditure categories were expected to be constant for the relevant benchmark family and were thus held constant for all districts. No significant geographic variation or trends were expected to be seen for these goods, and the final costs for each district came directly from the benchmark family's spending level calculated for each category from the Consumer Expenditure Survey.

As in 2019 and 2021, expenses for Alcohol, Tobacco, and Apparel categories were also held constant for all districts, as previous years of data collection had found very low variability in prices between districts. Apparel items were increasingly being reported to be purchased online, further reducing variability between districts.

3.5 DEVELOPING FINAL COST OF LIVING MEASURES

After the collection of all price data, two major steps were taken to develop the final cost of living measures. First, the price data for the market basket items was weighted by the shopping patterns model in order to develop prices for each district that reflect where people in the district purchase their items. Second, annual expenditures were calculated by determining the ratio of the district average price to the statewide average price for each good and then multiplying that average by the typical expenditure on that item according to the Consumer Expenditure Survey. This second step scales up costs so that the limited numbers of (for example) grocery items for which data were collected represent the full annual expenditures for food for the benchmark household. Each of these steps is described in further detail below.

INTEGRATE PRICE DATA WITH SHOPPING PATTERNS SURVEY DATA

People do not make all their purchases in the school district in which they live. A shopping patterns survey, conducted in 2019, gathered data on where people shop for 15 categories of items and services: produce, perishable groceries, non-perishable groceries, alcoholic beverages, household products, clothing and shoes, gas, car maintenance and repair, small appliances, tobacco, TVs, and where they go for movie theaters, haircuts, pizza restaurants and other restaurant meals. For each of these items, the shopping patterns matrix specifies where people living in each district shop for each item, based on the proportional location of surveyed shoppers' most recent purchases. For example, people who live in the Denver County school district may buy gasoline in not only Denver but also neighboring school districts such as Adams-Arapahoe, Boulder Valley, Brighton, Cherry Creek, Jefferson County, and others. By multiplying the shopping patterns matrices that link "home district" with "shopping districts", regional variations in costs and shopping preferences are reflected.

In any instances where people reported shopping in a district where a price was not able to be gathered, the proportion of shopping attributed to that district is redistributed proportionally among the other districts where people reported shopping and where prices were gathered.

CALCULATE ANNUAL EXPENDITURES

Calculating the annual expenditures for each district involved determining the district average price for each item, weighting that price by the proportion of teachers in the district to calculate a state average price, calculating the ratio of the district average price to the state average price, and then multiplying that ratio by the typical expenditures in a category according to the Consumer Expenditure Survey. These steps are elaborated below.

Mirroring the methodology used since the 2007 cost of living study, most market basket items were sampled by school district in 2021. This helped to ensure that all final cost of living data was specific to an exact school district. In a few cases, the data were only available at a county or regional level and needed to be applied to districts based on location. Utilities prices, daycare prices, and insurance prices are a few of the cases where data was available at the county or regional level and had to be applied to districts. In these cases, the county (or other) price was assigned to each district located in that county in order to arrive at a price for each district.

Statewide average prices were then calculated by weighting the average price in each district by the proportion of the state's teachers in that district and then adding together the weighted prices for all districts. District average prices were then compared to state average prices by calculating the ratio of the district average price to the state average price. These ratios were then multiplied by the typical expenditure for the category according to the Consumer Expenditure Survey in order to determine a final annual expenditure on that item for each district.

This process was repeated for each market basket item, and then all expenditures on items in a common category were summed to determine annual expenditures for that category (i.e., categories include food at home, food away from home, housing, transportation, etc.). Finally, annual expenditures in each category were combined to provide total annual expenditures for each district.

CALCULATE CONFIDENCE INTERVALS

Confidence intervals were also calculated for most expenditure categories to estimate the uncertainty in the prices available to consumers in each district. For each district sampled, the variance of the mean (i.e., standard error), was calculated for the prices obtained from that district. These variances were weighted by the shopping patterns for each district and the teacher populations to calculate a state average variance. Then ratio variances were calculated by comparing the variance for a district to the state average variance. Ratio variances were aggregated over items in a category and a confidence interval was calculated for the category as a whole.

Essentially, large confidence intervals reflect a large variance of the mean, which means there is a large variability in the prices collected and relatively few prices collected. In some cases, variability in the error may be reduced by additional sampling in those districts; however, this is only likely to be true in large districts where the universe of stores available to sample from is large. In, for example, a small, rural district with only one substantial grocery store, where a convenience store has also been sampled, the variance of the mean will be large, but sampling additional convenience stores (if any are available) is likely to only artificially inflate the mean price for the district, because convenience stores tend to charge higher prices than grocery stores. In cases like this there is a tradeoff between reducing error variability and accurately estimating the cost of living in a district. Whether additional sampling is

needed should be evaluated on a case-by-case basis. It should be noted that other factors in addition to the variability of the mean district price will affect uncertainty in the cost of living indices, but currently no additional factors are incorporated in the confidence interval estimates. See Appendix C for a more detailed discussion of statistical measures used in this study.

APPENDIX A: DETAILED RESULTS

This appendix provides an additional level of detail about the results of the study, breaking out costs of living in each district by major expenditure category.

Results are provided both in visual form, through maps provided in this section, and in tabular form in an accompanying spreadsheet. Readers receiving this report electronically will need to review an accompanying spreadsheet file, due to the volume of data.

Maps are provided for the four largest expenditure categories: A) housing, B) transportation, C) food at home, and D) healthcare.

Note. The index value is the ratio of the cost of the housing market basket in each district to the statewide average cost of the housing market basket. In the following maps, shades of green depict less expensive districts while shades of orange depict more expensive districts.

EXHIBIT A: MAPS OF THE **HOUSING** INDEX, 2023

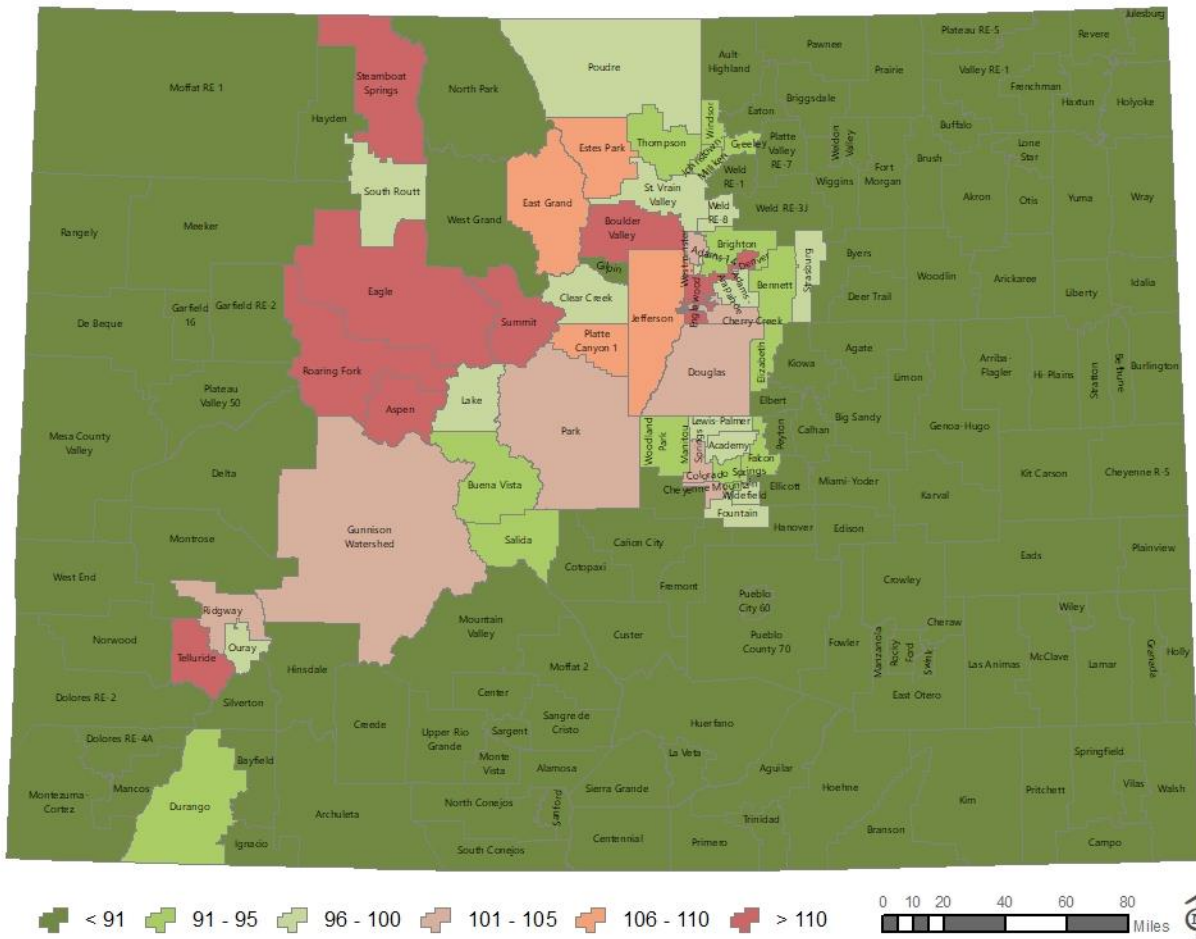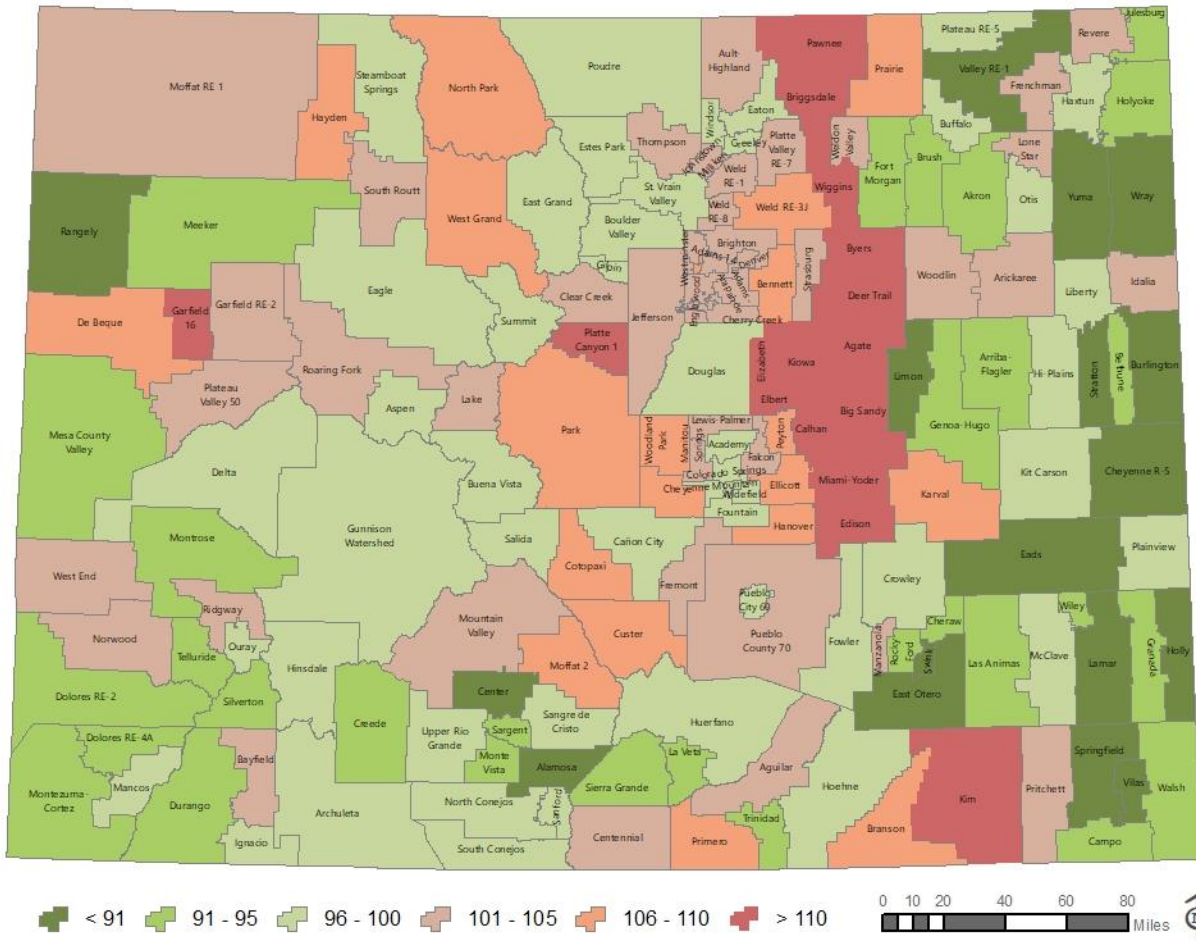### STATEWIDE

FRONT RANGE

EXHIBIT B: MAPS OF THE TRANSPORTATION INDEX, 2023

STATEWIDE

Legend: < 91 | 91 - 95 | 96 - 100 | 101 - 105 | 106 - 110 | > 110

FRONT RANGE

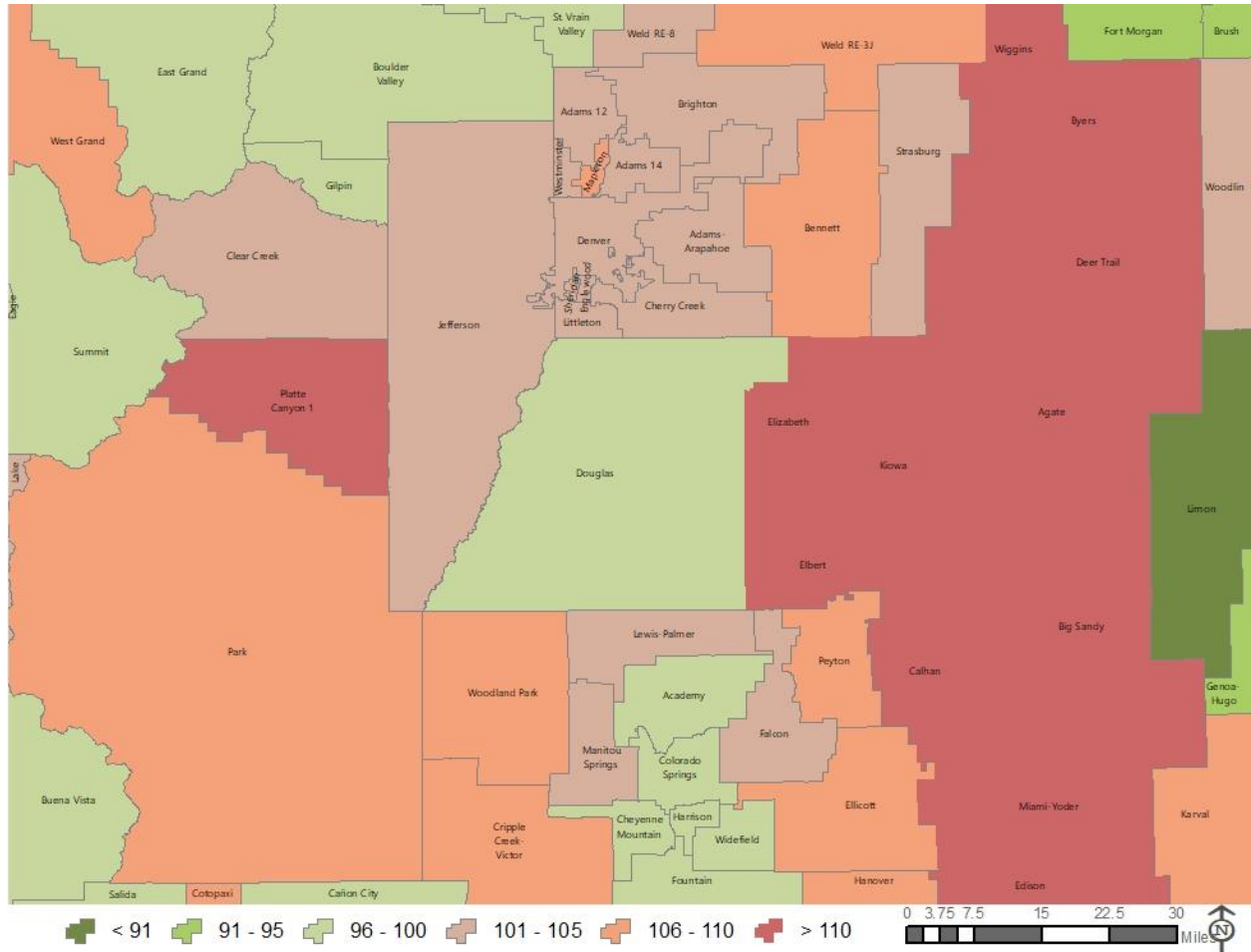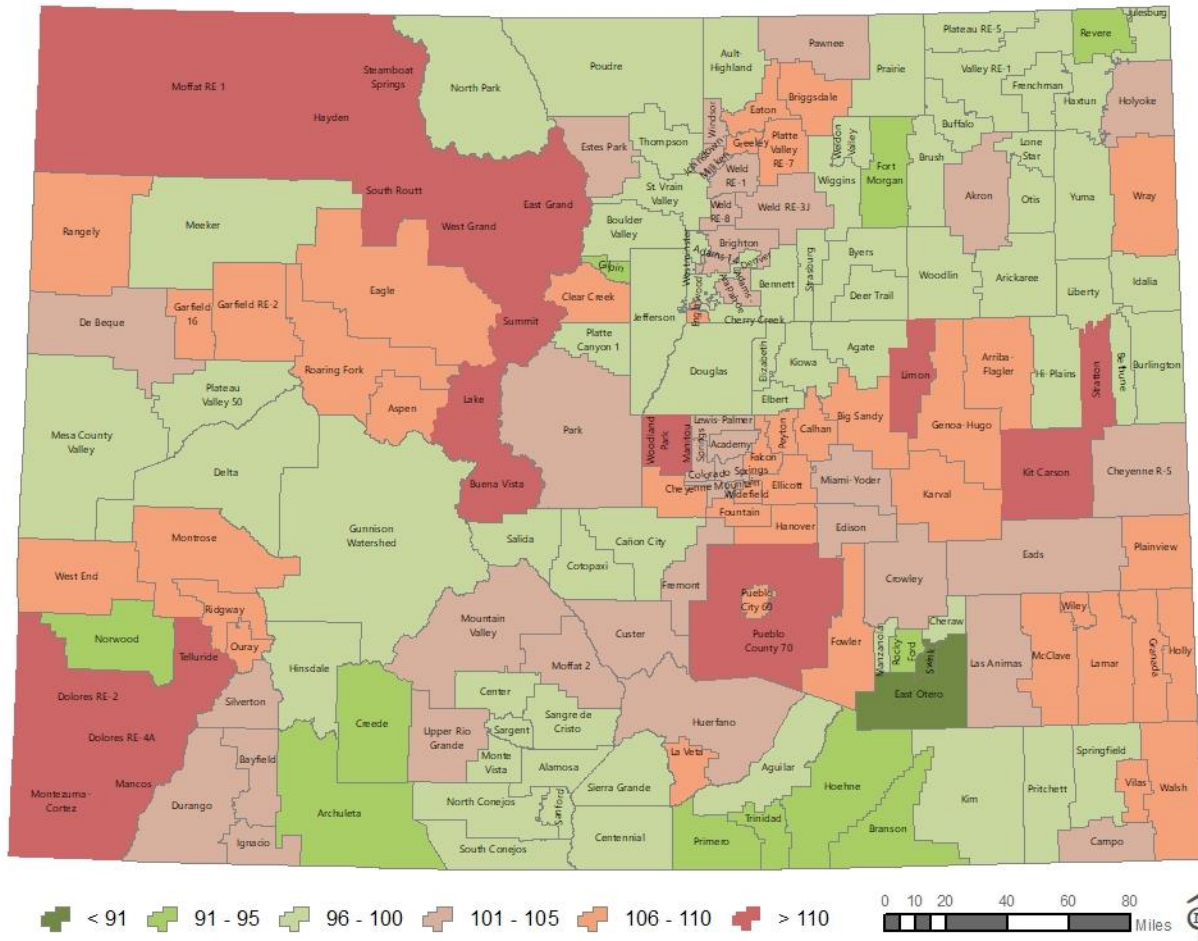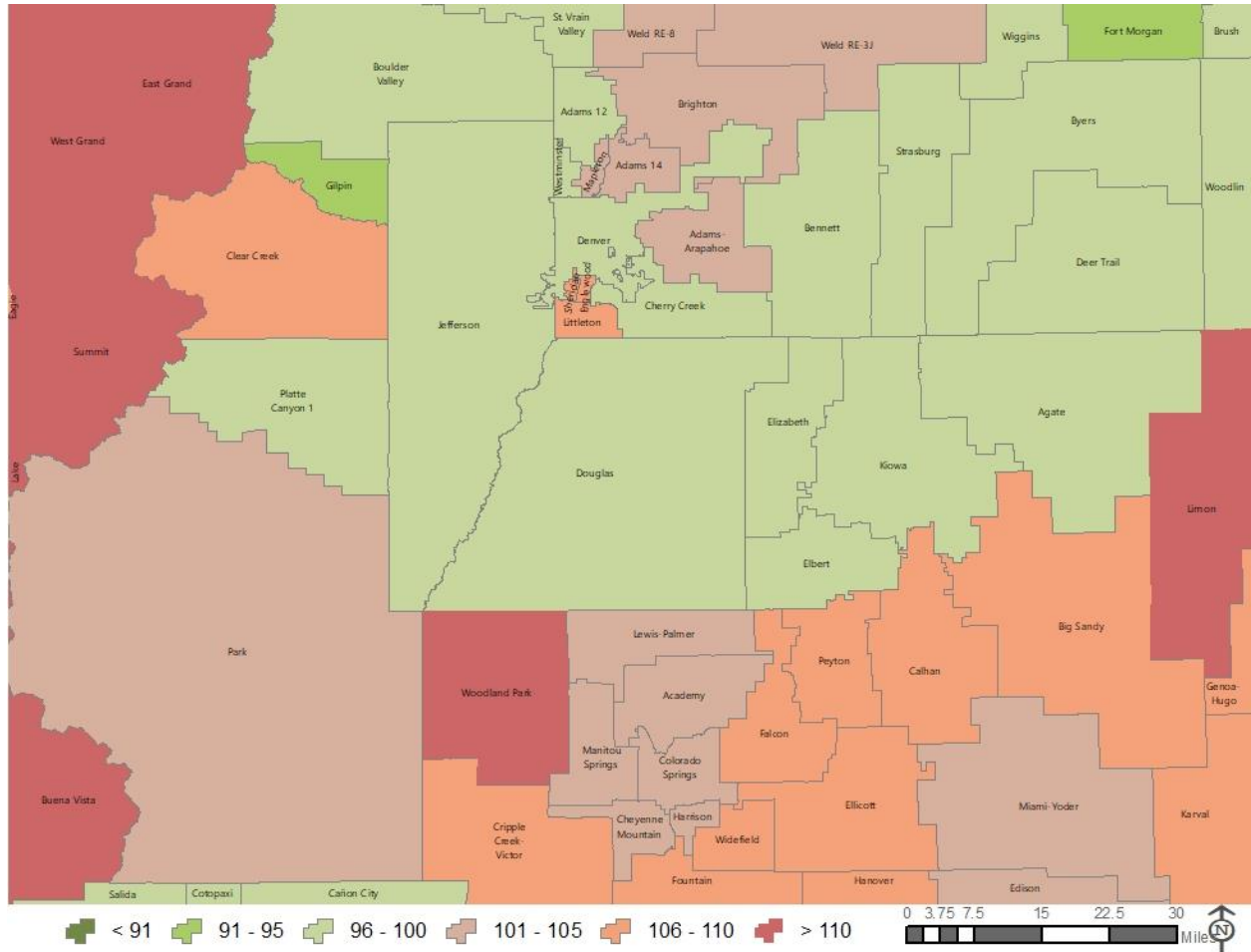| Legend		
< 91	91 - 95	96 - 100
101 - 105	106 - 110	> 110

EXHIBIT C: MAPS OF THE **FOOD AT HOME** INDEX, 2023

STATEWIDE

Legend: < 91 | 91 - 95 | 96 - 100 | 101 - 105 | 106 - 110 | > 110

0 10 20 40 60 80 Miles

FRONT RANGE

EXHIBIT D: MAPS OF THE **HEALTHCARE** INDEX, 2023

STATEWIDE

Legend: ▪ < 91 ▪ 91 - 95 ▪ 96 - 100 ▪ 101 - 105 ▪ 106 - 110 ▪ > 110

0 10 20 40 60 80 Miles

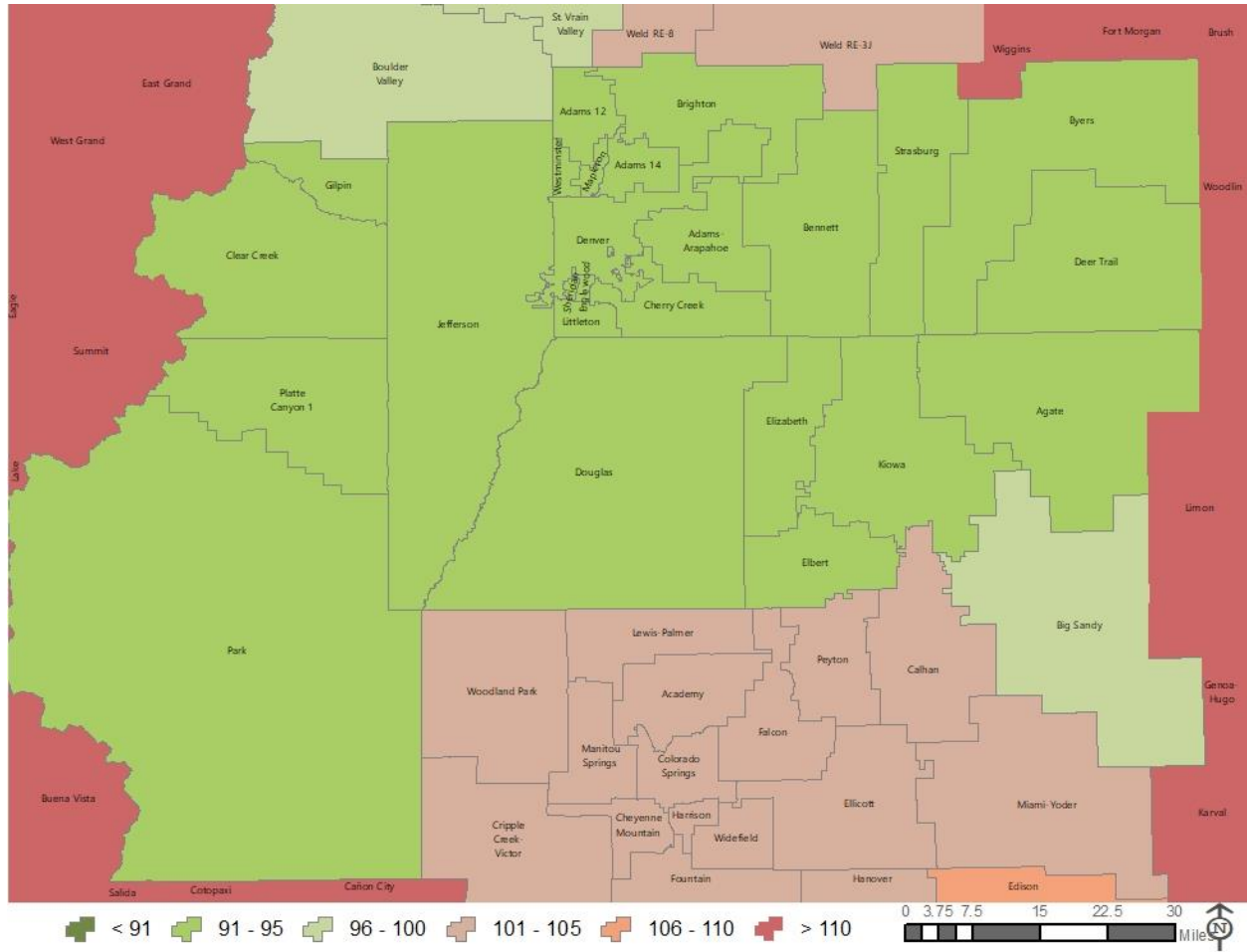FRONT RANGE

| | < 91 | | 91 - 95 | | 96 - 100 | | 101 - 105 | | 106 - 110 | | > 110 |

APPENDIX B: CHANGES FROM THE 2021 STUDY AND IMPLICATIONS

MARKET BASKET CHANGES

In 2023, we continued with the optimized market basket used in the two prior iterations of the study, with minimal updates. The optimized market basket focuses data collection on a smaller number of reliable indicators that are more proportionally representative of expenditure categories. Specifically, the following were updated:

> Pet food was used in place of batteries for the entertainment category.

> As in previous iterations of the study, the vehicles used in collecting oil change prices and vehicle financing information were updated. For the oil change, the F-150 XL truck was updated from a 2017 to a 2019 model year, and for financing, the Honda Civic LX 4-door sedan was updated from a 2019 to a 2021 model year.

> Internet service was added in the household operations category. To estimate terrestrial internet costs, we used the Zip Code Competition & Pricing Data from BroadbandNow Research. For places in Colorado where terrestrial internet is unavailable, we used satellite internet cost estimates. Final internet service costs were calculated by overlapping cost rates by internet service availability by census blocks by school districts, and then calculating cost averages for each school district weighted by the proportion of households within each overlapping block. A full description of the approach can be found in [Section 3.4 Data Collection Details](#).

METHODOLOGICAL CHANGES

Methodological changes were minimal in 2023, compared to the prior iteration. Differences from 2021 are described below.

> The mortgage interest payment calculation was changed to allow for different interest rates across districts. Recent studies show that the average credit score varies by geography, which results in average interest rates varying by geography. We utilized the average credit score category for each county in Colorado to determine the mortgage interest rate available in Colorado at that credit score level. The interest rate variability was not huge, ranging from 6.33% for counties with the highest average credit scores to 6.74% for those with the lowest average credit scores. This has a modest impact on mortgage interest payments but does better capture the cost of living for those living in areas with poorer credit. The three counties with the lowest average credit scores are Adams, Morgan, and Pueblo. Taking their slightly higher interest rates into account slightly increases their cost of living. In contrast, Pitkin, Summit, and Boulder counties are among those with the highest average credit scores, which provides a slight buffer to their very high housing values. This had negligible impact on the final index, with the largest impact being on Aspen and amounting to a reduction of less than one point (0.70).

> References for interest rate variability by geography:

> Van Dam, A. (2023, February 17). Why the South has such low credit scores. *The Washington Post*. Available t: https://www.washingtonpost.com/business/2023/02/17/bad-southern-credit-scores/

> Agarwal, S., Presbitero, A., Silva, A. F., and Wix, C. (2023, January). Who Pays for Your Rewards? Redistribution in the Credit Card Market. FEDS Working Paper No. 2023-7, Available at SSRN: https://ssrn.com/abstract=4347647 or http://dx.doi.org/10.17016/FEDS.2023.007

> In prior years, the vehicle financing analysis included estimating an average interest rate and the average of additional loan fees for each school district. Interest rates and loan fees were gathered by calling banks and credit unions throughout the state. Financing fees were then added to ownership taxes, registration fees, and licensing fees based on taxing jurisdiction. In 2023, we decided to exclude loan fees from the financing

calculations. We made this decision because more often than not the financial institution representatives we talked with on the phone were better able to provide us with the APR for the loan (which includes the cost of fees) than they were able to provide us with the interest rate (which does not include fees) and fees, separately. The distribution of financing remained similar, and therefore this change had minimal impact on the final index results.

> The approach to estimating the cost for residential natural gas shifted slightly in 2023. This year, revenue from residential sales and the volume of residential sales by sub-service area was not listed by Atmos Energy Corporation or Black Hills Energy in their 2022 Energy Annual Report Proceedings, as provided by the Colorado Dept of Regulatory Affairs, Public Utility Commission. Several phone calls and email communications to the Public Utility Commission and the Federal Energy Regulatory Commission did not produce any new information. Therefore, the cost per therm for those two natural gas utilities was derived from their most recent Annual Report of Natural Gas Supply and Disposition (form EIA-176), provided by the U.S. Energy Information Administration. This is the same source used to estimate natural gas cost for smaller municipal gas utilities such as Trinidad and Ignacio. The key difference is the EIA data required us to assume all sub-areas of those utilities were charged the same rate, whereas in prior years each subarea had its own rate.

> The approach to gathering retail prices was very similar to last time, however somewhat more data was able to be collected online this year as more stores have built websites for online shopping from specific store locations. This year, more hair salons were found to be publishing prices online, as well. As in previous years, we did some initial in-person validation shopping to compare prices available in-store to those published online. We also made some modifications to the order of items priced to space out repeated calls to stores in the sampled lists for multiple items (e.g., grocery stores).

> Lastly, although not a change from prior years, in 2023 we did look for a new water and wastewater rate source. Specifically, we explored using the Water and Wastewater Rate Survey developed by the American Water Works Association in partnership with Raftelis. This source did have rates for several large water utilities in Colorado; however, it did not have rates for the hundreds of smaller utilities. Therefore, we maintained our prior approach of gathering standard water rates online or by calling utilities.

APPENDIX C: STATISTICAL MEASURES & TECHNIQUES USED IN THIS REPORT

This appendix is reproduced from previous cost of living reports to ensure that this information on the development of confidence intervals is available to readers each year. Confidence intervals reflect the uncertainty arising from the fact that every store in the state is not visited. The general concept employed in this methodology is the propagation of uncertainty. Uncertainty propagation examines how the uncertainty in a calculated result depends on the uncertainty in the measured values that are entered into the formula. The generalized equation for error propagation for a function *f(x, y, z ...)* where variables x, y and z are uncorrelated is:

$$\sigma_f^2 = \left(\frac{\partial f}{\partial x}\right)^2 \sigma_x^2 + \left(\frac{\partial f}{\partial y}\right)^2 \sigma_y^2 + \left(\frac{\partial f}{\partial z}\right)^2 \sigma_z^2 + ... \qquad [1]$$

where σ_i^2 is the variance of variable *i*. For this project, we are interested in determining the variances (the 95% confidence interval of f is approximately $1.96\sigma_f$) of the cost of living index $COL = f(\mu_D, S, p, w)$ where μ_D are the mean prices of consumer products in the district, S are the shopping patterns, *p* are the decimal population fractions in each district, and w are weights that determine the contributions of individual consumer products to the overall cost of living. All four of these variable types are estimated from surveys of one type or another, and hence have error associated with them. However, only the errors in the district consumer prices μ_D are considered in the Bengtsson treatment.

The Bengtsson derivations for the propagation of μ_D errors are approximate in that equation [1] is not applied directly to the *COL* function. Rather, for simplicity, equation [1] is applied successively to components of the *COL* function in order to build up the final expression for σ_f^2. This simplification is probably necessary given the complexity of the *COL* function. An amplification of the derivation of the variances of interest is provided later. The conceptual part of this appendix will address some key questions.

Does a large variance in the item cost data automatically translate to a large confidence interval? Consider that you wanted to get a haircut in Aspen. It is likely that you could find haircuts ranging from around $20 to well over $100, leading to a large variance in the price of haircuts in Aspen. Does this necessarily mean that the cost of living index will have a large confidence error? No, because the confidence interval depends on the *variance of the estimate of the mean price* as opposed to the variance of the sample. But districts with large price variances do require more intensive sampling. Consider a simplified example where there are 20 places to get a haircut in Aspen, and at half of them you can get a $20 haircut and at the other half haircuts cost $100. Let's also assume that by chance whenever we sample haircut prices that we sample equally between the two haircut prices. Table 1 illustrates what happens to the variance and 95% confidence interval of the estimate of the mean price as a function of number of prices sampled.

Variance and Confidence Interval of Mean Price Estimate as a Function of Sample Size

N	Estimate of Mean Price	Variance of Sample	Variance of Estimate of Mean Price	95% Confidence Interval of Estimate of Mean Price
2	$60	3200	1516	$76
4	$60	2133	449	$42
8	$60	1829	144	$24
16	$60	1797	24	$10

While this example is somewhat extreme, it does illustrate that large variances in the district prices can be overcome by more intensive sampling. However, a question arises; are the higher priced haircuts even pertinent to the middle-income population targeted by the study, given the availability of lower priced haircuts? Seemingly, much of this problem would go away with a combination of strict item criteria and careful outlier detection process. If additional sampling of certain districts is indicated by large CI, more detailed outlier removal for that shopping district may be indicated.

Does a large CI always signal a need for additional price sampling? The primary motivation of determining confidence intervals of COL indices is to determine if additional sampling is needed. The question arises, is additional sampling always indicated when the CI is large? Probably not. Consider a rural area where there may be one grocery store in which the majority of people shop, but also several small convenience stores with somewhat higher prices. Provided the initial price sampling included the grocery store, additional sampling of convenience stores will likely artificially inflate the mean price. The uncertainty in the size of the shopping universe also complicates this situation (see first paragraph of the appendix). As the number of stores sampled (n) approaches the number of stores in the universe of stores (U), the uncertainty in the mean price estimate approaches zero. So, in a small district with large price variances, the strategy for reducing the CI would be to sample every store. However, in some cases the number of stores sampled to date exceeded the supposed value of U. This uncertainty of U makes it difficult to be certain that every store has been sampled. The need to increase sampling of high CI districts needs to be evaluated on a case by case basis. Most of the challenges described so far could be eliminated with store-specific shopping patterns for the target income group. However, reliable collection of such data is probably impossible.

What are the limitations of the method used to calculate the confidence intervals of the COL indices? One of the major limitations of the method of calculating CI is that only uncertainty in mean district prices is taken into account. There is also likely to be uncertainty in the shopping patterns, which also propagates through the calculation and would affect the uncertainty in the COL indices. There may also be smaller errors associated with the weighting and population factors, depending on what these measures are designed to represent. Mathematically, the derivation of an analytical expression to propagate uncertainty in the district prices, shopping patterns, and other sources of uncertainty may be difficult. A Monte Carlo method may be more practical. However, given the expected size of the uncertainty in the shopping patterns, the overall uncertainty in the COL indices, if additional factors are included, may appear to be unacceptably large without prior education.

Alternatively, a separate CI interval could be calculated using uncertainty of the shopping pattern alone, without consideration of the uncertainty in shopping patterns. The purpose of this CI would be to determine if additional surveying of shopping patterns is needed.

What does the confidence interval actually tell us? The confidence interval as calculated by the Bengtsson method indicates the level of uncertainty in the COL indices as affected by uncertainty in the prices available to consumers. It does not reflect the overall uncertainty in the mean COL estimates. It can be used as a screening tool to identify districts that may potentially benefit from additional price sampling. However, once identified, some additional consideration needs to be given to whether additional price sampling would actually be beneficial or whether tools such as outlier detection may be more appropriate. In general, shopping areas that have a large number of consumer choices and large price variances may benefit from additional sampling. If the shopping district has relatively few choices, additional sampling could help provided 1) the new stores sampled actually capture a significant market share and 2) the total universe of stores in the district is known with certainty.

Statistical Appendix

To illustrate the application of equation 1 to the *COL* function and to aid in decoding the vector notation in the Bengtsson methodology, we will consider a simple case in which there are two school districts and three shopping districts in the state. For each consumer item that contributes to the COL index, we estimate the mean price within the district μ_D by a shopping survey of a subset *n* of the stores. We also calculate the variance of the sample σ_D from the sample data. The *variance of the estimate of* μ_D is given by $\sigma_\mu^2 = \sigma_D^2/n$, which is also the square of the standard error of the sample. As *n* approaches the total number of stores that have that item (*U*), the accuracy of our estimate of μ_D increases. We account for this effect on σ_μ^2 by multiplying by the factor $(U-n)/(U-1)$. So, for our example we have: $\boldsymbol{\mu_D} = (\mu_{D1}, \mu_{D2}, \mu_{D3})'$ and $\boldsymbol{\sigma_\mu} = (\sigma_{\mu1}^2, \sigma_{\mu2}^2, \sigma_{\mu3}^2)'$. We also have the shopping pattern matrix (note that the shopping matrix assembled by Corona Insights is actually **S'** as shown below):

$$\mathbf{S'} = \begin{pmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \end{pmatrix}$$ [2]

The actual prices paid by consumer in the district is the shopping-pattern-weighted costs $\boldsymbol{\mu_{SD}} = \mathbf{S'}\boldsymbol{\mu_D}$. If we expand this for school district 1 we get:

$$\mu_{SD1} = S_{11}\mu_{D1} + S_{12}\mu_{D2} + S_{13}\mu_{D3}$$ [3]

If we now apply equation [1] to find $\sigma_{S\mu1}^2$ (the variance of μ_{SD1}):

$$\sigma_{S\mu1}^2 = \left(\frac{\partial\mu_{SD1}}{\partial\mu_{D1}}\right)^2\sigma_{\mu1}^2 + \left(\frac{\partial\mu_{SD1}}{\partial\mu_{D2}}\right)^2\sigma_{\mu2}^2 + \left(\frac{\partial\mu_{SD1}}{\partial\mu_{D3}}\right)^2\sigma_{\mu3}^2 = S_{11}^2\sigma_{\mu1}^2 + S_{12}^2\sigma_{\mu2}^2 + S_{13}^2\sigma_{\mu3}^2$$

This corresponds to the vector notation:

$$\sigma_{S\mu}^2 = S'\sigma_\mu^2 S$$

where σ_μ^2 and $\sigma_{S\mu}^2$ are square matrices with the elements of interest on the diagonals.

The state-average price is given by:

$$\mu_{SS} = p_1(S_{11}\mu_{D1} + S_{12}\mu_{D2} + S_{13}\mu_{D3}) + p_2(S_{21}\mu_{D1} + S_{22}\mu_{D2} + S_{23}\mu_{D3})$$
$$= (p_1 S_{11} + p_2 S_{21})\mu_{D1} + (p_1 S_{12} + p_2 S_{22})\mu_{D2} + (p_1 S_{13} + p_2 S_{23})\mu_{D3}$$

To find the variance of the state-average price we again apply equation [1]:

$$\sigma_{SS}^2 = \left(\frac{\partial \mu_{SS}}{\partial \mu_{D1}}\right)^2 \sigma_{\mu 1}^2 + \left(\frac{\partial \mu_{SS}}{\partial \mu_{D2}}\right)^2 \sigma_{\mu 2}^2 + \left(\frac{\partial \mu_{SS}}{\partial \mu_{D3}}\right)^2 \sigma_{\mu 3}^2$$
$$= (p_1 S_{11} + p_2 S_{21})^2 \sigma_{\mu 1}^2 + (p_1 S_{12} + p_2 S_{22})^2 \sigma_{\mu 2}^2 + (p_1 S_{13} + p_2 S_{23})^2 \sigma_{\mu 3}^2$$

This corresponds to the vector notation:

$$\sigma_{SS}^2 = p'S'\sigma_\mu^2 Sp \quad \leftarrow \text{imagine this in bold}$$

The *COL* is a weighted function of the ratios $r_D = \mu_{SD}/\mu_{SS}$. Now for district 1 we calculate the variance σ_{r1}^2 of the ratio $r_{D1} = \mu_{SD1}/\mu_{SS}$ by application of equation [1] again, remembering that the variances of μ_{SD1} and μ_{SS} are $\sigma_{S\mu 1}^2$ and σ_{SS}^2, respectively:

$$\sigma_{r1}^2 = \left(\frac{\partial r_D}{\partial \mu_{SD1}}\right)^2 \sigma_{S\mu 1}^2 + \left(\frac{\partial r_D}{\partial \mu_{SS}}\right)^2 \sigma_{SS}^2$$
$$= \frac{1}{\mu_{SS}^2}\sigma_{S\mu 1}^2 + \frac{\mu_{SD1}^2}{\mu_{SS}^4}\sigma_{SS}^2 = \frac{1}{\mu_{SS}^2}\left(\sigma_{S\mu 1}^2 + r_{D1}^2\sigma_{SS}^2\right)$$

where we assume r_{D1} can be approximated by 1. Finally, the cost of living index over i items is given by:

$$COL = \sum w_i r_{Di}$$

and its variance is given by:

$$\sigma_{COL}^2 = \sum w_i^2 \sigma_{ri}^2$$

APPENDIX D: RAW PRICING DATA FOR SELECTED PURCHASE CATEGORIES

This appendix provides the raw pricing data that underpins the analysis. Readers receiving this report electronically will need to review an accompanying spreadsheet file, due to the volume of data.

APPENDIX E: SHOPPING PATTERNS MATRICES

This appendix provides the geographic shopping patterns matrix used in this analysis. The matrix is based on a survey of Colorado residents conducted in the fall of 2019. Data from this survey, in conjunction with mathematical modeling methods, were used to construct a geographic shopping matrix describing where the residents of each school district typically purchase products (i.e., what proportion of purchases are made in the home district, in each neighboring district, online, etc.). Readers of this report will need to review an accompanying spreadsheet file due to the volume of data.