State of Colorado

Technical Support Document

For Recommended 8-Hour Ozone Designations

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Colorado Department of Public Health and Environment
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SECTION 1

Denver Metro Area / North Front Range Region

SECTION 1: DMA/NFR Area – Nine Factor Analysis for Ozone Nonattainment

Designation Recommendation:

The State recommends that the current Denver Metro/North Front Range 8-hour nonattainment area be designated as nonattainment for the 2008 revised 8-hour ozone standard. This recommendation is based on monitoring information that indicates the region is not in compliance with the 2008 8-hour ozone standard and the following technical review and analysis.

Figure 1-1: DMA/NFR existing 8-hour Ozone Nonattainment Area

Nonattainment Boundary Recommendation:

The State recommends that the proposed nonattainment area boundary for the revised 8-hour ozone standard should be identical to the current EPA-approved ozone nonattainment boundary for the 9-County Area. This large area encompasses the region's 1) urbanized area, 2) traffic and commuting patterns, and 3) industrial and commercial activities. With the Rocky Mountains to the west, the Palmer Divide to the south, the Cheyenne Ridge to the north, and following the South Platte River valley to the northeast, the area is commonly referred to as the Denver Basin and serves as the topographic and climatological airshed for the region. The recommended boundary is as follows:

Denver-Boulder-Greeley-Fort Collins-Loveland

- Adams County
- Arapahoe County
- Boulder County (including the portion of Rocky Mountain National Park therein)
- Broomfield County
- Denver County
- Douglas County
- Jefferson County
- Larimer County (part) including the portion of Rocky Mountain National Park therein and that portion of the county that lies <u>south of a line</u> described as follows: Beginning at a point on Larimer County's eastern boundary and Weld County's western boundary intersected by 40 degrees, 42 minutes, and 47.1 seconds north latitude, proceed west to a point defined by the intersection of 40 degrees, 42 minutes, 47.1 seconds north latitude and 105 degrees, 29 minutes, and 40.0 seconds west longitude, thence proceed south on 105 degrees, 29 minutes, 40.0 seconds west longitude to the inter-section with 40 degrees, 33 minutes and 17.4 seconds north latitude, thence proceed west on 40 degrees, 33 minutes, 17.4 seconds north latitude until this line intersects Larimer County's western boundary and Grand County's eastern boundary.
- Weld County (part): That portion of the county that lies <u>south of a line</u> described as follows: Beginning at a point on Weld County's eastern boundary and Logan County's western boundary intersected by 40 degrees, 42 minutes, 47.1 seconds north latitude, proceed west on 40 degrees, 42 minutes, 47.1 seconds north latitude until this line intersects Weld County's western boundary and Larimer County's eastern boundary.

DMA/NFR Overview:

The EPA recommends nine criteria, or "factors", to help with attainment/non-attainment determinations and, if necessary, to help determine the appropriate size of a non-attainment area. States must submit an analysis of these nine factors, along with a proposed non-attainment boundary, for any areas that are not meeting the federal standard. The nine factors to be addressed are:

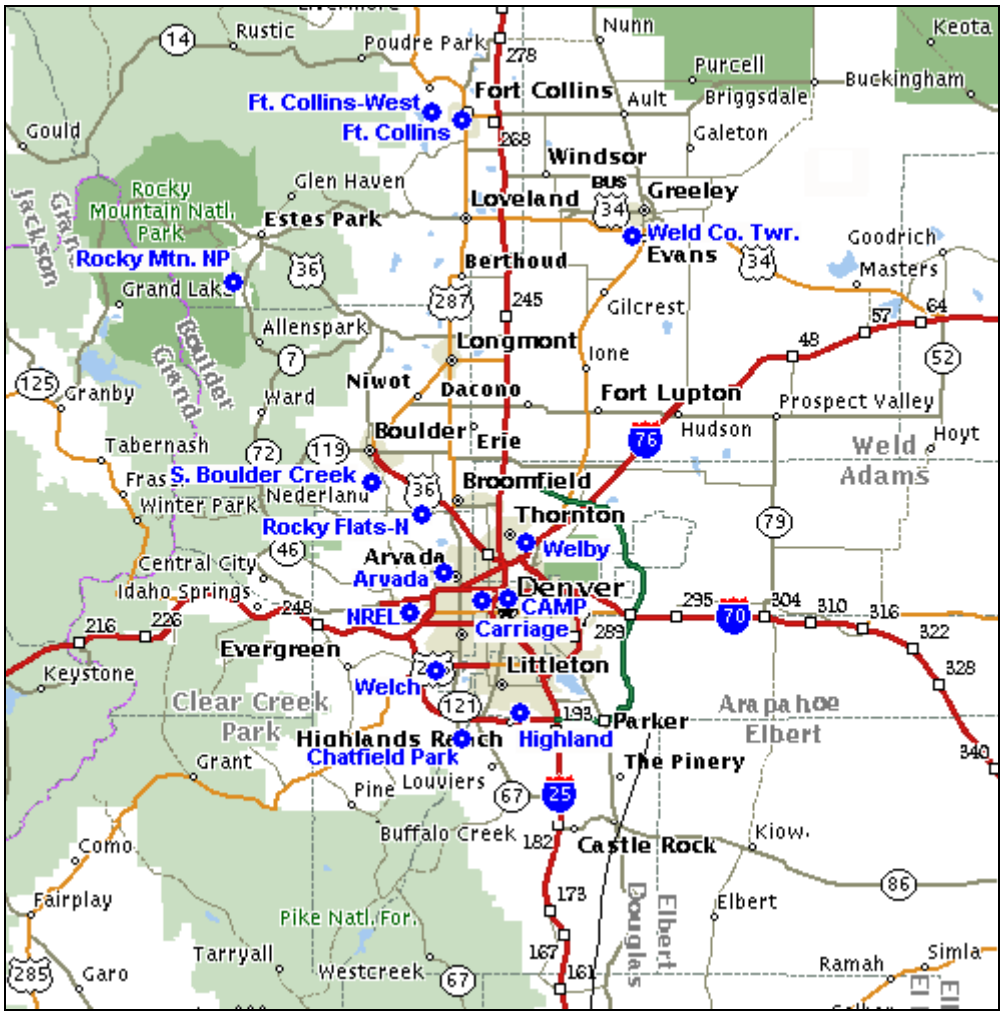
1. Air quality data
2. Emissions data
3. Population density and degree of urbanization

4. Traffic and commuting patterns
5. Growth rates and patterns
6. Meteorology
7. Geography/topography
8. Jurisdictional boundaries
9. Level of control of emission sources

Since ozone monitoring data in the 9-county region indicates non-attainment of the 2008 National Ambient Air Quality Standard (NAAQS), the following nine factor analysis is necessary to support the conclusion that the existing non-attainment boundary is appropriate for the revised ozone standard.

Figure 1-1 indicates the location of ozone monitors in the Denver Metro Area and North Front Range (DMA/NFR) Region.

Figure 1-1: Ozone Monitoring Sites for the Denver Metro Area/North Front Range Region



Factor # 1: Air Quality Data

There are 13 ozone monitors (see Table 1-1) currently operating in the Denver Metro Area and North Front Range (DMA/NFR) Region. The CAMP monitor was discontinued in January 2008 because of recurring monitoring of low ozone levels and was moved to a new required "NCore" monitoring site that is located at the Denver Municipal Animal Shelter. The Highland monitor was temporarily shuttered in 2008 because of interruption of on-site power availability but will be restarted in 2009 when on-site power is restored.

Table 1-1: Ozone Monitoring Data for the Denver Metro/North Front Range Region

Denver Metro Area/North Front Range 4th Maximum 8-Hour Ozone Values and 3-Year Averages							
Site Name	***AQS#***	**Year**				**3-Year Average 2005-2007 (ppm)**	**3-Year Average 2006-2008* (ppm)**
		2005 (ppm)	**2006 (ppm)**	**2007 (ppm)**	**2008* (ppm)**		
CDPHE-APCD Sites							
Welby	08-001-3001	0.073	0.069	0.070	0.076	0.070	0.071
Highland	08-005-0002	0.080	0.081	0.075	n/a	**0.078**	n/a
S. Boulder Ck.	08-013-0011	0.076	0.082	0.085	0.076	**0.081**	**0.081**
CAMP	08-031-0002	0.051	0.062	0.057	n/a	0.056	n/a
Carriage	08-031-0014	0.074	0.072	0.076	0.072	0.074	0.073
Denver Animal	08-031-0025	n/a	n/a	n/a	0.070	n/a	n/a
Chatfield Park	08-035-0004	0.084	0.086	0.082	0.080	**0.084**	**0.082**
Arvada	08-059-0002	0.078	0.082	0.079	0.074	**0.079**	**0.078**
Welch	05-059-0005	0.064	0.081	0.080	0.073	0.075	**0.078**
Rocky Flats-N	08-059-0006	0.077	0.090	0.090	0.079	**0.085**	**0.086**
NREL	08-059-0011	0.079	0.083	0.085	0.076	**0.082**	**0.081**
Ft. Coll. West	08-069-0011	n/a	0.087	0.085	0.076	n/a	**0.082**
Ft. Collins CSU	08-069-1004	0.076	0.078	0.069	0.066	0.074	0.071
Weld Co. Twr.	08-123-0009	0.078	0.082	0.074	0.073	**0.078**	**0.076**
Other Agency Sites							
Rocky Mtn. NP	08-069-0007	0.075	0.076	0.078	0.076	**0.076**	**0.076**
Other Sites Near the DMA/NFR							
Co. Spg.-Acad., CO	08-041-0013	0.077	0.072	0.072	0.070	0.073	0.071
Manitou Spgs., CO	08-041-0016	0.075	0.076	0.072	0.072	0.074	0.073
Centennial, WY	56-001-????	0.066	0.070	0.066	0.069	0.067	0.068
* Note: Data are through October 2008.							

The following figures provide historical trend data of the 8-hour ozone 4th maximum for the DMA/NFR Region.

Figure 1-2: Northern and Southern Denver Metro Area - 8-hour (4th Max) Ozone Values

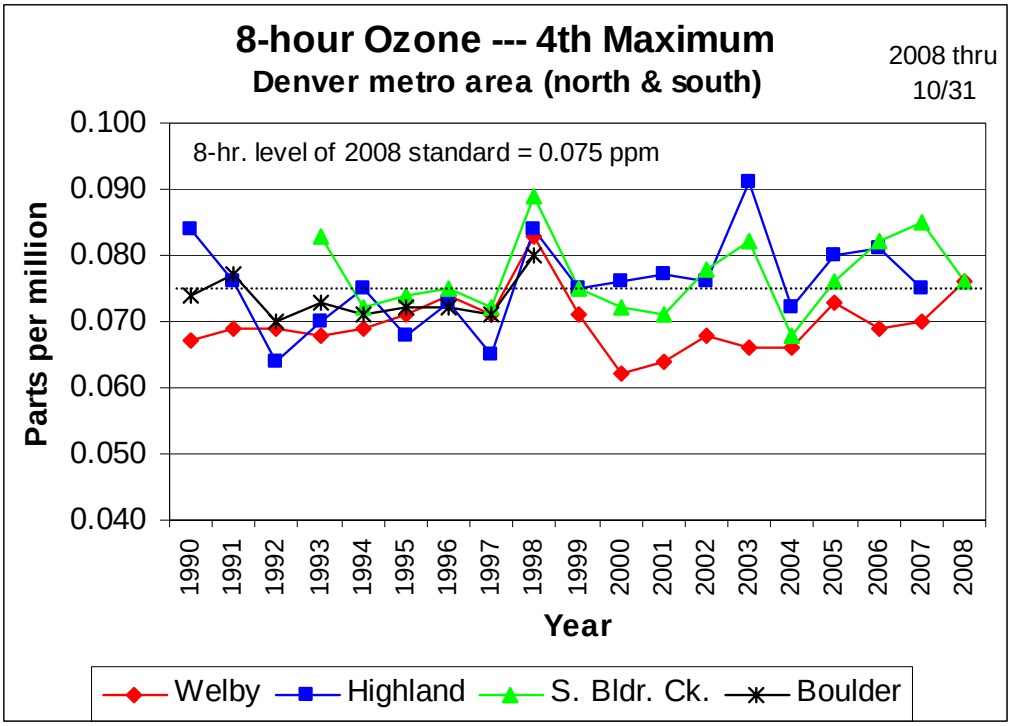


Figure 1-3: Western Denver Metro Area - 8-hour (4th Max) Ozone Values

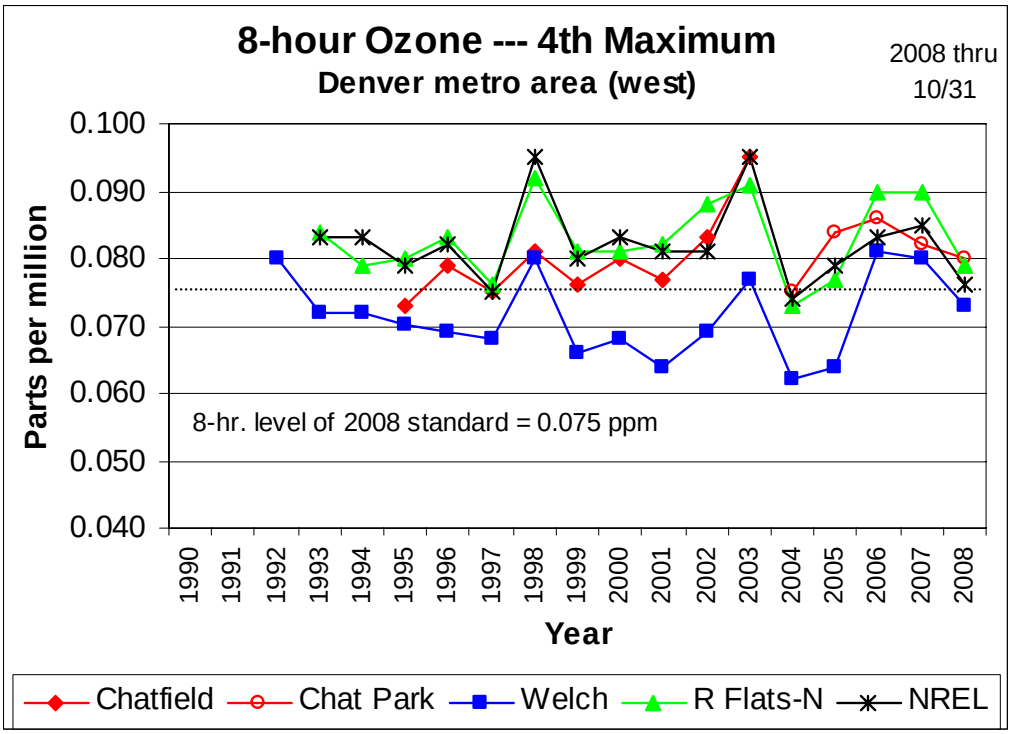


Figure 1-4: Core Denver Metro Area - 8-hour (4th Max) Ozone Values

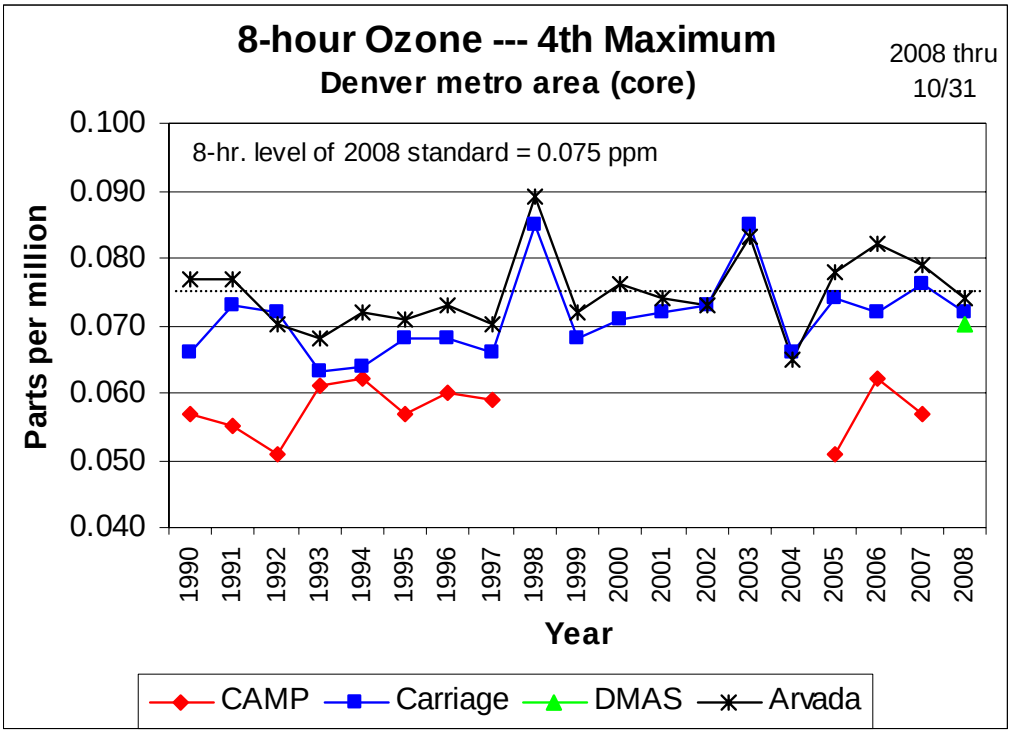
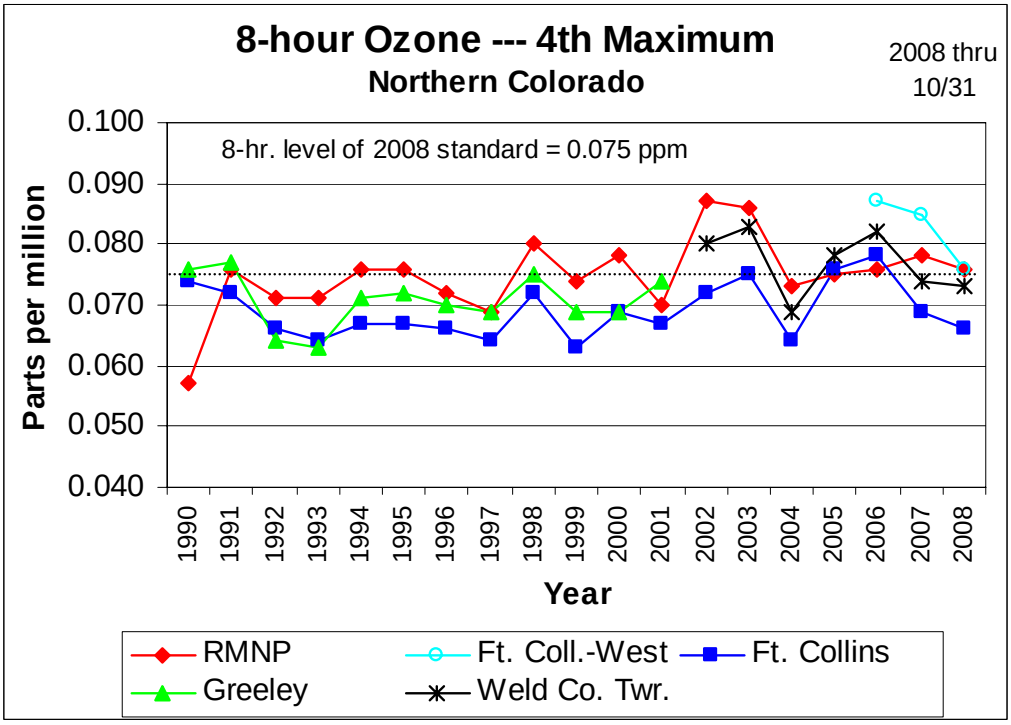


Figure 1-5: North Front Range Area - 8-hour (4th Max) Ozone Values



A passive ozone study was conducted during the summer of 2007 by the Colorado Department of Public Health and Environment – Air Pollution Control Division in the North Front Range area. Samples over a period of 48 hours were collected during July and August. While not directly comparable to the NAAQS due to the sample durations, the data did compare reasonably well to the 48-hour averages for the same periods from a collocated continuous analyzer. While most of the data were in the existing non-attainment are boundaries, two sites were not: one near Black Hawk in Gilpin County and one near Idaho Springs in Clear Creek County. The 48-hour averages from these two sites were lower than the 48-hour averages from all the continuous analyzers except for the CAMP analyzer in downtown Denver. This indicates that these two counties are not likely to have high ozone concentrations.

Monitoring Conclusions:

The monitoring data supports the recommended nonattainment designation for the current 8-hour ozone nonattainment area. If future monitoring locations indicate that additional counties or regions are in violation of the revised ozone standard, the existing nonattainment boundary will be revaluated and expanded as necessary.

Factor # 2: Emissions Data

Table 1-2 includes the 2006 emissions data for NOx and VOC emissions for 13 source categories for the 9-county DMA/NFR region. The emissions data for Larimer and Weld Counties includes the whole county and does not apportion emissions originating from the proposed non-attainment area (NAA) portion of these counties. The northern portion of Larimer County (NAA excluded) 2006 NOx and VOC emissions are estimated at 2,936 tpy (~27% of County total) and 2,968 tpy (~27% of County total) respectively. The northern portion of Weld County (NAA excluded) 2006 NOx and VOC emissions are estimated at 279 tpy (~1% of County total) and 864 tpy (~1% of County total) respectively.

Table 1-2: 2006 Ozone Precursor Emissions Data for DMA/NFR Nonattainment Area Counties

2006 Emissions Data																		
Category	Adams		Arapahoe		Boulder		Broomfield		Denver		Douglas		Jefferson		Larimer		Weld	
	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]
Aircraft	1	8	6	43	2	13	0	1	1,940	324	0	0	2	13	1	9	3	17
Commercial Cooking	0	14	0	24	0	18	0	2	0	40	0	7	0	28	0	15	0	7
Forest and Prescribed Fire	13	17	722	0	5	4	0	0	0	0	13	32	39	54	26	50	50	67
Fuel Combustion	469	27	7,221	42	394	22	55	3	847	49	265	15	799	46	367	21	293	16
Highway Vehicles	7,968	4,556	2,513	5,022	3,324	2,681	916	659	9,977	6,517	4,528	2,882	7,423	5,645	5,171	3,827	6,660	3,694
Non-Road	2,424	1,957	35	3,037	1,769	1,762	275	183	3,459	2,529	1,807	1,598	2,814	2,810	1,647	2,230	1,870	1,581
O&G area	236	1,328	426	157	86	383	14	93	32	57	0	0	0	0	32	382	5,876	23,320
Railroads	1,087	47	0	18	358	15	81	3	252	11	553	24	320	14	74	3	1,510	65
Solvent Utilization	0	1,070	983	1,405	0	1,428	0	0	0	1,778	0	504	0	1,407	0	695	0	1,587
Other Point Sources	14,345	6,116	1	2,277	5,530	1,920	14	431	3,307	2,862	127	889	2,606	2,974	3,560	1,276	9,109	45,971
Structure Fires	1	5	0	6	0	4	0	0	1	7	0	2	1	6	0	3	0	2
Surface Coating	0	664	19	1,134	0	579	0	0	0	1,192	0	552	0	1,267	0	443	0	335
Woodburning	20	1,501	2	1,235	22	1,300	2	176	30	2,144	13	750	46	3,302	36	2,082	24	1,865
TOTAL	26,565	17,309	11,928	14,402	11,491	10,129	1,358	1,552	19,845	17,509	7,306	7,256	14,051	17,566	10,916	11,035	25,395	78,526
		NAA Counties																

Table 1-3 includes the 2006 emissions data for NOx and VOC emissions for 13 source categories for the counties nearby the DMA/NFR region

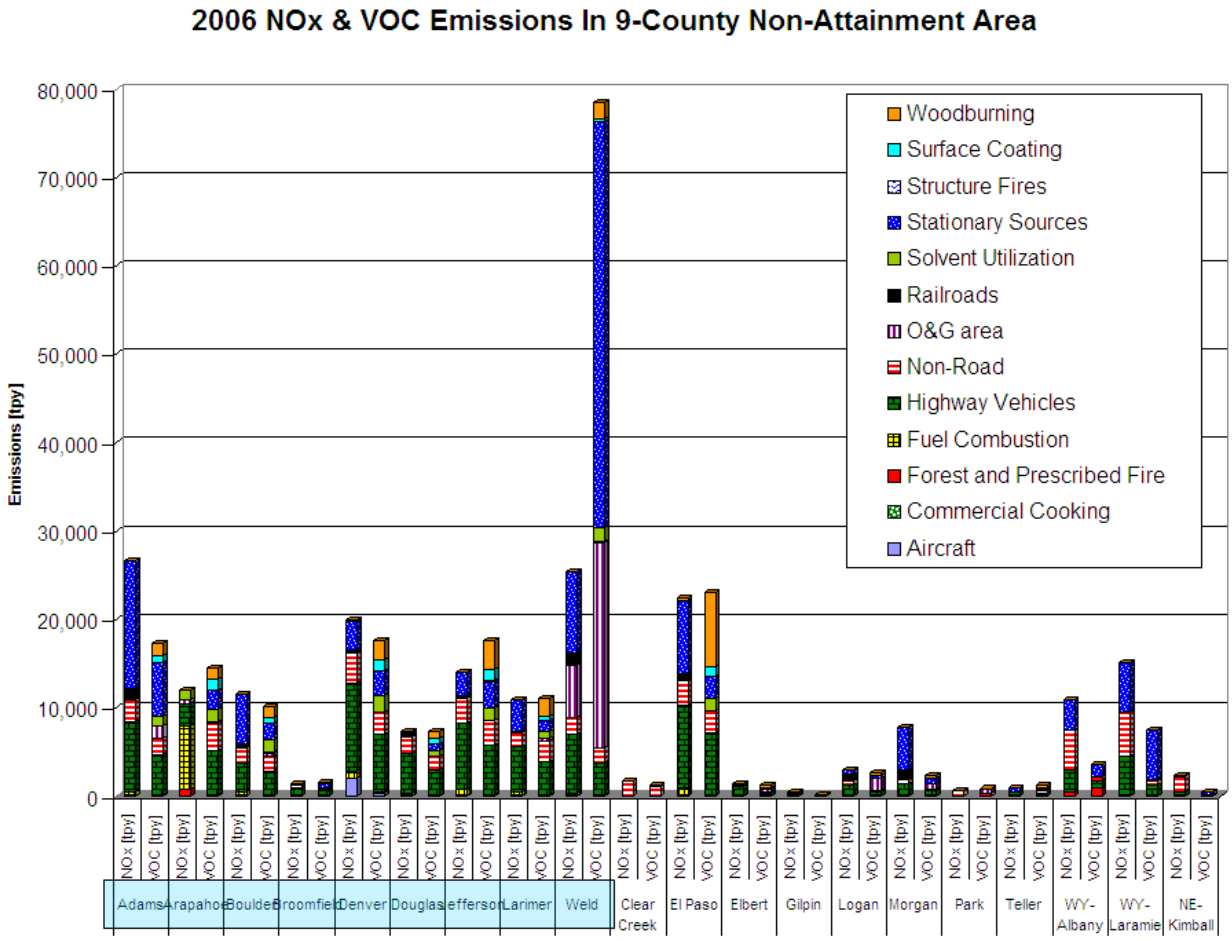
Table 1-3: 2006 Ozone Precursor Emissions Data for Counties nearby the DMA/NFR region

2006 Emissions Data																				
Category	Clear Creek		El Paso		Elbert		Gilpin		Logan		Morgan		Park		Teller		WY-Laramie		NE-Kimball	
	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]	NOx [tpy]	VOC [tpy]
Aircraft	0		144	56	0	0	0		0	0	0	0			0	0				
Commercial Cooking	0	0	0	24	0	0	0	0	0	1	0	1	0	0	0	1				
Forest and Prescribed Fire	0	1	12	24	0	0	0	0	20	22	0	0		1	5	13	4	8	0	0
Fuel Combustion	0		754	44	30	2	0		30	2	36	2			30	2				
Highway Vehicles	15	1	9,312	7,028	1,069	342	7	0	1,218	447	1,366	537	22	1	368	318	4,542	1,163	524	0
Non-Road	1,649	1,025	2,843	2,453	144	129	126	113	489	206	420	207	526	303	97	347	4,899	493	1,723	139
O&G area	40	108	0	0	18	290	116	55	57	1,318	19	602	107	460	0	0	12	148	0	0
Railroads			816	35	101	4	0	0	594	22	1,074	40	0	0	0	0				
Solvent Utilization	0	0	0	1,409	0	55	208	8	0	57	0	71			0	54				
Other Point Sources		29	8,201	2,486	67	104		18	543	276	4,873	491		42	361	85	5,627	5,614	108	363
Structure Fires	56	66	1	6	0	0		8	0	0	0	0		24	0	0				
Surface Coating	0	0	0	995	0	31	0	0	0	16	0	20	0	0	0	42				
Woodburning		14	294	8,439	12	334		3	4	218	6	298		18	17	426	1	4	0	0
TOTAL	1,760	1,245	22,378	22,999	1,439	1,291	457	206	2,956	2,586	7,794	2,270	656	848	879	1,287	15,084	7,430	2,355	502

Counties surrounding 9-County NAA; WY & NE emissions based on interpolation of WRAP data for similar categories

A summary of the above tabular data is provided in the following graph: The county names highlighted in blue are the 9-counties in the existing nonattainment area.

Figure 1-6: 2006 Emissions In and Nearby the 9-County Nonattainment Area



Emissions Data Conclusions:

Precursor emissions outside of the current 8-hour ozone nonattainment area are substantially less than the emissions within the current NAA boundary. With the exception of El Paso County,

precursor emissions in nearby counties are either very small by comparison or at substantial distances from high concentration monitors. For El Paso County, the State determines that this region is in a separate airshed and emissions do not significantly contribute to ozone concentrations in the recommended NAA. Also, ozone monitoring in El Paso County indicates attainment of the revised 8-hour ozone standard. Therefore, the emissions information supports the recommended nonattainment designation for the current 8-hour ozone nonattainment area. If future emissions growth indicates that additional counties or regions should be included in the nonattainment area, the existing nonattainment boundary will be revaluated and expanded as necessary.

Factor # 3: Population Density and Degree of Urbanization

EPA suggests that since ground-level ozone and ozone precursor emissions are pervasive and readily transported, it is important to examine ozone-contributing emissions across a relatively broad geographic area. Accordingly, EPA recommends that the Core Based Statistical Area (CBSA) or Combined Statistical Area (CSA) associated with a violating monitor(s) should serve as the starting point or "presumptive" boundary for evaluating the geographic boundaries of any probable ozone non-attainment areas.

In Figure 1-7, the latest Colorado CBSA map (2007) indicates the presumptive 8-hour nonattainment area (highlighted in red) that includes the two CBSAs with violating ozone monitors, the Denver-Aurora-Boulder CSA, including the Greeley/Weld County area, (highlighted in blue) and the Fort Collins-Loveland Metropolitan Statistical Area comprising Larimer County. Although, EPA recommends that any CBSA with a violating monitor should serve as the starting point or "presumptive" nonattainment area boundary, there are several considerations in the nine factor analysis that contribute to determining an appropriate nonattainment area boundary.

Based on the subsequent analysis of the nine factors, the Division has determined that the inclusion of Park County in the presumptive ozone non-attainment area is not appropriate since precursor emissions are very low (~1,900 tpy NOx & VOC combined), the population (~17,000) is very sparse and the extent of ozone transport into the area is unknown. In addition, there has been no ozone monitoring within Park County as it is not expected to have high ozone concentrations. Consequently, Park County is not proposed for inclusion in the recommended 8-hour ozone nonattainment area.

Based on the subsequent analysis of the nine factors, the Division has determined that the inclusion of Gilpin and Clear Creek Counties in the presumptive ozone non-attainment area is not appropriate since precursor emissions are low (~4,000 tpy NOx & VOC combined), the population (~14,600) is sparse and the extent of ozone transport into the area is unknown. In addition, passive ozone monitoring that was performed in 2007 within Clear Creek and Gilpin Counties indicated lower ozone levels than other known high ozone areas. Consequently, Gilpin and Clear Creek Counties are not proposed for inclusion in the recommended 8-hour ozone nonattainment area.

Based on the subsequent analysis of the nine factors, the Division has determined that the inclusion of Elbert County in the presumptive ozone non-attainment area is not appropriate since precursor emissions are low (~2,700 tpy NOx & VOC combined), the population (~23,100) is very sparse and the extent of ozone transport into the area is unknown. In addition, there has been no ozone monitoring within Elbert County as it is not expected to have high ozone concentrations. Consequently, Elbert County is not proposed for inclusion in the recommended 8-hour ozone nonattainment area.

Based on the subsequent analysis of the nine factors, the Division has determined that the inclusion of the northern portions of Larimer and Weld Counties in the presumptive ozone non-attainment area is not appropriate since precursor emissions are low (~7,050 tpy NOx & VOC combined), the population (~16,800) is very sparse and the extent of ozone transport into the area is unknown. There has been no ozone monitoring in the northern areas of Larimer and Weld Counties. However, an EPA CASTNET ozone monitor located in southern Wyoming indicates attainment of the revised ozone standard. Consequently, the northern portions of Larimer and Weld Counties are not proposed for inclusion in the recommended 8-hour ozone nonattainment area.

Figure 1-7: 2007 Core Based Statistical Areas and Counties in Colorado

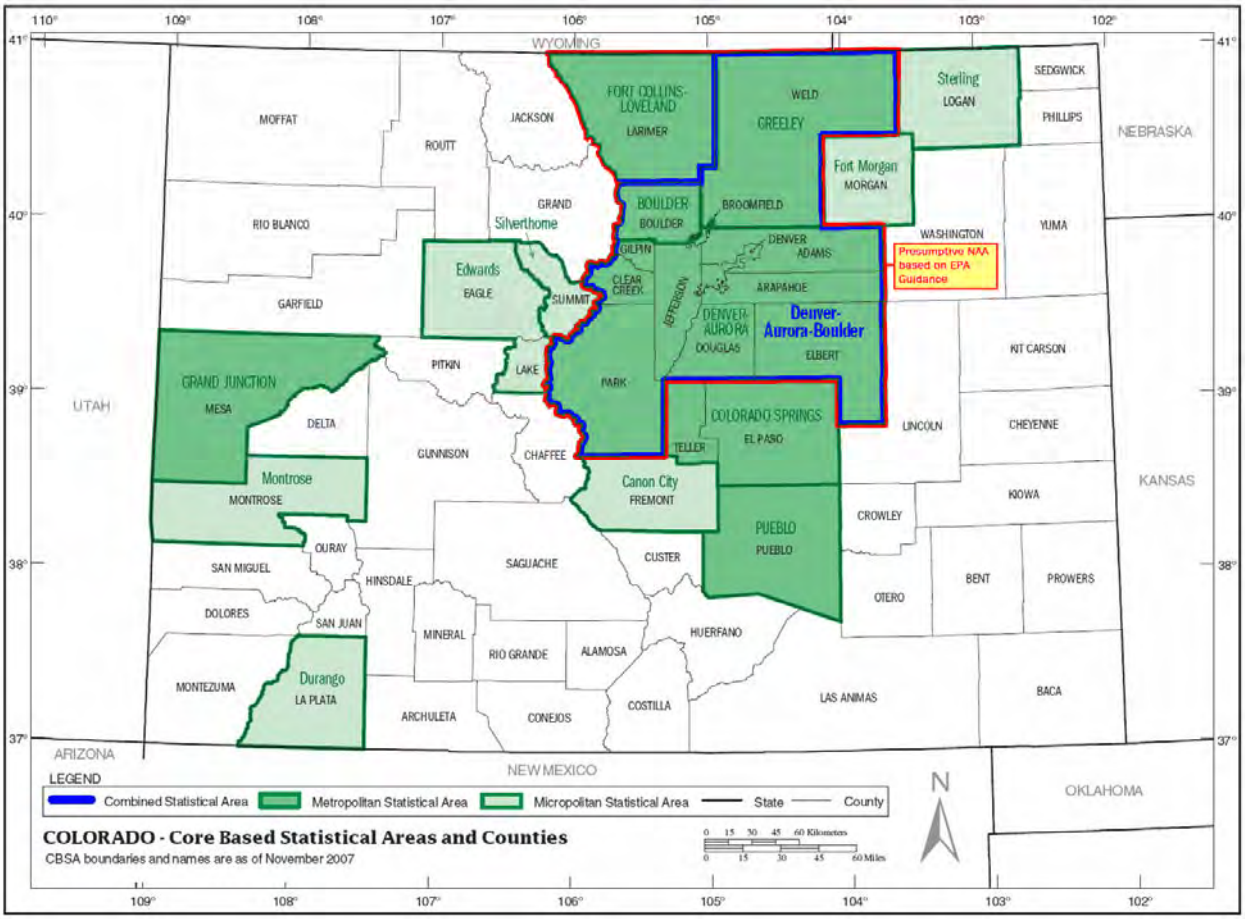


Table 1-4: 2007 Colorado Metropolitan/Micropolitan Statistical Areas

Colorado Metropolitan/Micropolitan Statistical Areas (= Core-Based Statistical Areas)			
Code	**Metropolitan/Micropolitan Statistical Areas**	**Principal Cities**	**Counties**
14500	Boulder, CO Metropolitan Statistical Area	Boulder	*Boulder*
15860	Canon City, CO Micropolitan Statistical Area	Canon City	*Fremont*
17820	Colorado Springs, CO Metropolitan Statistical Area	Colorado Springs	*El Paso*, Teller
19740	Denver-Aurora, CO Metropolitan Statistical Area	Denver, Aurora	*Adams*, *Arapahoe*, *Broomfield*, Clear Creek, *Denver*, *Douglas*, Elbert, Gilpin, *Jefferson*, Park
20420	Durango, CO Micropolitan Statistical Area	Durango	*La Plata*
20780	Edwards, CO Micropolitan Statistical Area	Edwards	*Eagle*, Lake
22660	Fort Collins-Loveland, CO Metropolitan Statistical Area	Fort Collins, Loveland	*Larimer*
22820	Fort Morgan, CO Micropolitan Statistical Area	Fort Morgan	*Morgan*
24300	Grand Junction, CO Metropolitan Statistical Area	Grand Junction	*Mesa*
24540	Greeley, CO Metropolitan Statistical Area	Greeley	*Weld*
33940	Montrose, CO Micropolitan Statistical Area	Montrose	*Montrose*
39380	Pueblo, CO Metropolitan Statistical Area	Pueblo	*Pueblo*
43540	Silverthorne, CO Micropolitan Statistical Area	Silverthorne	*Summit*
44540	Sterling, CO Micropolitan Statistical Area	Sterling	*Logan*
216	Denver-Aurora-Boulder, CO Combined Statistical Area includes the following: Boulder, CO Metropolitan Statistical Area Denver-Aurora, CO Metropolitan Statistical Area Greeley, CO Metropolitan Statistical Area		

(*italics* = central counties)

In Figure 1-8 below, the population density and the degree of urbanization for NE Colorado, SE Wyoming and SW Nebraska is depicted based on the 2000 US Census. The non-attainment area is highlighted in black and some peripheral counties are labeled that were also evaluated in the above emissions data section.

The northern portions of Larimer and Weld Counties generally have population densities that are under 5-persons per square mile.

Figure 1-8: Population Density & Degree of Urbanization of NE Colorado Region

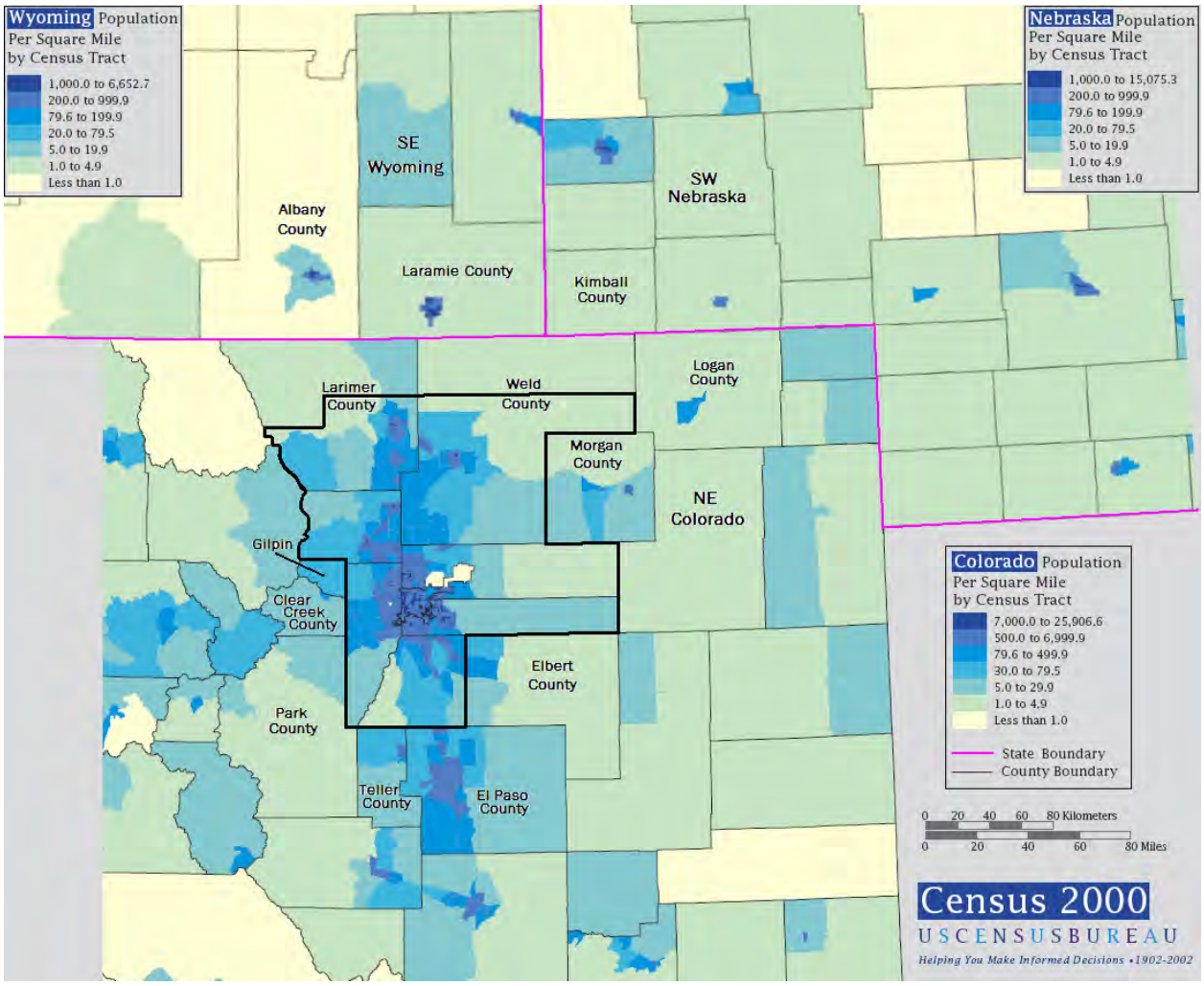


Figure 1-9: 2006 Regional Population Density for Denver Metro Area

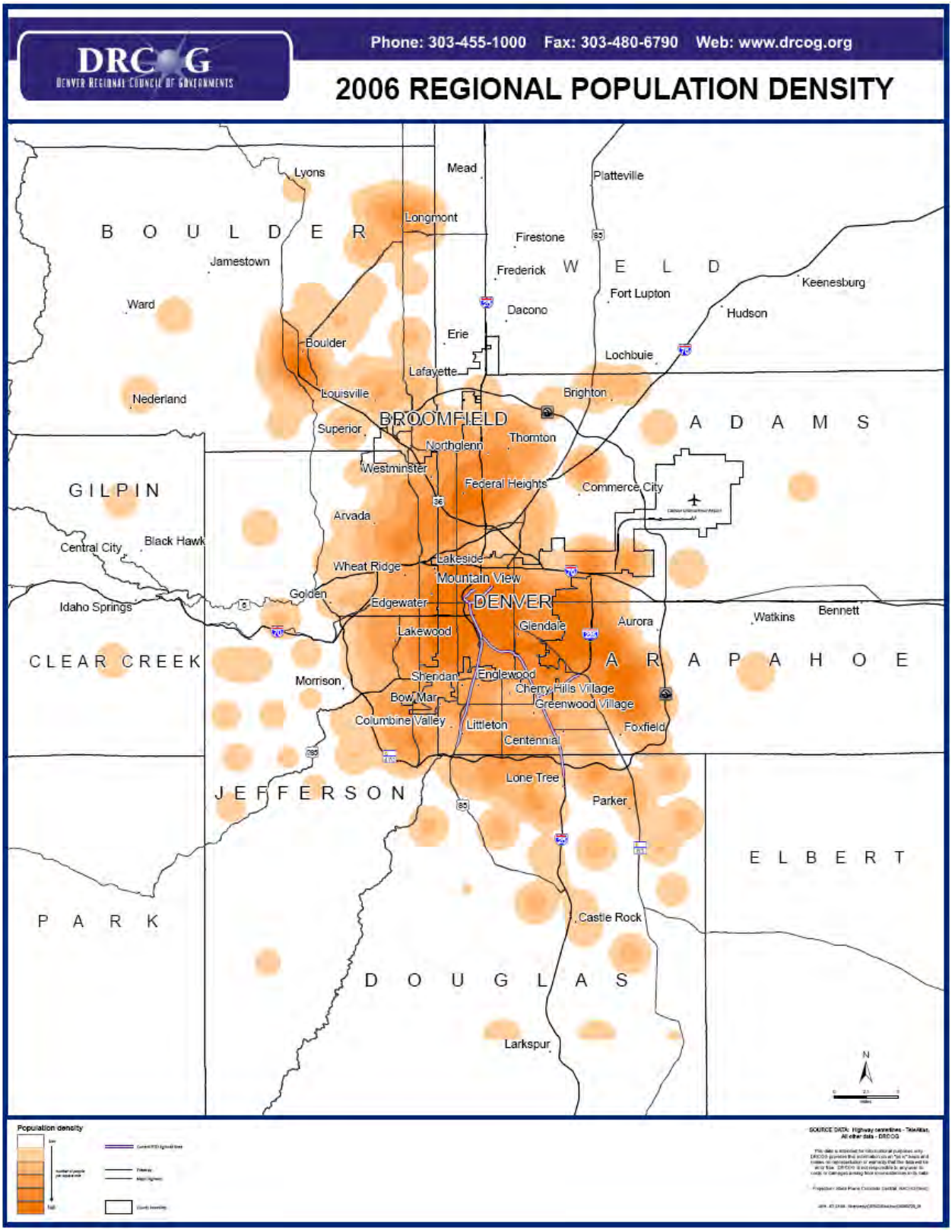
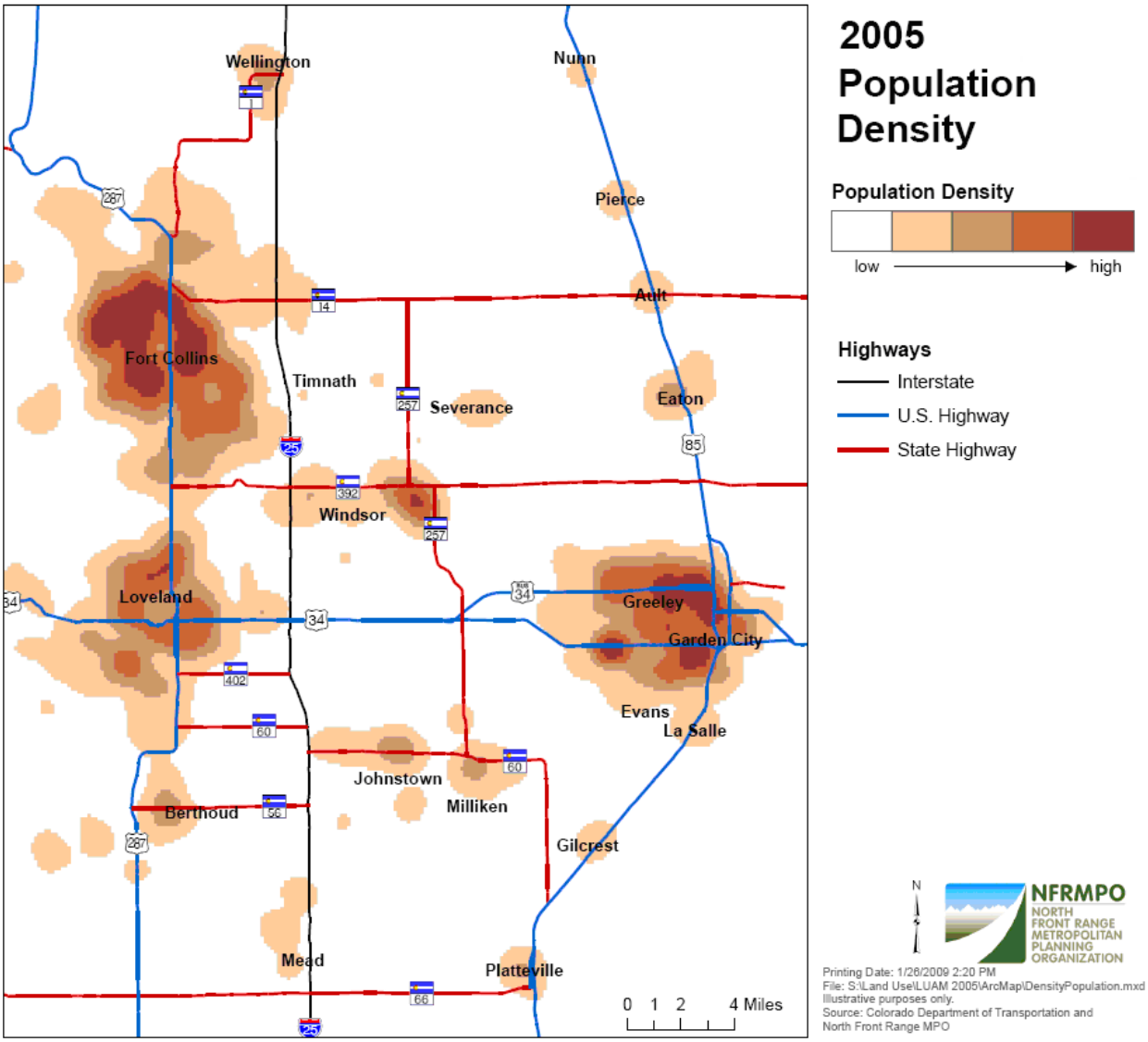


Figure 1-10: 2005 Regional Population Density for North Front Range Area

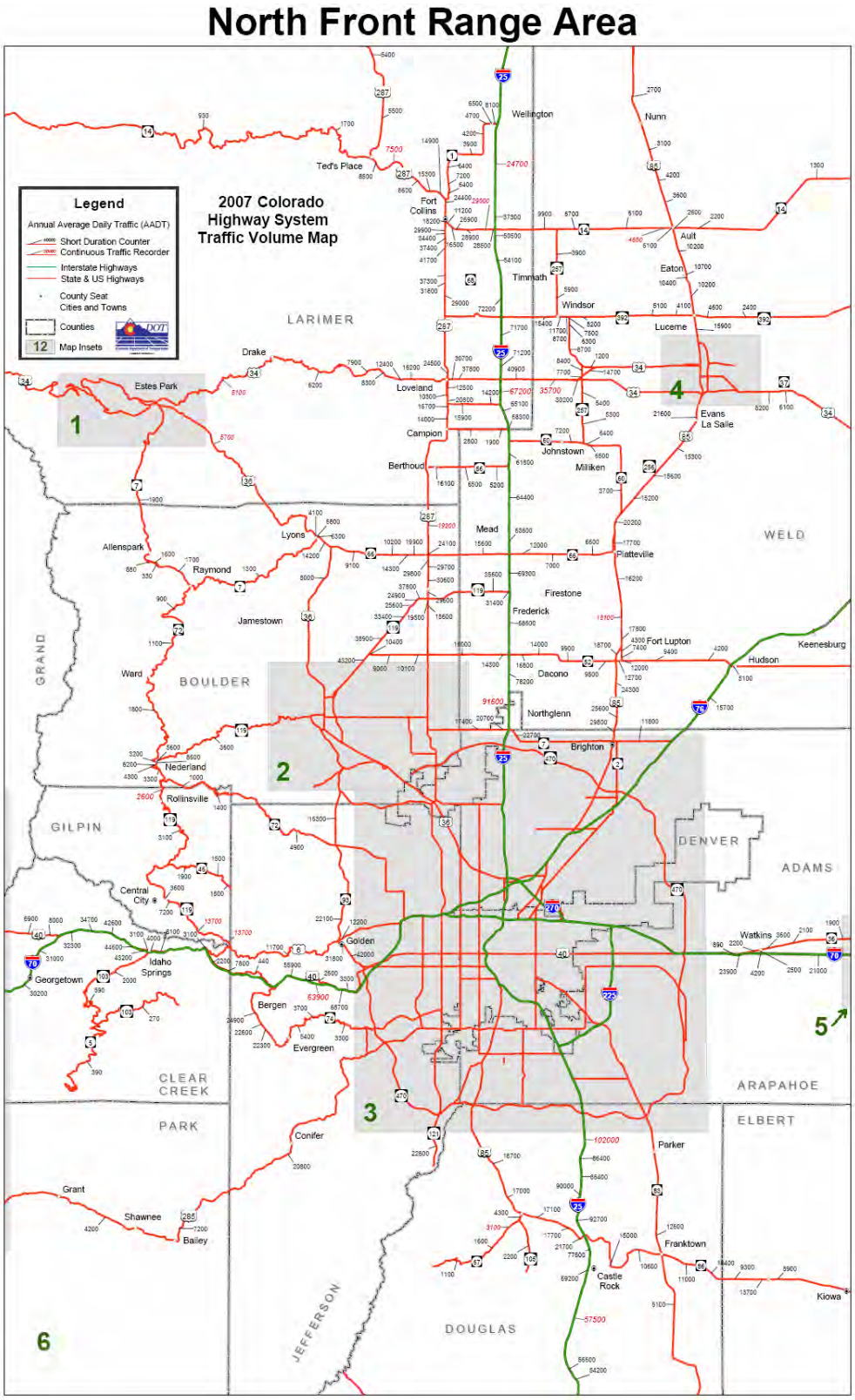


Population Density and Degree of Urbanization Conclusions:

The region's population density/degree of urbanization information illustrates that the urbanization (and the associated activities that can result in emissions of ozone precursors) is concentrated within the current 8-hour ozone NAA boundaries. Urbanization rapidly diminishes beyond the central portion of the current NAA. Because population in the surrounding counties is low by comparison, and the human landscape is rural with small pockets of development, the population/urbanization information supports the recommended nonattainment designation for the current 8-hour ozone nonattainment area. If future urbanization indicates that additional counties or regions should be included in the nonattainment area, the existing nonattainment boundary will be revaluated and expanded as necessary.

Factor #4: Traffic and Commuting Patterns

Figure 1-11: CDOT Traffic Volume in North Front Range Area



The above shaded areas in Figure 1-11 with numbers (1-5) are expanded below to provide more detail on localized annual average daily traffic volumes.

Figure 1-12: CDOT Traffic Volume in Estes Park Area

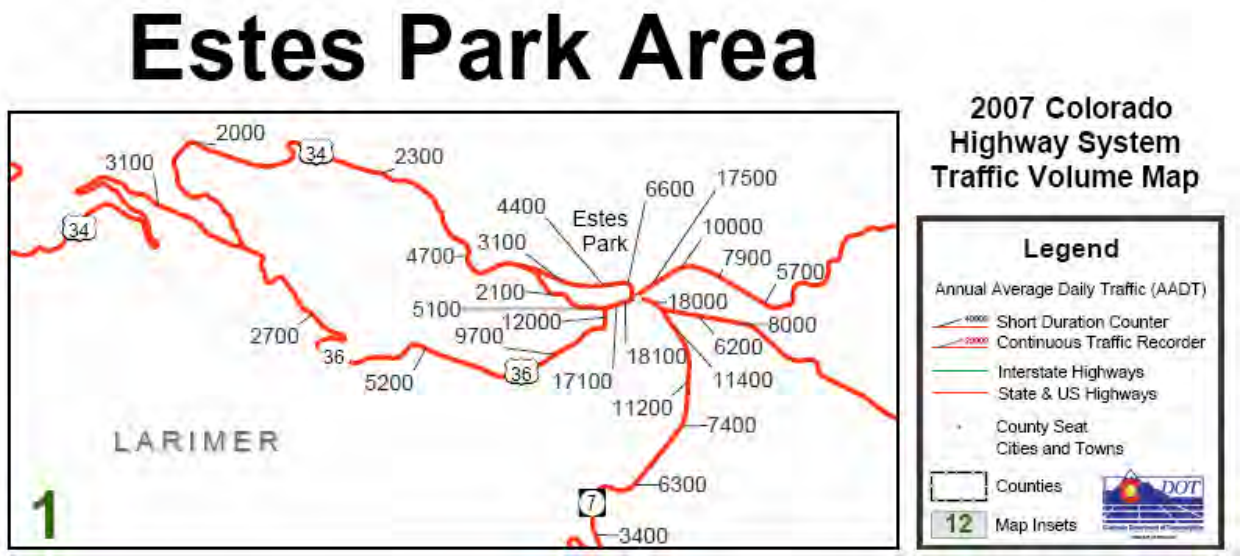


Figure 1-13: CDOT Traffic Volume in Boulder Area

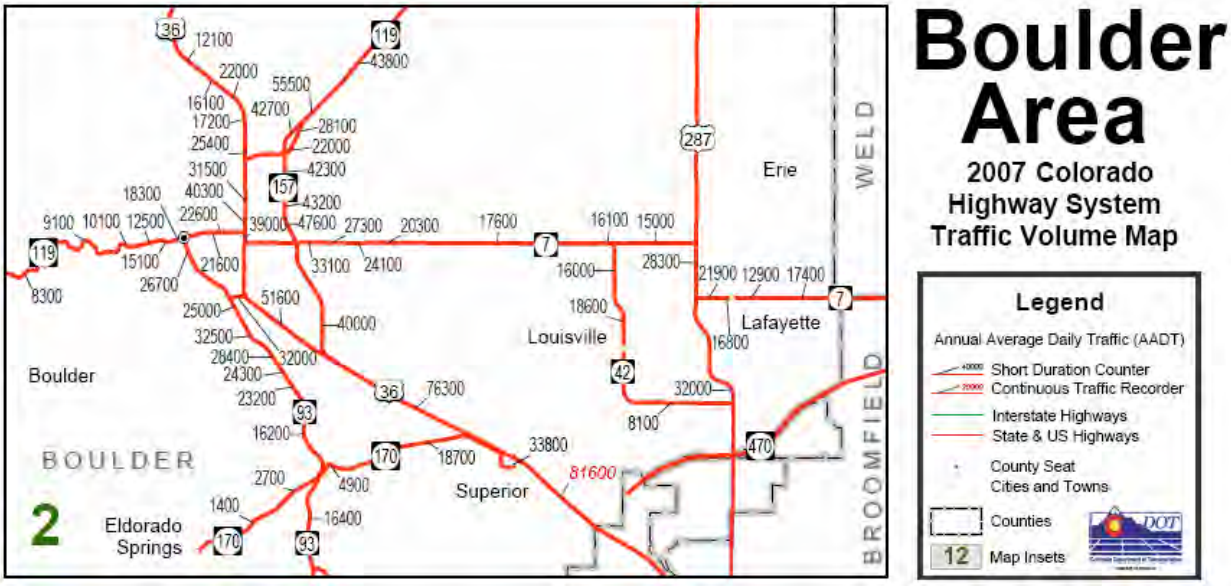


Figure 1-14: CDOT Traffic Volume in Denver Metro Area

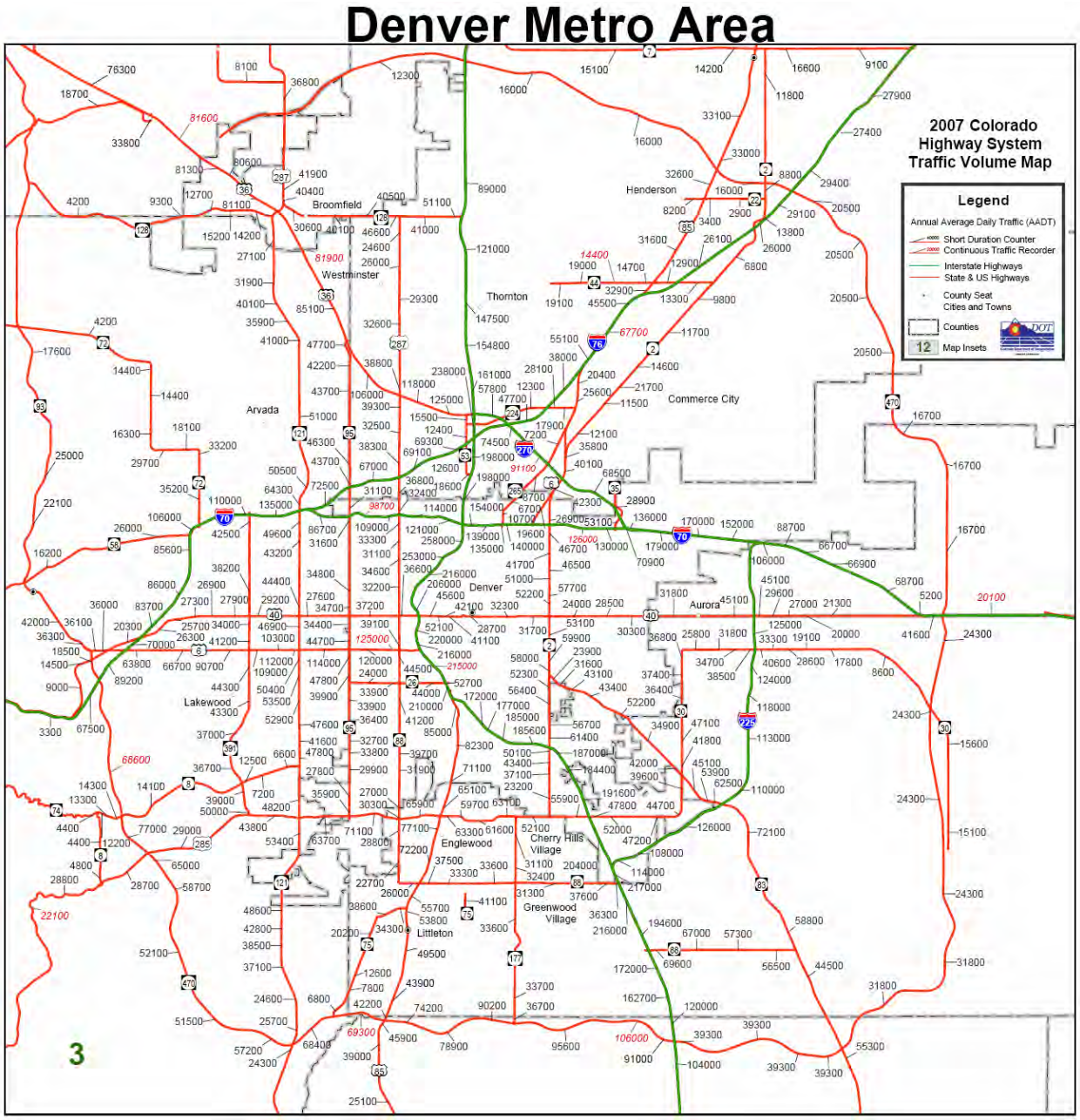


Figure 1-15: CDOT Traffic Volume in Greeley Area

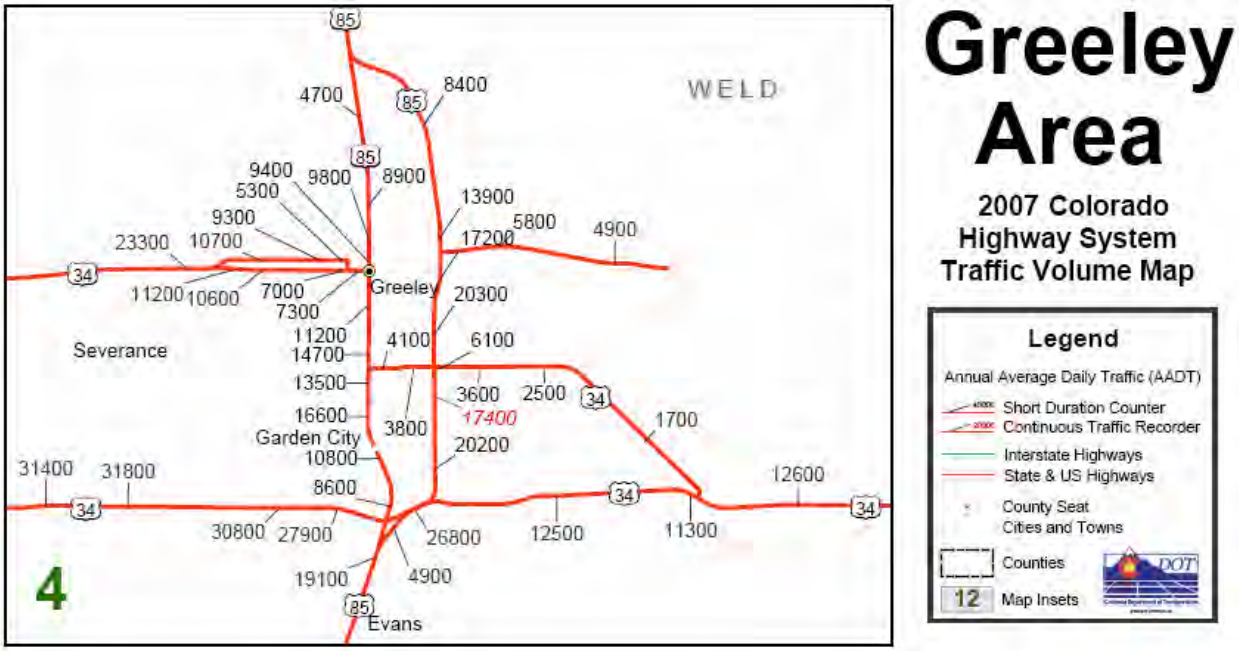


Figure 1-16: CDOT Traffic Volume in Bennett Area

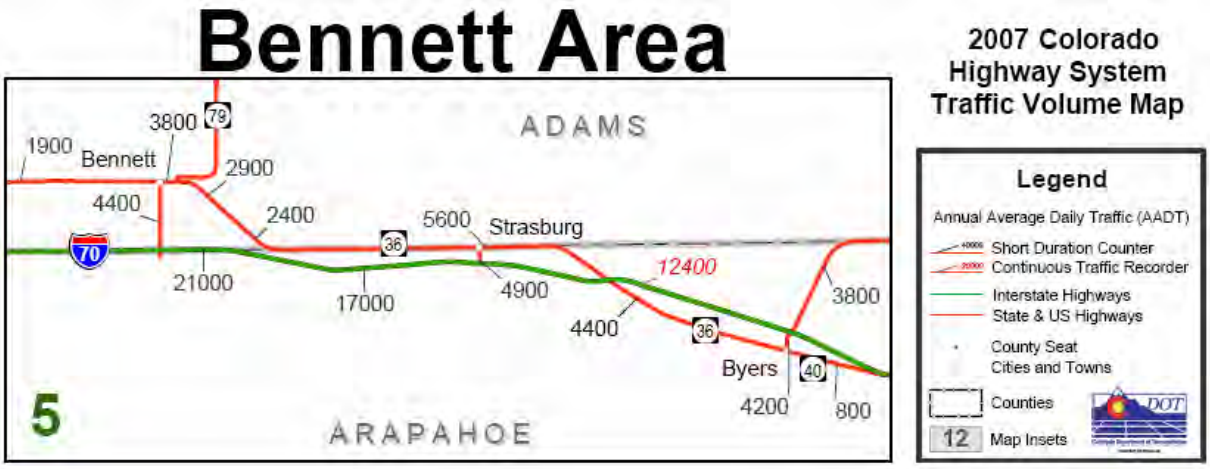


Figure 1-17: Number of Workers Commuting between Denver Region and Neighboring Counties

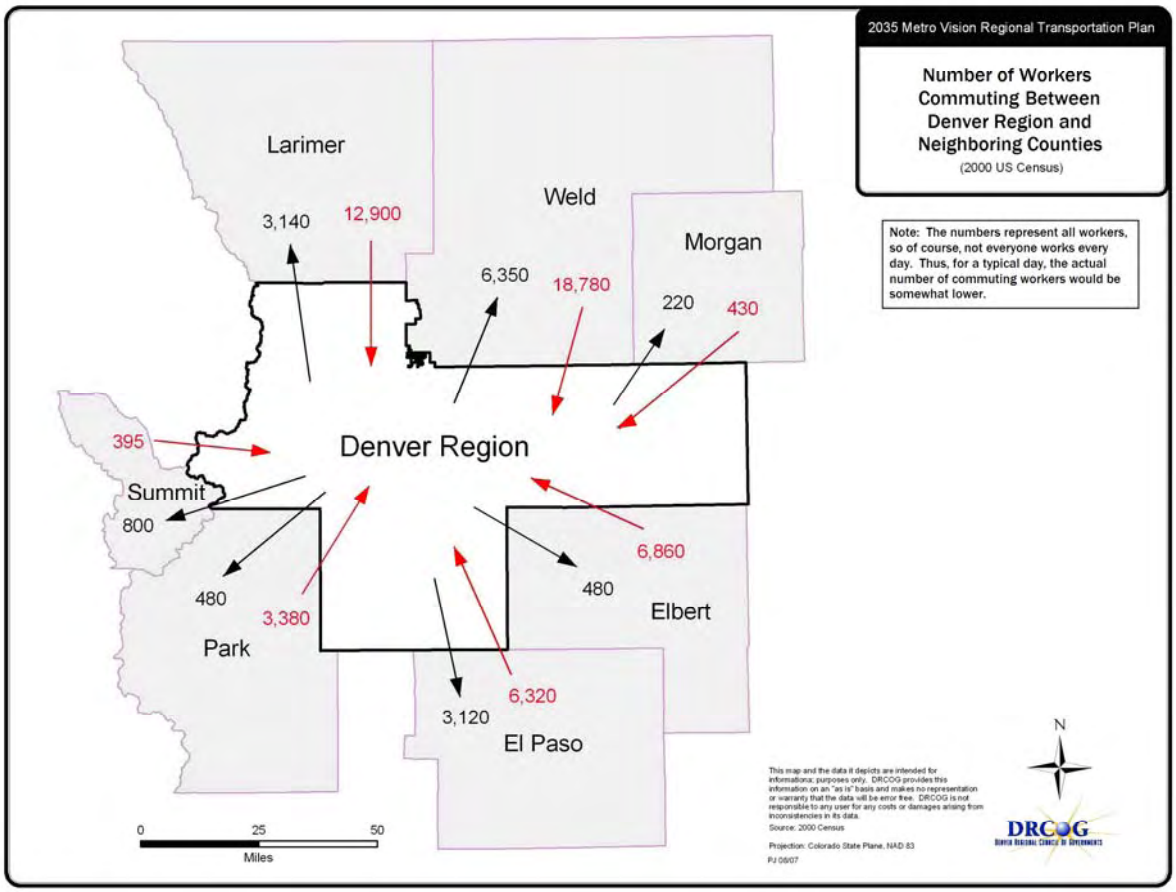


Figure 1-17 indicates the work trips between the Denver Region and surrounding counties. The numbers represent all workers commuting between the Denver Region and nearby counties. Since not everyone works everyday, the actual number of workers commuting on any given day would be somewhat lower.

Traffic and Commuting Patterns Conclusion:

The region's traffic and commuting patterns illustrate that vast majority of vehicle trips occur within the current 8-hour ozone NAA boundary. Average daily traffic rapidly diminishes beyond the core area of the current NAA. Commuting information also indicates that work trips into the region are minimal when compared to traffic volumes that exist in the recommended NAA. Because vehicular traffic in the surrounding counties is low by comparison, and the human landscape is rural with small pockets of development, the traffic and commuting information supports the recommended nonattainment designation for the current 8-hour ozone nonattainment area. If future traffic and commuting information indicates that additional counties or regions should be included in the nonattainment area, the existing nonattainment boundary will be revaluated and expanded as necessary.

Factor #5: Growth Rates and Patterns

In Figure 1-18, the population data for Larimer and Weld Counties includes the whole county and does not apportion persons residing in the non-attainment area portion of these counties. The 2007 population for the northern portion of Larimer County (NAA excluded) is estimated at 13,836 persons (~5% of County total). The 2007 population for the northern portion of Weld County (NAA excluded) is estimated at 2,934 persons (~1% of County total).

Figure 1-18: Recent Population Estimates for Denver Metro Area, North Front Range and Neighboring Counties

County	July 2000 (State Estimate)	July 2007 (State Estimate)	2000 to 2007 Total % Change (State Estimate)	2000 to 2007 Annual % Change (State Estimate)
Adams	350,642	424,379	17.4%	2.5%
Arapahoe	491,134	551,732	11.0%	1.6%
Boulder	275,071	294,654	6.6%	0.9%
Broomfield	39,466	53,691	26.5%	3.8%
Clear Creek	9,386	9,408	0.2%	0.0%
Denver	555,781	596,585	6.8%	1.0%
Douglas	180,689	275,120	34.3%	4.9%
Elbert	20,189	23,093	12.6%	1.8%
El Paso	520,571	587,590	11.4%	1.6%
Gilpin	4,776	5,144	7.2%	1.0%
Grand	12,885	14,391	10.5%	1.5%
Jackson	1,578	1,475	-7.0%	-1.0%
Jefferson	526,269	538,323	2.2%	0.3%
Larimer	253,131	288,245	12.2%	1.7%
Lincoln	6,167	5,718	-7.9%	-1.1%
Logan	20,869	21,883	4.6%	0.7%
Morgan	27,262	28,577	4.6%	0.7%
Park	14,698	17,006	13.6%	1.9%
Summit	25,727	28,615	10.1%	1.4%
Teller	21,147	22,877	7.6%	1.1%
Washington	4,923	4,842	-1.7%	-0.2%
Weld	183,560	244,513	24.9%	3.6%
Totals for NAA:	2,855,743	3,267,242	12.6%	1.8%
Totals for Nearby Counties:	690,178	770,619	10.4%	1.5%
Note: NAA Totals include the total populations for Weld and Larimer Counties				
	Counties in the Current 8-hour Ozone Nonattainment Area			

Figure 1-19: Population Projections for Denver Metro Area, North Front Range and Neighboring Counties

	Projection Date							
County	July 2000 (State Estimate)	July 2005 (State Estimate)	July 2010 (State Estimate)	July 2015 (State Estimate)	July 2020 (State Estimate)	July 2025 (State Estimate)	July 2030 (State Estimate)	July 2035 (State Estimate)
Adams	350,642	401,332	455,134	508,975	562,424	615,676	664,415	709,778
Arapahoe	491,134	533,091	583,854	634,590	685,559	736,920	782,745	825,502
Boulder	275,071	288,105	303,277	320,962	340,355	359,032	374,511	386,151
Broomfield	39,466	48,559	58,196	64,499	70,631	76,707	82,027	86,592
Clear Creek	9,386	9,467	9,769	10,898	12,098	13,268	14,414	15,487
Denver	555,781	576,933	621,430	647,681	671,579	690,917	710,912	734,000
Douglas	180,689	249,096	304,234	358,819	417,330	464,301	501,226	532,529
Elbert	20,189	22,699	23,606	29,233	39,603	49,144	57,420	64,607
El Paso	520,571	568,436	622,858	697,011	754,745	811,436	868,281	938,219
Gilpin	4,776	4,997	5,332	5,879	6,470	7,074	7,666	8,233
Grand	12,885	13,902	15,336	17,539	20,322	23,014	25,533	27,896
Jackson	1,578	1,528	1,472	1,532	1,629	1,702	1,753	1,803
Jefferson	526,269	532,417	551,617	572,770	603,182	637,274	664,586	684,166
Larimer	253,131	276,757	306,176	338,548	373,471	410,990	446,962	480,691
Lincoln	6,167	5,876	5,712	6,033	6,405	6,795	7,194	7,549
Logan	20,869	21,558	22,923	25,668	28,446	31,126	33,239	35,096
Morgan	27,262	28,442	28,990	31,499	35,390	39,605	43,916	48,187
Park	14,698	16,525	18,748	23,462	29,553	35,954	40,596	43,345
Summit	25,727	27,575	30,937	35,539	40,620	45,837	50,749	55,227
Teller	21,147	22,260	24,096	27,154	30,197	32,976	35,497	37,775
Washington	4,923	4,921	4,758	4,824	4,879	4,928	4,958	4,955
Weld	183,560	227,809	267,938	311,230	363,048	423,164	488,353	555,661
Totals for NAA:	2,855,743	3,134,099	3,451,856	3,758,074	4,087,579	4,414,980	4,715,736	4,995,070
Totals for Nearby Counties:	690,178	748,186	814,537	916,271	1,010,357	1,102,859	1,191,216	1,288,379
Note: NAA Totals include the total populations for Weld and Larimer Counties								
	Counties in the Current 8-hour Ozone Nonattainment Area							

Figure 1-20: Population Percent Change Projections for Denver Metro Area, North Front Range and Neighboring Counties

	Average Annual Percent Change						
County	2000 to 2005 (State Estimate)	2005 to 2010 (State Estimate)	2010 to 2015 (State Estimate)	2015 to 2020 (State Estimate)	2020 to 2025 (State Estimate)	2025 to 2030 (State Estimate)	2030 to 2035 (State Estimate)
Adams	2.7%	2.5%	2.3%	2.0%	1.8%	1.5%	1.3%
Arapahoe	1.7%	1.8%	1.7%	1.6%	1.5%	1.2%	1.1%
Boulder	0.9%	1.0%	1.1%	1.2%	1.1%	0.8%	0.6%
Broomfield	4.2%	3.7%	2.1%	1.8%	1.7%	1.4%	1.1%
Clear Creek	0.2%	0.6%	2.2%	2.1%	1.9%	1.7%	1.4%
Denver	0.7%	1.5%	0.8%	0.7%	0.6%	0.6%	0.6%
Douglas	6.6%	4.1%	3.4%	3.1%	2.2%	1.5%	1.2%
Elbert	2.4%	0.8%	4.4%	6.3%	4.4%	3.2%	2.4%
El Paso	1.8%	1.8%	2.3%	1.6%	1.5%	1.4%	1.6%
Gilpin	0.9%	1.3%	2.0%	1.9%	1.8%	1.6%	1.4%
Grand	1.5%	2.0%	2.7%	3.0%	2.5%	2.1%	1.8%
Jackson	-0.6%	-0.7%	0.8%	1.2%	0.9%	0.6%	0.6%
Jefferson	0.2%	0.7%	0.8%	1.0%	1.1%	0.8%	0.6%
Larimer	1.8%	2.0%	2.0%	2.0%	1.9%	1.7%	1.5%
Lincoln	-1.0%	-0.6%	1.1%	1.2%	1.2%	1.1%	1.0%
Logan	0.7%	1.2%	2.3%	2.1%	1.8%	1.3%	1.1%
Morgan	0.9%	0.4%	1.7%	2.4%	2.3%	2.1%	1.9%
Park	2.4%	2.6%	4.6%	4.7%	4.0%	2.5%	1.3%
Summit	1.4%	2.3%	2.8%	2.7%	2.4%	2.1%	1.7%
Teller	1.0%	1.6%	2.4%	2.1%	1.8%	1.5%	1.3%
Washington	0.0%	-0.7%	0.3%	0.2%	0.2%	0.1%	0.0%
Weld	4.4%	3.3%	3.0%	3.1%	3.1%	2.9%	2.6%
	Counties in the Current 8-hour Ozone Nonattainment Area						

Growth Rates and Patterns Conclusions:

The region's growth rates and patterns illustrate that vast majority of increased population and urbanization will occur within the current 8-hour ozone NAA boundary. Population density and developed areas are projected to rapidly diminish beyond the core area of the current NAA. Because projected population and activity in the surrounding counties is low by comparison, and

the human landscape is projected to be rural with small pockets of development, the growth information supports the recommended nonattainment designation for the current 8-hour ozone nonattainment area. If future growth information indicates that additional counties or regions should be included in the nonattainment area, the existing nonattainment boundary will be revaluated and expanded as necessary.

Factor #6: Meteorology

Meteorology is the single most important factor affecting mid-summer ozone in the DMA/NFR, and Front Range and Platte Valley meteorology are significantly affected by the terrain. As reported in a number of papers on the mesoscale meteorology of the area[1,2,3,4,5,6,7] the South Platte Valley and surrounding plains, the east-west Cheyenne Ridge along Colorado's border with Wyoming to the north of the South Platte Valley, the east-west Palmer Divide to the south of the Denver metro area, and the Continental Divide to the west of the South Platte Valley create local circulations that tend to magnify and constrain the influence of local emissions on air quality. Although the terrain and these circulations do not prevent transport into or away from the basin, these factors tend to define a natural airshed. This airshed's boundaries provide a geographical focus for air quality control strategies.

In general three key circulations affect summer air quality within this basin or airshed. The first of these is nighttime and early-morning down-valley drainage flow. At night, infrared radiation from the surface disproportionately cools the ground and the air next to it. This chilled air is denser than surrounding air and flows downhill. These downhill flows converge to form drainage winds that move surface air down the canyons and valleys toward a widening of the Platte Valley in Weld County (see Figure 1-21). Here the wider valley and a constriction further downstream cause pooling of cooler air. Both the drainage winds and the cold pooling trap nighttime and early morning emissions. This phase contributes to the accumulation of emissions that are later processed by the sun and the daytime mountain-valley circulation during the afternoon.

The second key circulation is thermally-driven upslope flow which is a component of a mountain-valley circulation. Daytime solar heating of higher terrain and sun-facing slopes creates areas of low pressure over these surfaces that cause a reversal of the nighttime drainage pattern. Winds tend to blow uphill or up-slope (see Figure 1-22). The mountain valley circulation consists of thermally-driven surface upslope flow (toward the southwest, west, and northwest) to mountain top level during the afternoon, mixing and transport vertically, and weak transport to the east at higher altitudes. Vertical mixing over Denver closes this loop, tending to keep ozone in the area. Light winds, a deep layer of thermally-driven upslope flow, local vertical recirculation, cloud-free skies, and warm temperatures are key ingredients for high ozone at the surface.

Figure 1-21: Nighttime drainage flows (red arrows) into the Platte Valley or Basin

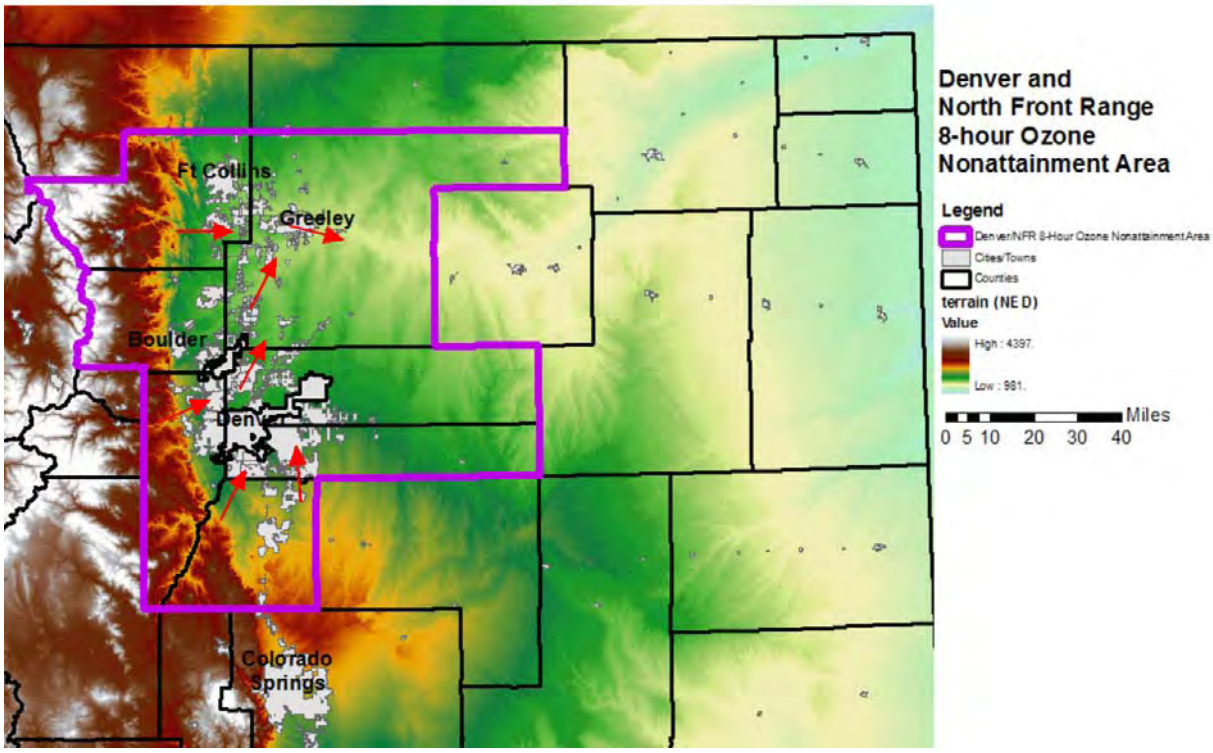
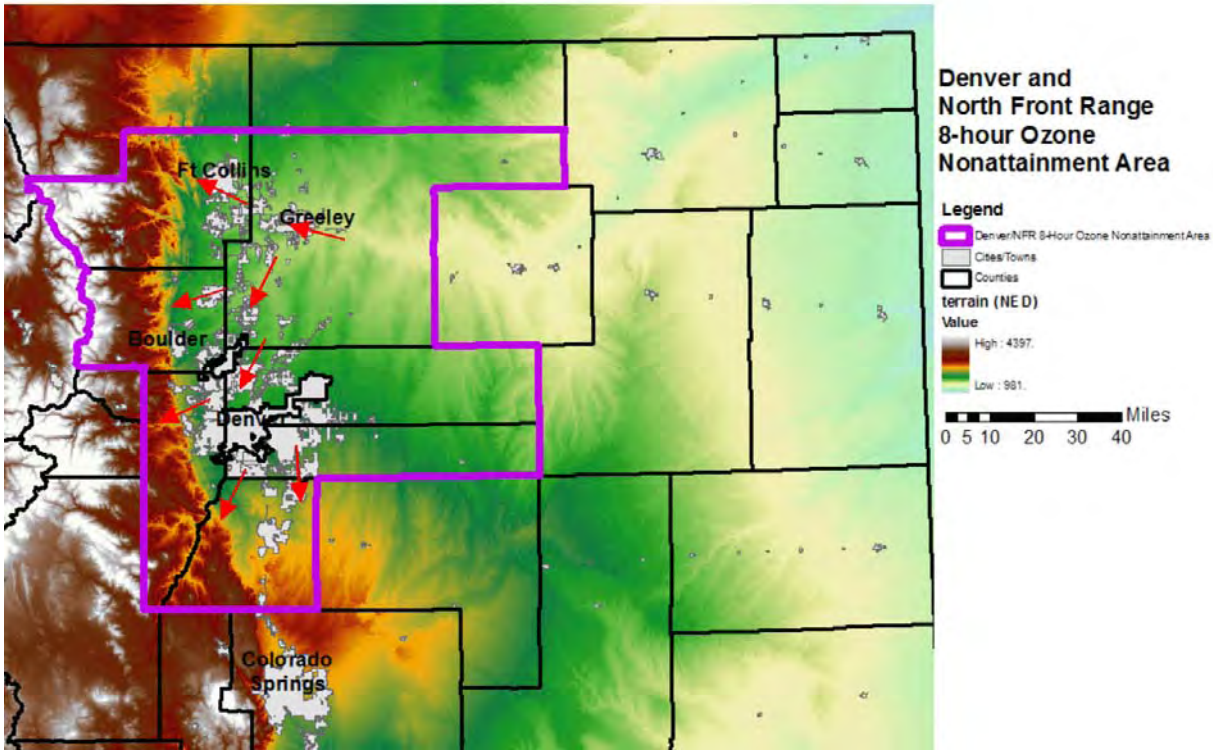
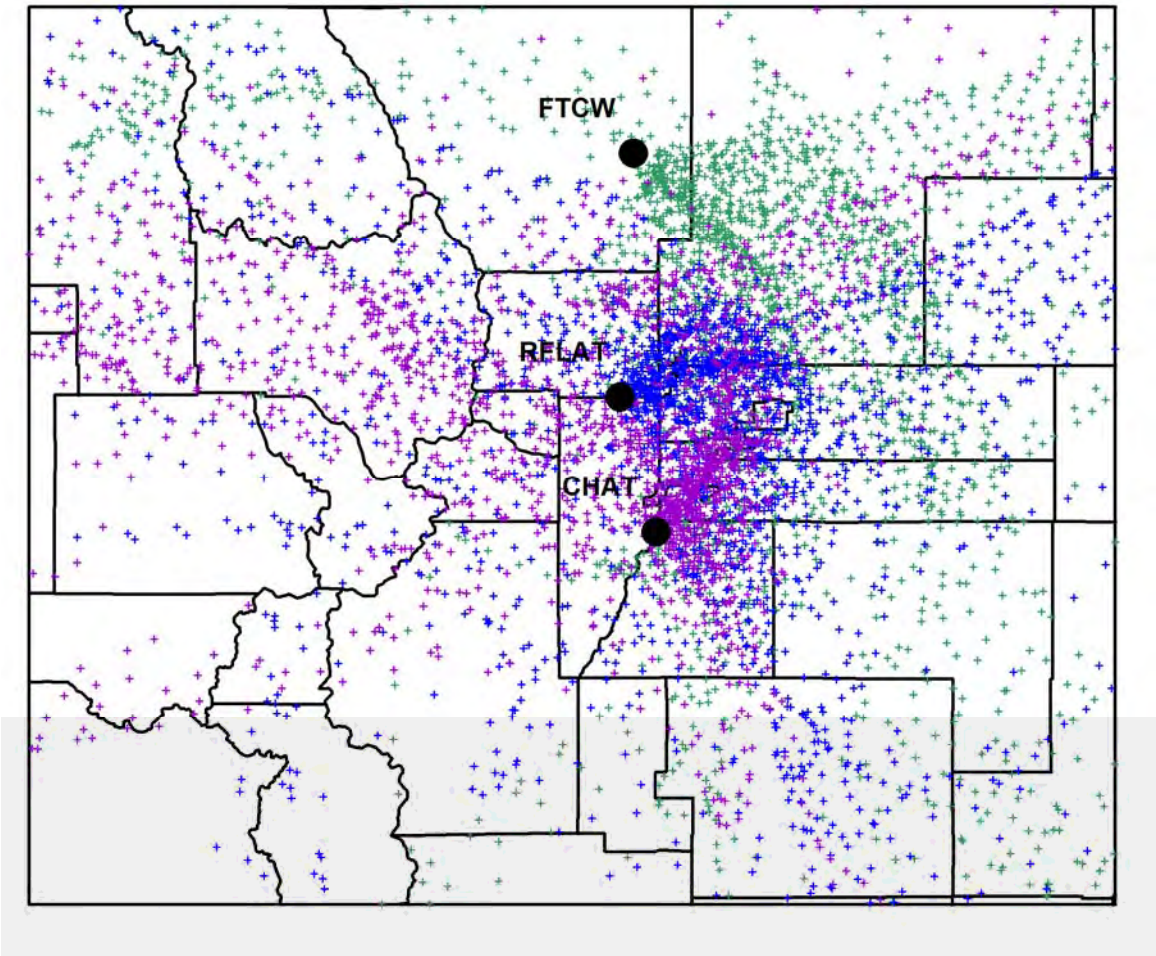


Figure 1-22: Daytime thermally-driven upslope flows (red arrows) toward higher terrain



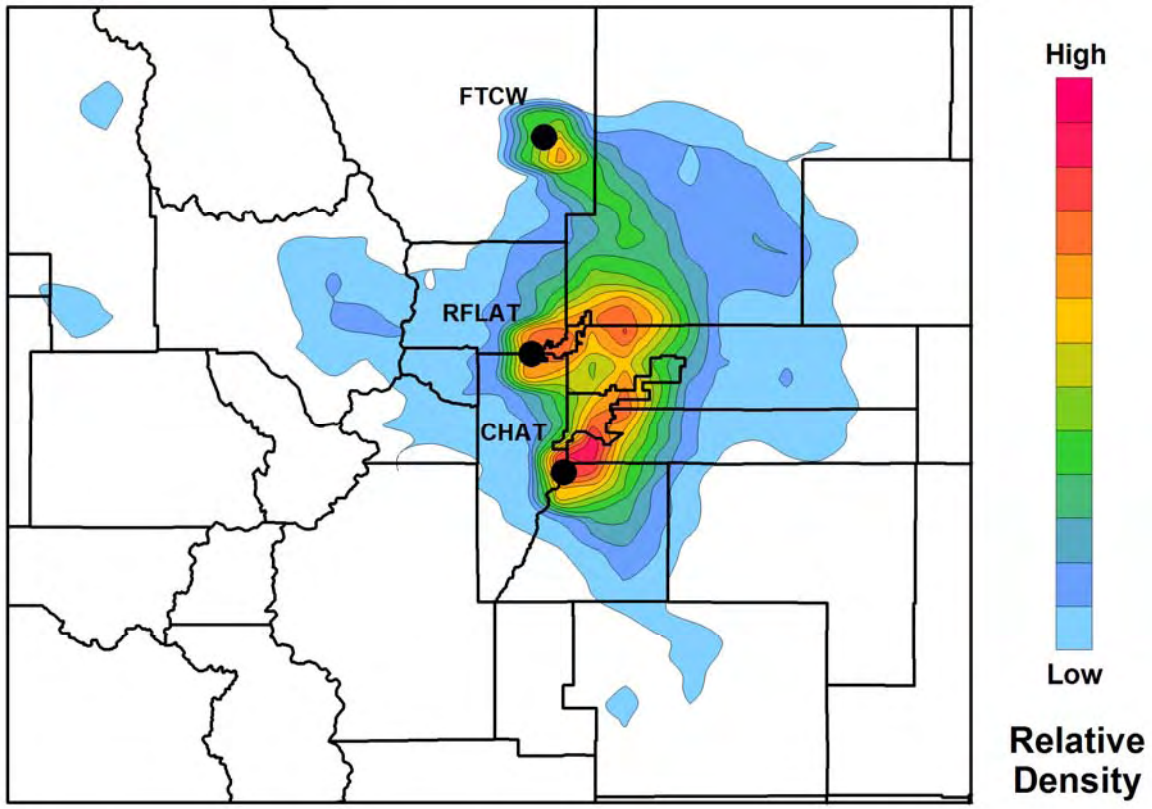
HYSPLIT back-trajectory analyses on the four highest days for each year in 2006 to 2008 for Fort Collins West, Rocky Flats, and Chatfield show that the highest densities of the back-trajectory points for the prior 24-hours are within the airshed, overlap with the highest emissions source areas, and are in the Non-Attainment area (see Figures 1-23 and 1-24). Figure 1-24 shows the relative densities for these back trajectories showing a prevalence of short-travel trajectory points upwind of each site

Figure 1-23: Hourly Back Trajectory Points at FTCW, RFLAT and CHAT Monitoring Sites



The above plot depicts the 24-hour back trajectory points for each hour in each 8-hour period for the 12 highest ozone concentration days at Fort Collins-West (FTCW - green), Rocky Flats (RFLAT - in blue), and Chatfield (CHAT - purple) for the period 2006-2008.

Figure 1-24: Relative Densities of Hourly Back Trajectory Points at FTCW, RFLAT and CHAT Monitors



The above density plot depicts the relative densities of 24-hour back trajectory points for each hour in each 8-hour period for the 12 max O3 Concentration days at Chatfield, Rocky Flats, and Fort Collins West (2006-2008), showing a prevalence of short-range transport from upwind (down-valley) of each site.

Meteorology Conclusions:

The region's meteorological information indicates that the current 8-hour ozone NAA boundary is appropriate for the recommended ozone NAA. The Division has thoroughly evaluated the region's meteorology over the years and has concluded that the airshed for the region is encompassed by the current 8-hour NAA. Upslope flow from the lower elevation regions through the urbanized and industrialized regions of the air shed dominates on high ozone days. If meteorological information indicates that additional counties or regions should be included in the nonattainment area, the existing nonattainment boundary will be revaluated and expanded as necessary.

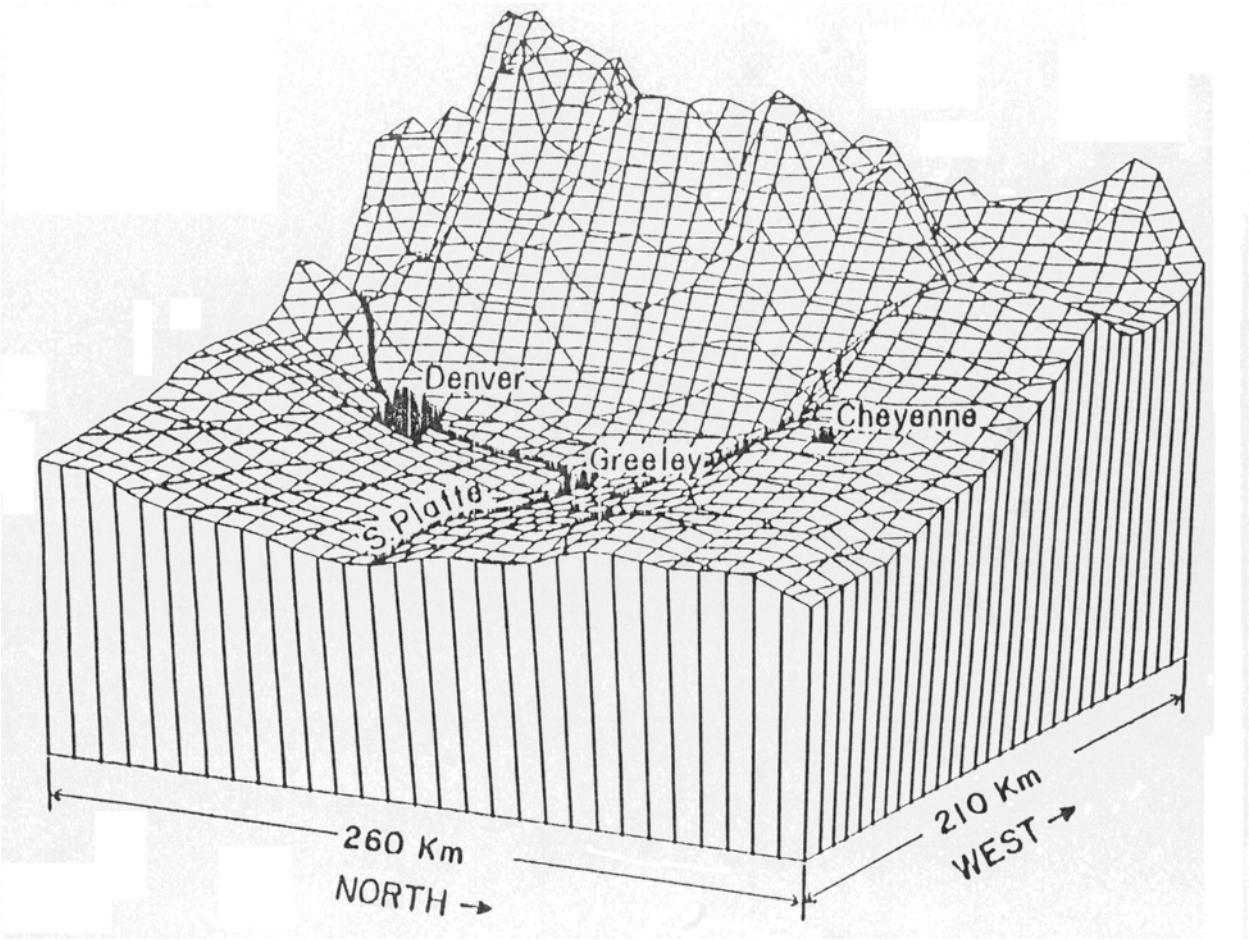
Meteorology References:

1) Szoke, E. J., and J. A. Augustine, 1990. An examination of the mean flow and thermodynamic characteristics of a mesoscale flow feature: the Denver Cyclone, Preprints, Fourth Conference on Mesoscale Processes, Boulder, American Meteorological Society.
2) Szoke, E. J., 1991. Eye of the Denver Cyclone, ***Monthly Weather Review 119***, 1283-1292.
3) Schreibner-Abshire, W. and A. R. Rodi, 1991. Mesoscale convergence zone development in northeastern Colorado under southwest flow, ***Monthly Weather Review 119***.
4) Crook, N. A., T. L. Clark, and M. W. Moncrieff, 1990. The Denver Cyclone. Part I: generation in low froude number flow, ***Journal of the Atmospheric Sciences 47***, No. 23, 2725-2742.
5) Crook, N. A., T. L. Clark, and M. W. Moncrieff, 1991. The Denver Cyclone. Part II: interaction with the convective boundary layer, ***Journal of the Atmospheric Sciences 48***, No. 19, 2109-2126.
6) Reddy, P. J., D.E. Barbarick, and R.D. Osterburg, 1995. Development of a statistical model for forecasting episodes of visibility degradation in the Denver metropolitan area, ***Journal of Applied Meteorology 34***, No. 3, 616-625.
7) Toth, J. J., and R. H. Johnson, 1985. Summer surface flow characteristics over northeast Colorado, ***Monthly Weather Review 113***, No. 9, 1458-1469

Factor #7: Geography/Topography

With the Rocky Mountains to the west, the Palmer Divide to the south, the Cheyenne Ridge to the north, and following the S. Platte River valley to the northeast, the area is commonly referred to as the Denver Basin and serves as the topographic and climatological airshed for the region. The region's geography and topographic features supports the recommended nonattainment designation for the current 8-hour ozone nonattainment area. The following topographic map illustrates the physical barriers that define the Denver Basin.

Figure 1-25: Topographic illustration of physical barriers that define the Denver Basin



Geography/Topography Conclusion:

The region's east-facing open bowl topography indicates that the current 8-hour ozone NAA boundary is appropriate for the recommended ozone NAA. If future refined modeling indicates that additional counties or regions should be included in the nonattainment area, the existing nonattainment boundary will be revaluated and expanded as necessary.

Factor #8: Jurisdictional Boundaries

Regional Air Quality Council

The Regional Air Quality Council (RAQC) is designated by Governor Ritter as the lead air quality planning agency for the Denver metropolitan area. In this capacity, the mission of the RAQC is to develop effective and cost efficient air quality initiatives with input from state and local government, the private sector, stakeholder groups, and private citizens. The RAQC's primary task is to prepare state implementation plans (SIPs) for compliance with federal air quality standards. The RAQC consists of an 11member board appointed by the Governor. In July 2007, when it was clear that the region was in violation of the 8-hour ozone standard, Governor Bill Ritter directed the RAQC to develop an effective plan (SIP) to reduce ozone in the

Denver/North Front Range area by September 2008. The Governor also urged the RAQC to propose measures that would further reduce ozone concentrations during the 2008 summer season and set as its immediate goal the reduction or elimination of ozone levels measured above 0.08 ppm. In addition, the Governor directed the RAQC to begin the process for considering additional measures that may be necessary to meet an anticipated lower federal standard for ozone.

North Front Range Transportation and Air Quality Planning Council

The North Front Range Transportation and Air Quality Planning Council (NRFTAQCPC) is designated by the Governor as the lead air quality planning organization for the North Front Range region. The North Front Range Transportation and Air Quality Planning Council is a nonprofit public organization of 15 local and county governments in Larimer and Weld counties and is funded through federal and state grants, and local funds. The goal of the North Front Range Transportation and Air Quality Planning Council is to enhance air quality and mobility among northern Colorado communities and between the North Front Range and the Denver Metro area by developing cooperative working relationships and financial partnerships among its member governments, the Colorado Department of Transportation (CDOT), Federal Highway Administration (FHA), the Federal Transit Administration (FTA), and the private sector. The North Front Range Transportation and Air Quality Planning Council is responsible for proposing air quality measures affecting the North Front Range and performing conformity determinations to ensure its transportation plans and programs comply with the state implementation plan.

Colorado Air Quality Control Commission

The Colorado Air Quality Control Commission (AQCC) is the regulatory body with responsibility for adopting air quality regulations consistent with state statute including the responsibility and the authority to adopt state implementation plans (SIPs) and implementing regulations. The AQCC takes action on SIPs and regulations through a public rulemaking process. The AQCC has nine members who are appointed by the Governor and confirmed by the State Senate.

Factor #9: Level of Control of Emission Sources

The current recommended nonattainment area has been subject to numerous and aggressive emission control programs. The State has recently adopted a revised Ozone Action Plan that is projected to bring the region into compliance with the 1997 8-hour ozone standard by December 2010. This latest initiative to reduce ozone precursor emissions, coupled with State-only efforts to further reduce the region's and the State's precursor emissions, should greatly assist in further progress towards eventual attainment of the 2008 8-hour ozone standard.

Stationary Source Emission Controls:

Front Range oil and gas controls
- 90% emission reduction from condensate tanks
- Low-bleed pneumatics only

Statewide oil and gas controls
- Existing/new tanks 20 tpy and greater
- Existing/new dehydrators 15 tpy and greater
- New engines over 100 hp/existing engines over 500 HP
- COGCC 1341 Statewide requirements for oil and gas sources

Gasoline station controls - Stage 1 vapor recovery
Stationary source controls for VOCs and NOx in Regulations 3, 6 and 7
Paint shops, solvent usage, industrial process changes
Xcel's voluntary emission reduction agreement on Denver Metro Area facilities

Mobile Source Emission Controls:

Federal diesel fuel standards
Summertime Low RVP Gasoline
- 7.8 lb. Summertime RVP
  - One-hour Ozone Maintenance SIP Area
  - June 1st – September 15th
  - One-pound ethanol waiver
- 9.0 lb. Summertime RVP
  - Northern Front Range and rest of state
  - One-pound ethanol waiver
  - 7.8 lb. Summertime RVP requested for NFR

Tier II Low Sulfur Gasoline
- 30ppm average/80ppm max
  - Statewide/Year Round
  - Phased-in from 2004

Enhanced I/M throughout the region
Federal tailpipe standards – TIER II
Ozone Transportation Conformity
Diesel school bus retrofits
Federal alternative fuels programs
Federal/state tax credits for hybrids/alternative fuels use

Area Source Emission Controls:

New off-road vehicle/equipment standards
New architectural/traffic/industrial and consumer products standards
Prescribed burning limits
Off-road & small engine standards
Low emission gasoline cans

Education/Outreach:

An extensive media-advertising program to raise public awareness about ozone solutions has been implemented - emphasis on motor vehicle solutions

- High ozone forecasting
- Paid advertising
- Media and education outreach
- Lawn mower exchange
- Gas can exchange
- Car care clinics
- Gas cap checks for municipal fleets
- Pre- and post-study surveys to determine effectiveness of the outreach and education efforts in affecting behavior change
- Outreach, awareness and education
- Rideshare/transit programs
- Local voluntary programs to reduce VMT
- Repair your air program - local high emitter identification/repair program
- Repair Your Air Campaign aggressively utilizes available “cash-for-clunkers” monies

Summary Conclusions for Denver Metro/North Front Range 8-hour Nonattainment Area:

The data and analysis presented in the nine factors provide documentation and compelling evidence supporting a finding of non-attainment and for maintaining the current nonattainment area for the revised 8-hour ozone area.

SECTION 2

Southwest Colorado Region

SECTION 2: Southwest Colorado – Nine Factor Analysis for Ozone Attainment

The State recommends that the Southwest Colorado Region be designated as attainment/unclassifiable for the 2008 revised 8-hour ozone standard. This recommendation is based on the following technical review.

Southwest Colorado Overview

In March of 2008, the United States Environmental Protection Agency (EPA) promulgated a new National Ambient Air Quality Standard (NAAQS) for ozone. This new standard lowered the 8-hour level of ozone from 0.08 parts per million (ppm) to 0.075 ppm, based on the fourth maximum 8-hour value at a site averaged over three years. Based on monitoring results from 2006-2008, the southwest portion of Colorado is in attainment of the new standard. However, one site in San Juan County in New Mexico, south of the Colorado border, is in violation of the new ozone NAAQS.

The EPA uses nine criteria, or "factors", to help with attainment/non-attainment determinations and, if necessary, to help determine the appropriate size of a non-attainment area. States must submit an analysis of these nine factors, along with a proposed non-attainment boundary, for any areas that are not meeting the federal standard. The nine factors that must be addressed are:

1. Air quality data
2. Emissions data
3. Population density and degree of urbanization
4. Traffic and commuting patterns
5. Growth rates and patterns
6. Meteorology
7. Geography/topography
8. Jurisdictional boundaries
9. Level of control of emission sources

Since ozone monitoring data from Colorado indicate attainment (rather than non-attainment) of the new NAAQS, the following analysis discusses these nine factors as necessary to demonstrate that Colorado should not be included in a non-attainment area originating from the violating ozone monitor in San Juan County, New Mexico. For this analysis, southwest Colorado is comprised of three counties (Archuleta, La Plata and Montezuma) and northwest New Mexico is comprised of two counties (Rio Arriba and San Juan). It must also be noted that this attainment demonstration recommendation relates only to non-tribal lands over which the State of Colorado has direct air quality jurisdiction.

Factor #1: Air Quality Data

The air quality analysis looked at all known ozone monitoring sites in both southwest Colorado and northwest New Mexico. A map of the site locations is presented in Figure 2-1. The data for 2005 to 2008 are presented in Table 2-1 and graphically in Figure 2-2. As indicated, all sites in Colorado are in attainment of the new NAAQS. Most 4th maximum 8-hour ozone values for sites in Colorado are near or below 0.070 ppm.

However, one site in San Juan County in New Mexico, the Navajo Lake site, violates of the new NAAQS, with a 3-year average of the 4th maximum 8-hour values of 0.077 ppm. This site is located approximately 13 miles south of the Colorado-New Mexico border on top of a mesa near the Navajo Lake Dam.

A passive ozone study was conducted during the summer of 2007 by the Colorado Department of Public Health and Environment – Air Pollution Control Division. Samples over a period of 48 hours were collected during August and September. The passive sampler results, including 48-hour averages from the continuous ozone monitors in the area, are presented in Figure 2-3. While not directly comparable to the NAAQS due to the sample durations, the data show that for the study period, no passive samples had ozone concentrations that were higher than the SUIT-Highway 550/Bondad, USFS-Shamrock or Mesa Verde National Park continuous analyzers (also averaged over 48-hours). This indicates that for the passive ozone locations used in this study, ozone concentrations are probably below the level of the new NAAQS as the continuous analyzers in Colorado have not violated the new NAAQS.

Figure 2-1: Map of Four Corners area ozone sites.

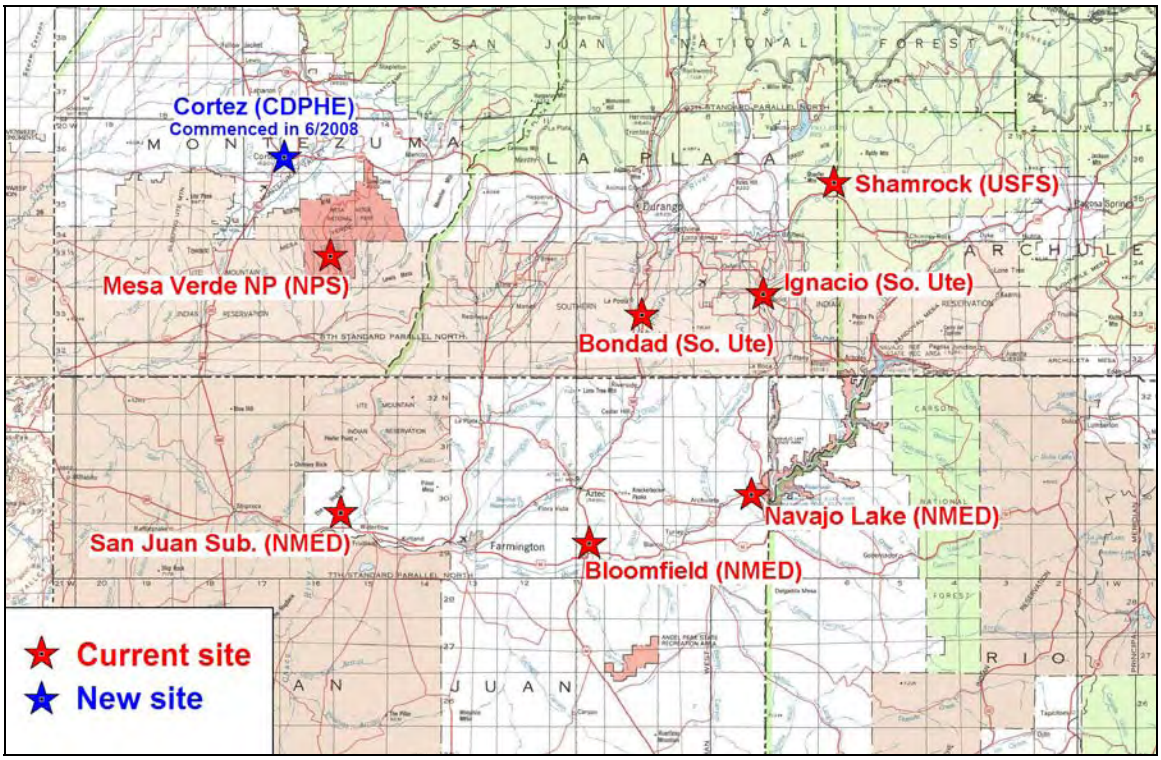


Table 2-1. Four Corners Area Ozone Data Summary.

4th Maximum 8-Hour Ozone Values and 3-Year Averages							
Site Name	**AQS#**	**Year**				**3-Year Average 2005-2007 (ppm)**	**3-Year Average 2006-2008* (ppm)**
		2005 (ppm)	**2006 (ppm)**	**2007 (ppm)**	**2008 (ppm)**		
Southern Ute Tribe - Ignacio	08-067-7001	(Void)	(Void)	(Void)	0.067	n/a	n/a
Southern Ute Tribe - Hwy. 550 / Bondad	08-067-7003	0.066	0.063	0.071	0.067	0.066	0.067
Mesa Verde Nat'l Park	08-083-0101	0.076	0.074	0.070	0.069	0.073	0.071
Cortez	08-083-0006	---	---	---	0.064	n/a	n/a
USFS - Shamrock Mine	08-067-????	0.075	0.074	0.069	0.069	0.072	0.070
NM - Shiprock Substation	35-045-1005	0.072	0.071	0.073	0.069	0.072	0.071
NM - Bloomfield	35-045-0009	0.075	0.063	0.069	0.064	0.069	0.065
NM - Navajo Lake	35-045-0018	---	0.079	0.079	0.075	n/a	**0.077**
* Note: Data are through October 2008.							

Figure 2-2. Four Corners area 4th maximum ozone data trends.

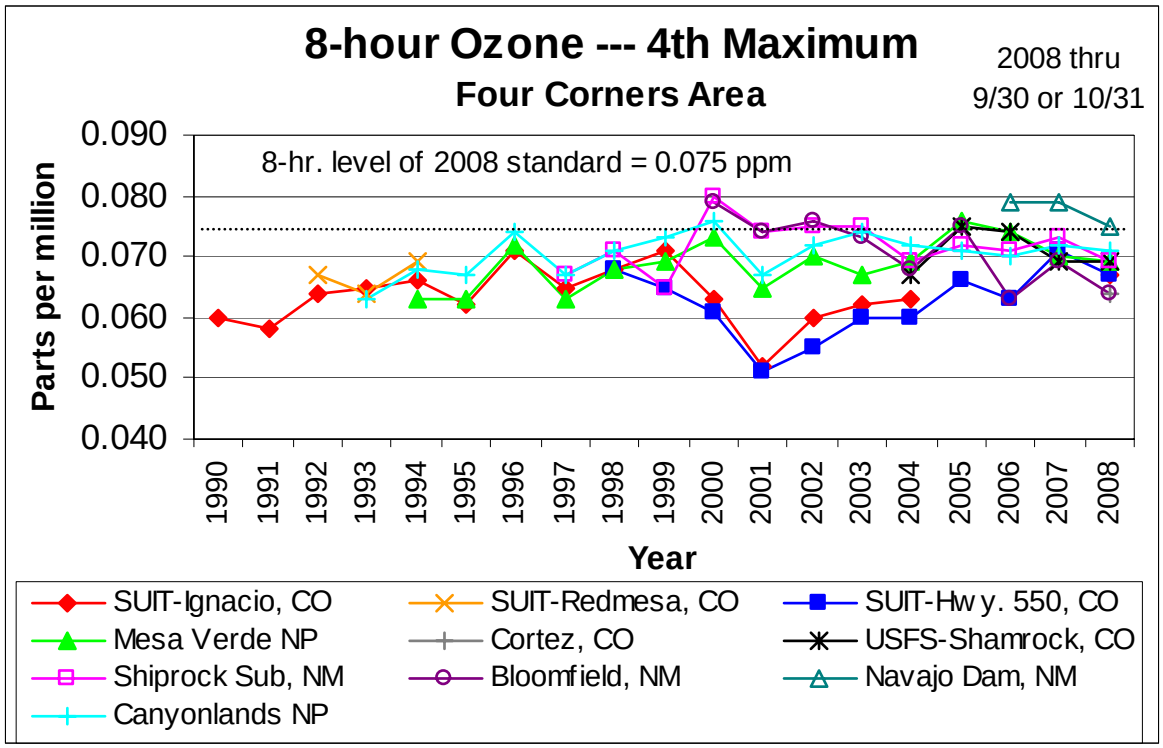
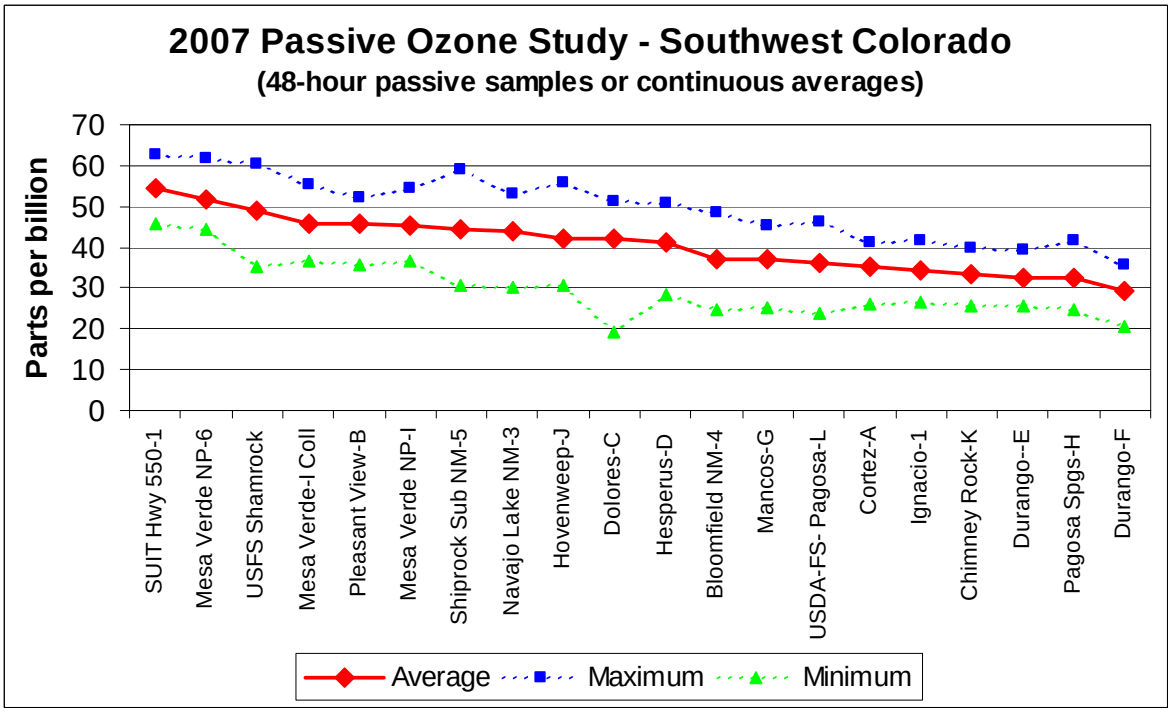


Figure 2-3. Southwest Colorado passive ozone study data.



Factor #2: Emissions Data

Ground-level ozone is primarily formed from the reactions of volatile organic compounds (VOCs) and oxides of nitrogen (NOx) in the presence of sunlight. Thus, it is typically a summertime pollutant, with VOCs and NOx being called "ozone precursors". Gas field development and production accounts for a large percent of the total ozone precursor emissions in the broader Four Corners area. The bulk of the gas field development is in New Mexico, as indicated in Figure 2-4. Many of the gas development support facilities/companies are also located in New Mexico.

The other significant ozone precursor emission sources in the area are coal-fired power plants. Two exist in the area, both in San Juan County, New Mexico. The San Juan Generating Station is in the midst of upgrades, including low-NOx burners, baghouses and mercury scrubbers. The Four Corners Power Plant is the one of the largest single sources of NOx in the country. It should also be noted that, at this time, EPA has approved the permit for the planned coal-fired Desert Rock Power Plant that will also be in San Juan County, New Mexico. Despite the planned application of state of the art emissions controls, this plant would be a significant source of additional NOx to the area.

Table 2-2 provides a summary of the 2006 Colorado emissions inventory for NOx and VOCs. Note that the Colorado inventory does not include emissions from Tribal lands. A summary of the 2005 Southern Ute Indian Tribe (SUIT) emissions inventory for NOx and VOCs is included separately in Table 2-2 as well. As can be seen for Colorado, VOCs are predominated by natural biogenic emissions, with minimal emissions from oil and gas development. NOx emissions for Colorado are primarily from oil and gas development sources.

Tables 2-3 and 2-4 provide a comparison of National Emissions Inventory (NEI) data for 2002 between Colorado and New Mexico. These are the most current NEI data available on EPA's website and include all emissions data for a county (State, Tribal, etc.). Of particular note is the magnitude of point source NOx emissions in San Juan County, New Mexico, with 71,990 tons per year (tpy) from electrical utilities (San Juan Generating Station and Four Corners Power Plant) and 13,405 tpy from fuel combustion from other sources. These two source categories alone are 22 times the total amount of point source NOx emissions from all three southwest Colorado Counties combined (3,748 tpy).

The sum of the point and non-point VOC emissions in Table 2-3 and 2-4 for petroleum and related industries are also much higher in the New Mexico counties compared to the Colorado counties: 1,591 tpy versus 313 tpy, respectively (5 times greater). Similarly, the sum of the point and non-point NOx emissions data for petroleum and related sources show a related disparity: 346 tpy versus 5 tpy for New Mexico and Colorado, respectively (69 times greater). Moreover, considering that the NEI for Colorado includes SUIT data, if one focused on the non-tribal portion of the VOC emissions, in Colorado they are very small compared to New Mexico.

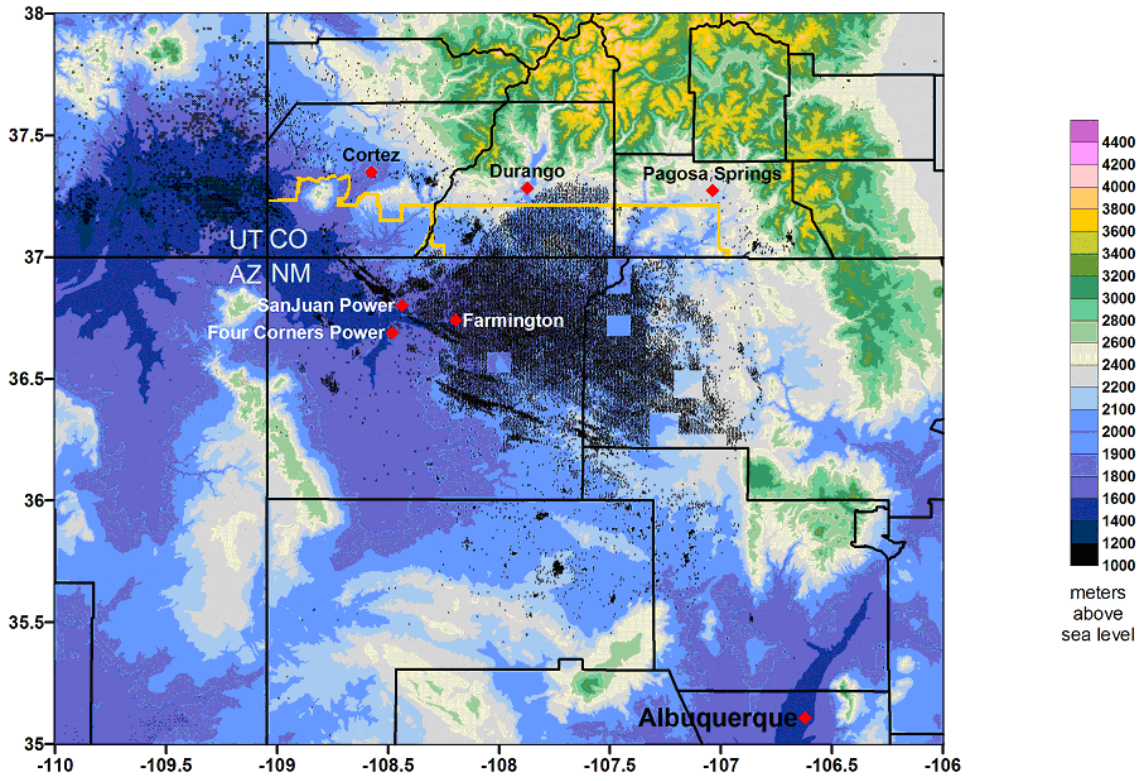
Furthermore, Tables 2-3 and 2-4, indicate that VOC highway emissions from the New Mexico counties are much higher than for the Colorado counties: 3,419 tpy versus 1,074 tpy, respectively (3 times greater). For NOx, the disparity is also similar: 4,833 tpy versus 1,730 tpy (3 times

greater). The large highway emissions disparity is likely due to the larger population base in New Mexico and the traffic associated with service equipment accessing the expansive development of gas wells in New Mexico.

Table 2-5 provides a summary of 2005 emissions inventory data used by ENVIRON International Corporation for ozone modeling in the Four Corners area. As can be seen in Figure 5, the ENVIRON modeling domain area is much larger than the five counties that are being used for the rest of this analysis. However, the data do show the disparity in emissions of ozone precursors between Colorado and New Mexico. For non-tribal Colorado lands, NOx emissions total 12,703 tpy, plus 4,694 tpy for the SUIT. In comparison, non-tribal lands in New Mexico have NOx emissions totaling 153,692 tpy, plus 45,323 tpy for the Navajo Nation. The Colorado NOx emissions are split between biogenic, mobile and oil/gas sources while the SUIT are NOx emissions are from oil/gas sources. For New Mexico, the majority of NOx emissions are from power plants, with oil/gas sources being a significant category as well. Most of the Navajo Nation NOx emissions are from power plants.

With VOC emissions, the ENVIRON inventory indicates that Colorado has 97,022 tpy, plus 1,926 tpy from the SUIT. In contrast, New Mexico has 259,828 tpy of VOC emissions, plus 431 tpy from the Navajo Nation. Biogenic sources dominate for Colorado while oil/gas sources dominate for New Mexico. Thus, Colorado (including the SUIT) is not likely to have much comparative impact on anthropogenic ozone formation in New Mexico, from an emissions standpoint.

Figure 2-4: Locations O&G Wells, Major Power Plants and Towns in the Four Corners Area



Note: In the above Figure 2-4, missing well data from the State of New Mexico accounts for rectangular gaps. Orange line indicates tribal land boundaries in Colorado. Information compiled by Colorado APCD.

Table 2-2: Colorado and Southern Ute NOx and VOC emissions inventory

NOx and VOC Emissions in Southwest Colorado Counties (2006 Colorado Inventory [non-tribal], 2005 Southern Ute Indian Tribe Inventory)

Category	Archuleta		La Plata		Montezuma	
	NOx (tons/yr)	VOC (tons/yr)	NOx (tons/yr)	VOC (tons/yr)	NOx (tons/yr)	VOC (tons/yr)
Aircraft	0	2	6	10	0	2
Biogenic	101	17,151	308	19,077	440	21,763
Commercial Cooking		1		3		2
Forest and Prescribed Fire	45	110	70	150	124	301
Fuel Combustion	16	1	66	4	33	2
Highway Vehicles	382	221	1,279	895	905	535
Non-Road	88	270	430	573	152	311
Oil & Gas area	82	28	4,622	1,821	55	209
Oil & Gas points	1	0	8,230	1,201	498	317
Solvent Utilization		27		124		76
Other Points	13	30	4	201	7	42
Structure Fires	0	0	0	1	0	0
Surface Coating		23		98		52
Woodburning	10	241	14	542	19	485
TOTAL	738	18,106	15,027	24,700	2,233	24,098

Category	Southern Ute Indian Tribe	
	NOx* (tons/yr)	VOC* (tons/yr)
Title V facilities	4,861	2,088
Oil & Gas wells**	4,285	34,343
Well-head compressors**	3,209	862
TOTAL	12,355	37,293

** Since the approval of this Technical Support Document by the Colorado Air Quality Control Commission, the Southern Ute Indian Tribe has re-calculated their emissions inventory numbers to include:*
(a) actual emissions rather than "potential to emit" emissions values;
(b) eliminate overlap between Southern Ute Indian Tribal land sources and non-tribal Colorado sources; and
(c) emissions factors that are more appropriate to coal-bed methane source-types in the Tribal Reservation area. Consequently, the Southern Ute Indian Tribe has determined that the values originally provided to Colorado and presented in Table 2-2 are no longer valid, and that the values presented in Table 2-5 of this Technical Support Document or in Table 4 of the ***"Southern Ute Indian Tribe: Technical Support Document for 2008 Revised Ozone NAAQS Area Designation Recommendation"*** *(March 10, 2009), are correct and supersede the Table 2-2 estimates for the Southern Ute Indian Tribe.*
*** May overlap with O&G area sources in Archuleta and La Plata Counties*

Table 2-3: NEI NOx and VOC emissions inventory for southwest Colorado.

2002 NEI NOx and VOC Emissions in Southwest Colorado Counties					
County	**NEI Tier 1 Category**	**Point**		**Non-Point + Mobile**	
		NOx (tons/yr)	**VOC (tons/yr)**	**NOx (tons/yr)**	**VOC (tons/yr)**
Archuleta	Fuel Comb. Elec. Util.	0.02	0.002	0	0
Archuleta	Fuel Comb. Industrial	13.2	2.85	0.4	0.004
Archuleta	Fuel Comb. Other	0	0	27.1	211
Archuleta	Chem. & Allied Product Mfg	0	0	0	0
Archuleta	Petroleum & Related Industries	0	0	0	0
Archuleta	Other Industrial Processes	0	0	0	0.97
Archuleta	Solvent Utilization	0	0	0	54.9
Archuleta	Storage & Transport	0	10.9	0	52.4
Archuleta	Waste Disposal & Recycling	0	0	0	0
Archuleta	Highway Vehicles	0	0	435	257
Archuleta	Off-Highway	0	0	87	251
Archuleta	Miscellaneous	0	0	0.49	8.89
	Total for County	13.22	13.752	549.99	836.164
La Plata	Fuel Comb. Elec. Util.	79.8	5.79	0	0
La Plata	Fuel Comb. Industrial	3,062	350	10.2	0.1
La Plata	Fuel Comb. Other	238	8.3	106	514
La Plata	Chem. & Allied Product Mfg	0	0	0	1.44
La Plata	Petroleum & Related Industries	0	183	0	0
La Plata	Other Industrial Processes	0.31	0.17	0	2.75
La Plata	Solvent Utilization	0	7.14	0	287
La Plata	Storage & Transport	0	191	0	166
La Plata	Waste Disposal & Recycling	0.12	0.13	0	0
La Plata	Highway Vehicles	0	0	274	164
La Plata	Off-Highway	0	0	473	576
La Plata	Miscellaneous	0	0	1,296	49,205
	Total for County	3380.23	745.53	2,159	50,916
Montezuma	Fuel Comb. Elec. Util.	6.25	0.35	0	0
Montezuma	Fuel Comb. Industrial	330	37	3.1	0.03
Montezuma	Fuel Comb. Other	14.2	0.26	60.1	455
Montezuma	Chem. & Allied Product Mfg	0	0	0	1.12
Montezuma	Petroleum & Related Industries	4.5	130	0	0
Montezuma	Other Industrial Processes	0	0	0	1.73
Montezuma	Solvent Utilization	0	0	0	148
Montezuma	Storage & Transport	0	114	0	130
Montezuma	Waste Disposal & Recycling	0.006	0.15	0	0
Montezuma	Highway Vehicles	0	0	1,021	653
Montezuma	Off-Highway	0	0	168	280
Montezuma	Miscellaneous	0	0	7.43	220
	Total for County	354.956	281.76	1259.63	1888.88
	Southwest Colorado Total	3,748	1,041	3,969	53,640

Table 2-4: NEI NOx and VOC emissions inventory for northwest New Mexico

2002 NEI NOx and VOC Emissions in Northwest New Mexico Counties					
County	**NEI Tier 1 Category**	**Point**		**Non-Point + Mobile**	
		NOx (tons/yr)	**VOC (tons/yr)**	**NOx (tons/yr)**	**VOC (tons/yr)**
Rio Arriba	Fuel Comb. Elec. Util.	27.2	7.05	0	0
Rio Arriba	Fuel Comb. Industrial	2,802	1,406	8.67	0.07
Rio Arriba	Fuel Comb. Other	0	0	73.2	230
Rio Arriba	Chem. & Allied Product Mfg	0	0	0	0
Rio Arriba	Petroleum & Related Industries	8.94	510	0	0
Rio Arriba	Other Industrial Processes	4.61	0	0	1.09
Rio Arriba	Solvent Utilization	0	0	0	159
Rio Arriba	Storage & Transport	0	657	0	325
Rio Arriba	Waste Disposal & Recycling	0	0	16	82.3
Rio Arriba	Highway Vehicles	0	0	1,647	1,200
Rio Arriba	Off-Highway	0	0	183	738
Rio Arriba	Miscellaneous	0	0	16.3	473
	Total for County	2842.75	2580.05	1944.17	3208.46
San Juan	Fuel Comb. Elec. Util.	71,990	473	0	0
San Juan	Fuel Comb. Industrial	13,405	2,813	14.2	0.06
San Juan	Fuel Comb. Other	0.3	1.6	201	120
San Juan	Chem. & Allied Product Mfg	0	7.03	0	1.12
San Juan	Petroleum & Related Industries	337	956	0	125
San Juan	Other Industrial Processes	20.5	0.13	0	3.84
San Juan	Solvent Utilization	0	1.75	0	563
San Juan	Storage & Transport	5.73	840	0	980
San Juan	Waste Disposal & Recycling	0.1	11.5	60.4	231
San Juan	Highway Vehicles	0	0	3,186	2,219
San Juan	Off-Highway	0	0	741	760
San Juan	Miscellaneous	0	0	11.1	206
	Total for County	85,759	5104.01	4213.7	5209.02
	Northwest New Mexico Total	88,601	7,684	6,159	8,419

Figure 2-5: ENVIRON Four Corners area modeling domain

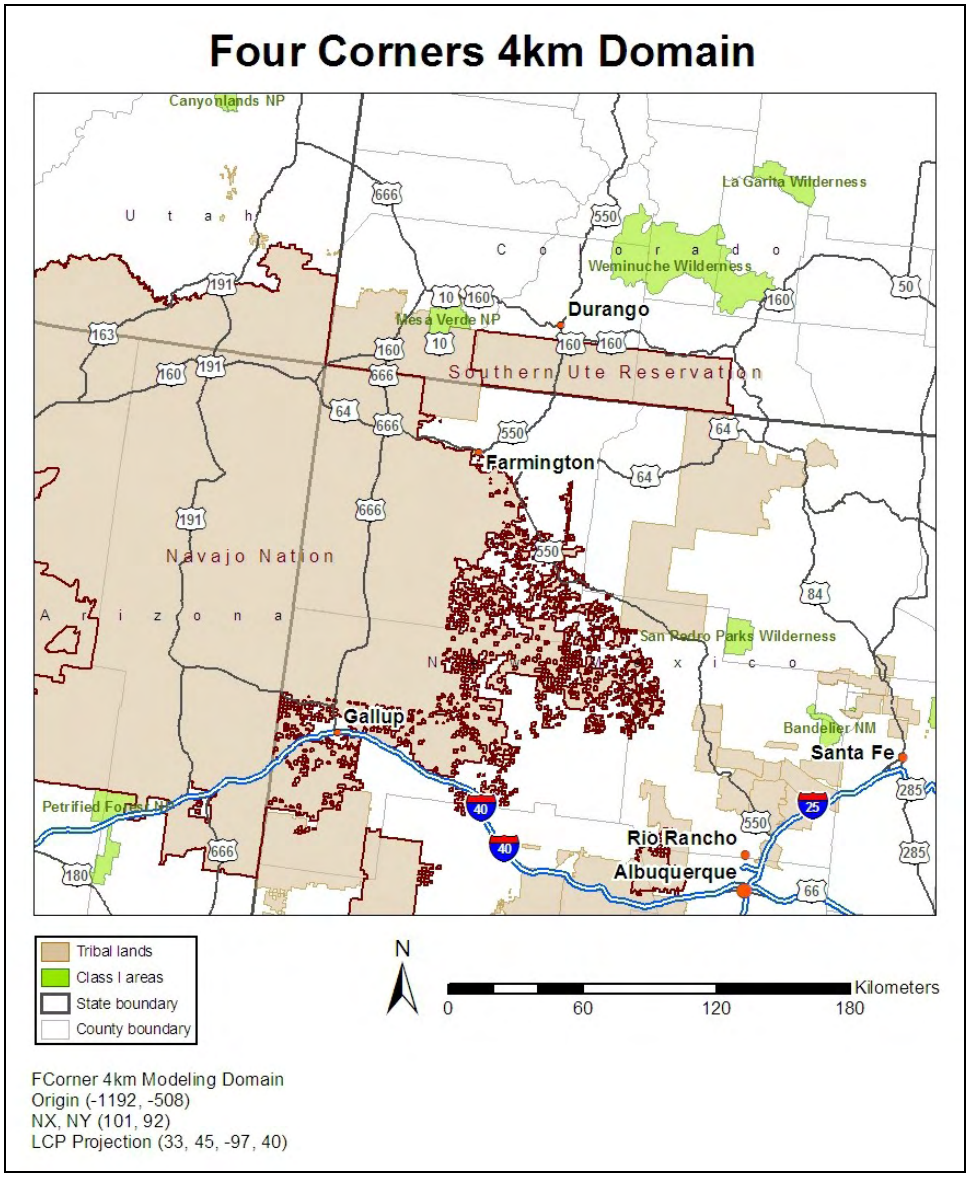


Table 2-5: ENVIRON Four Corners area emissions inventory data

ENVIRON Four Corners Area 2005 NOX and VOC Emissions Inventory Data									
NOx	Area (tpy)	Bio-genics (tpy)	Off-Road (tpy)	On-Road (tpy)	Area Oil & Gas (tpy)	Point Oil & Gas (tpy)	EGU (tpy)	Non-EGU (tpy)	Grand Total (tpy)
Arizona	97	1,102	2,407	4,661	13	0	0	0	8,279
Colorado	302	2,731	1,910	3,757	921	2,548	0	535	12,703
Navajo Nation	0	0	0	0	0	2,570	41,743	1,010	45,323
New Mexico	16,036	4,032	11,219	30,182	37,848	19,834	30,925	3,615	153,692
Puebla of Laguna	0	0	0	0	0	0	0	1,551	1,551
Puebla of Santa Anna	0	0	0	0	0	0	0	209	209
Southern Ute	0	0	0	0	0	4,694	0	0	4,694
Utah	42	582	181	741	51	352	0	78	2,027
Ute Mountain Ute	0	0	0	0	0	0	0	0	0
VOC	Area (tpy)	Bio-genics (tpy)	Off-Road (tpy)	On-Road (tpy)	Area Oil & Gas (tpy)	Point Oil & Gas (tpy)	EGU (tpy)	Non-EGU (tpy)	Grand Total (tpy)
Arizona	2,204	24,028	728	3,314	37	0	0	0	30,310
Colorado	3,632	83,394	4,884	2,616	891	1,257	0	348	97,022
Navajo Nation	0	0	0	0	0	293	17	121	431
New Mexico	26,675	90,934	5,690	17,079	109,480	7,857	264	1,849	259,828
Puebla of Laguna	0	0	0	0	0	0	0	11	11
Puebla of Santa Anna	0	0	0	0	0	0	0	49	49
Southern Ute	0	0	0	0	0	1,926	0	0	1,926
Utah	479	14,694	388	490	455	77	0	52	16,634
Ute Mountain Ute	0	0	0	0	0	0	0	0	0

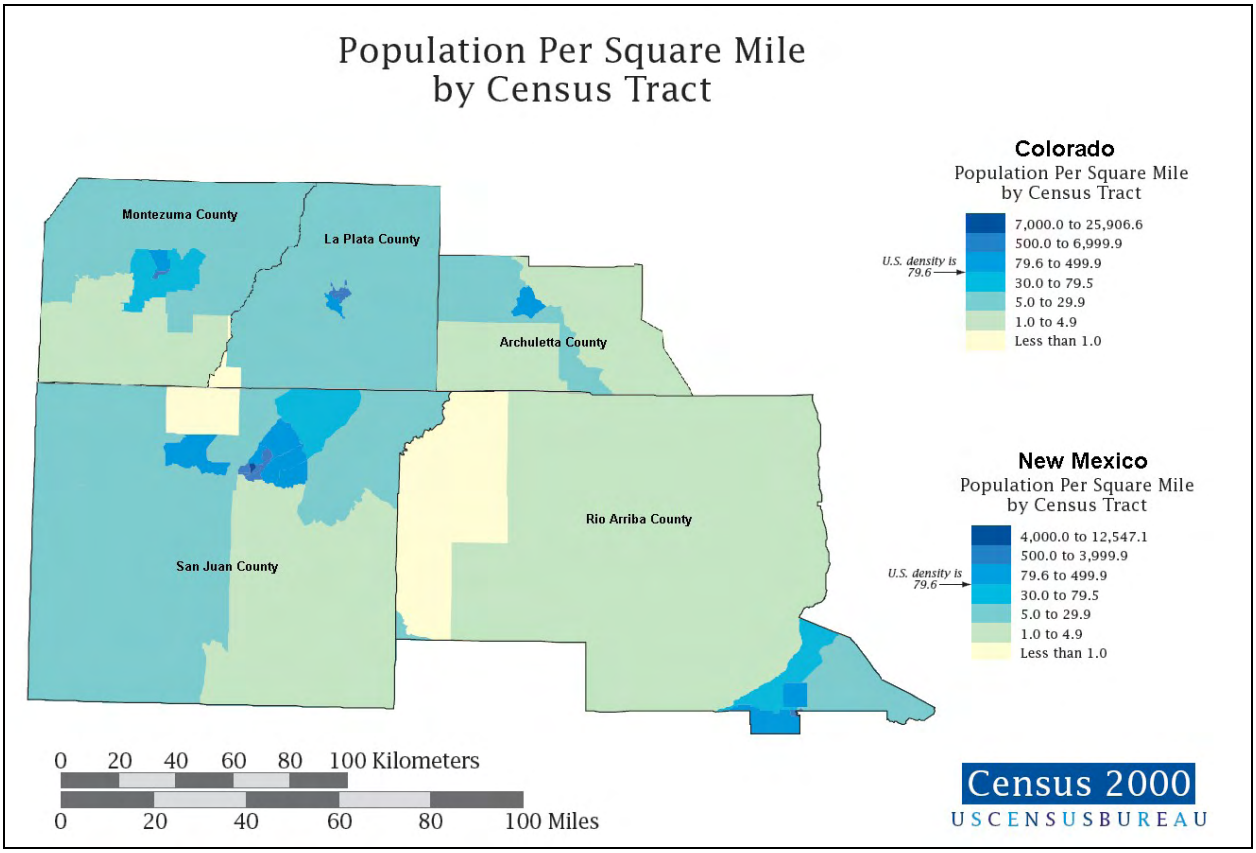
Factor #3: Population Density and Degree of Urbanization

There are very few large population centers southwest Colorado. The primary urban areas are Cortez, Durango and Pagosa Springs. Durango is classified by the US Census Bureau as a Micropolitan Statistical Area.

Northwest New Mexico likewise does not have many large population centers. The primary urban areas are Shiprock, Farmington, Bloomfield and Aztec. Farmington is classified by the US Census Bureau as a Metropolitan Statistical Area.

Overall, the Four Corners Region is quite sparsely populated, with most of the area being well below the United States average density of 80 people per square mile. Only the Farmington area in New Mexico exceeds the 4,000 people per square mile density, as seen in Figure 2-6.

Figure 2-6: Four Corners Area Population density map



Factor #4: Traffic and Commuting Patterns

Traffic volumes in southwest Colorado are generally quite low, especially in comparison to large urban areas. Figure 2-7 presents data from the Colorado Department of Transportation. Vehicle miles traveled in 2006, based on inventory data, are:

Archuleta County = 422,164 miles/day
La Plata County = 1,644,346 miles/day
Montezuma County = 1,002,181 miles/day

From traffic count maps for the area (see Figures 2-7 and 2-8), average daily traffic volumes appear to be similar for both Colorado and New Mexico. As is expected, the daily traffic is highest in the urban areas. These maps are only for major roadways, however. Traffic counts for minor roads and rough dirt roads as well as vehicle types are not reflected.

Figure 2-7: Southwest Colorado traffic volume maps

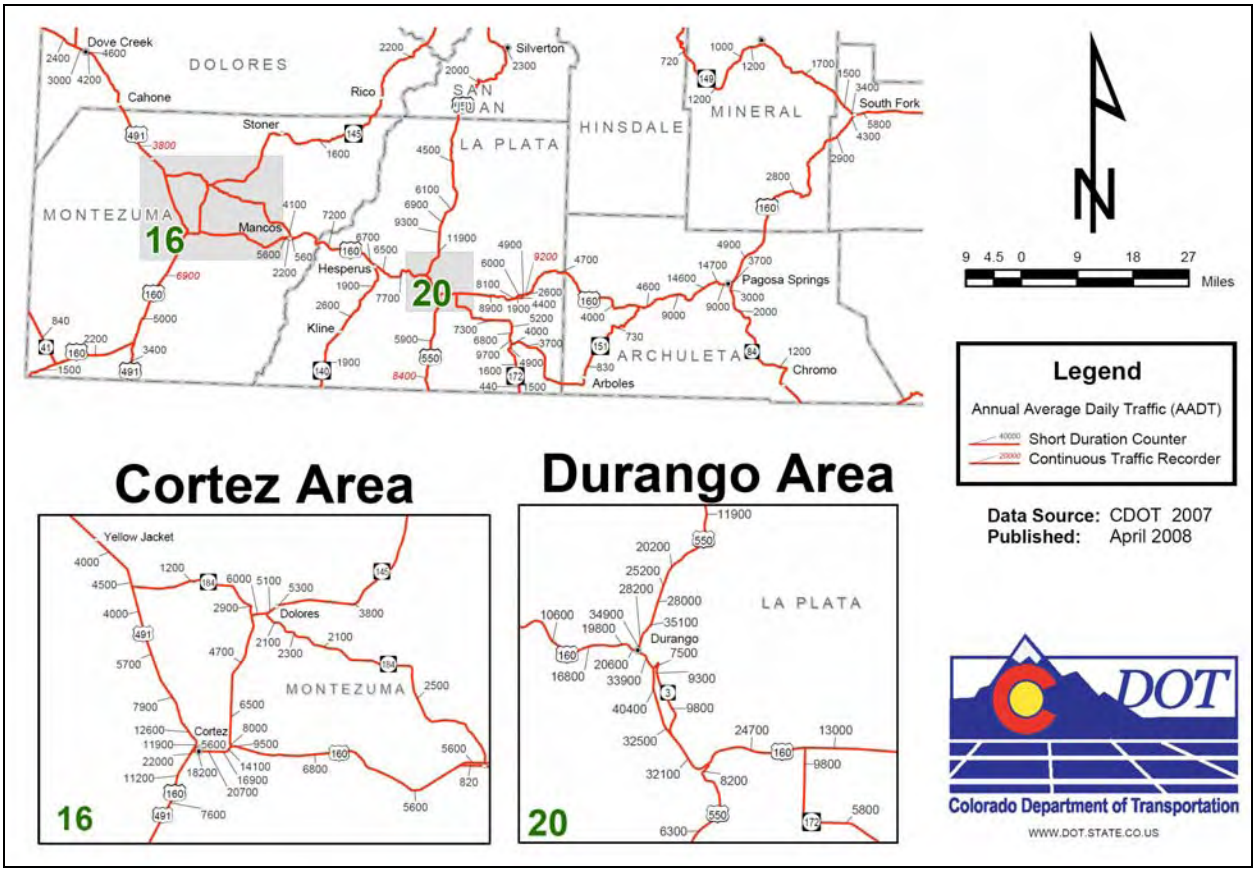
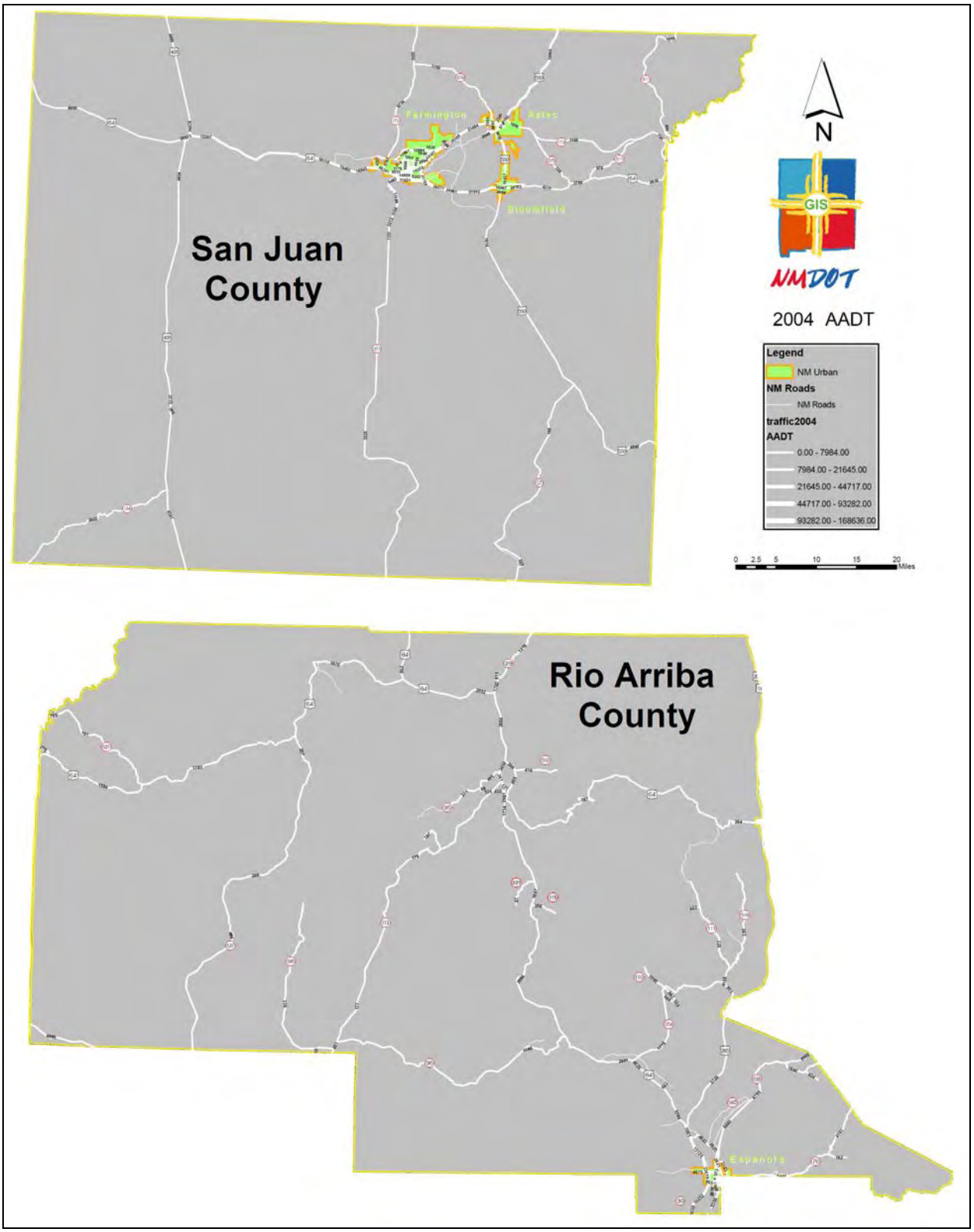


Figure 2-8: Northwest New Mexico traffic volume maps



Factor #5: Growth Rates and Patterns

Southwest Colorado is comprised of three counties for this analysis: Archuleta, La Plata and Montezuma. There are very few large population centers in southwest Colorado. The primary urban areas are Cortez, Durango and Pagosa Springs. Durango is classified by the US Census Bureau as a Micropolitan Statistical Area. The total population of the three southwest counties, as presented in Table 2-6, is 87,944 (July 2007 estimate).

Northwest New Mexico is comprised of two counties for this analysis: Rio Arriba and San Juan. Northwest New Mexico does not have many large population centers. The primary urban areas are Shiprock, Farmington, Bloomfield and Aztec. Farmington is classified by the US Census Bureau as a Metropolitan Statistical Area. The total population of the two northwest counties is 153,294 (July 2007 estimate), 75 percent higher than the southwest Colorado population.

Growth rates for the southwest area of Colorado from 2000 to 2007 range from 0.6 percent per year to 4.4 percent per year, with an average of 1.9 percent per year for the three counties. This is similar to the State of Colorado as a whole (see Table 2-6). Growth rates for the northwest area of New Mexico range from -0.6 percent per year to 1.7 percent per year, with an average of 0.8 percent per year for the two counties. This is lower than the State of New Mexico as a whole. Table 2-7 lists projected growth rates through 2025 for the three counties in Colorado and two counties in New Mexico through 2025. San Juan County, New Mexico has the highest expected growth rates for the future by a significant amount.

Table 2-6: Southwest Colorado and Northwest New Mexico Population Estimates - Recent

Southwest Colorado and Northwest New Mexico Population Estimates			
Counties and Municipalities	**April 2000 (US Census)**	**July 2007 (State estimate)**	**% Change 2000 - 2007**
COLORADO STATE	4,301,261	4,919,884	14.4% (2.1 %/yr)
Archuletta County	9,898	12,625	27.6% (3.9 %/yr)
Pagosa Springs	1,591	1,760	10.6% (1.5 %/yr)
Unincorp. Area	8,307	10,865	30.8% (4.4 %/yr)
La Plata County	43,941	49,758	13.2% (1.9 %/yr)
Bayfield	1,549	1,941	25.3% (3.6 %/yr)
Durango	13,922	16,169	16.1% (2.3 %/yr)
Ignacio	669	736	10.0% (1.4 %/yr)
Unincorp. Area	27,801	30,912	11.2% (1.6 %/yr)
Montezuma County	23,830	25,561	7.3% (1.0 %/yr)
Cortez	7,977	8,900	11.6% (1.7 %/yr)
Dolores	857	943	10.0% (1.4 %/yr)
Mancos	1,119	1,288	15.1% (2.2 %/yr)
Unincorp. Area	13,877	14,430	4.0% (0.6 %/yr)
NEW MEXICO STATE	1,819,046	1,969,915	8.3% (1.2 %/yr)
Rio Arriba County	41,190	40,827	-0.9% (-0.1 %/yr)

Southwest Colorado and Northwest New Mexico Population Estimates			
Counties and Municipalities	**April 2000 (US Census)**	**July 2007 (State estimate)**	**% Change 2000 - 2007**
Chama	1,199	1,167	-2.7% (-0.4 %/yr)
Espanola	7,105	6,829	-3.9% (-0.6 %/yr)
Unincorp. Area	32,886	32,831	-0.2% (-0.0 %/yr)
San Juan County	113,801	122,427	7.6% (1.1 %/yr)
Aztec	6,378	6,810	6.8% (1.0 %/yr)
Bloomfield	6,417	7,129	11.1% (1.6 %/yr)
Farmington	37,844	42,425	12.1% (1.7 %/yr)
Unincorp. Area	63,162	66,063	4.6% (0.7 %/yr)

Table 2-7: Southwest Colorado and Northwest New Mexico Population Projections - Future

Southwest Colorado and Northwest New Mexico Population Projections						
	Projection Date					
Counties	**July 2000**	**July 2005**	**July 2010**	**July 2015**	**July 2020**	**July 2025**
COLORADO	4,338,789	4,731,787	5,218,144	5,737,305	6,287,021	6,823,546
Archuleta	10,027	11,690	14,107	17,045	20,455	23,851
La Plata	44,570	48,226	51,517	58,707	67,672	74,989
Montezuma	23,863	24,811	26,645	29,317	32,293	35,449
NEW MEXICO	1,820,861	1,969,292	2,162,331	2,356,236	2,540,145	2,707,757
Rio Arriba	41,246	43,024	44,072	45,224	46,206	46,674
San Juan	114,043	126,008	133,170	140,523	146,815	151,501

	Annualized Percent Increase				
Counties	**2000 - 2005**	**2005 – 2010**	**2010 - 2015**	**2015 - 2020**	**2020 - 2025**
COLORADO	1.7%	2.0%	1.9%	1.8%	1.7%
Archuleta	3.1%	3.8%	3.9%	3.7%	3.1%
La Plata	1.6%	1.3%	2.6%	2.9%	2.1%
Montezuma	0.8%	1.4%	1.9%	2.0%	1.9%
NEW MEXICO	8.2%	9.8%	9.0%	7.8%	6.6%
Rio Arriba	4.3%	2.4%	2.6%	2.2%	1.0%
San Juan	10.5%	5.7%	5.5%	4.5%	3.2%

Factor #6: Meteorology

Ozone formation and transport are affected by prevailing winds through the depth of the mixed layer, and this can include the prevailing winds through a significant portion of the troposphere during the ozone season. The initial transport of emissions from ground-level and stack sources, however, may be strongly influenced by circulations driven by the local topography. Down-valley drainage is expected at night, particularly in the San Juan River drainage (see Figure 2-9). Conversely, thermally-driven up-valley flows are expected in the daytime. Wind roses for summer afternoons, when ozone production is expected to be greatest, show persistent up-valley flow in northwest New Mexico (see Figure 2-10).

HYSPLIT back-trajectory analyses for the four highest days at the Navajo Lake, New Mexico, monitor for each year in 2006 to 2008 (five days in 2008 due to a tied value) show that the bulk of the back-trajectory points for the prior 24-hours are in New Mexico. Figure 2-11 provides a compilation of all the back-trajectory points for the highest eight-hours on all 13 days from 2006, 2007 and 2008. Oil and gas well locations have been plotted in Figure 2-11 as well. These provide a reasonable representation of the spatial distributions of point and area sources associated with the oil and gas resource areas. Figures 2-12 through 2-14 show the back-trajectories for individual high-concentration days in 2006, 2007, and 2008, superimposed on oil and gas well locations. These back-trajectories show that air parcels typically had significant residence times over New Mexico source areas in contrast to source areas in Colorado during these high-concentration days.

Figure 2-9: Conceptual model of down-valley drainage wind vectors

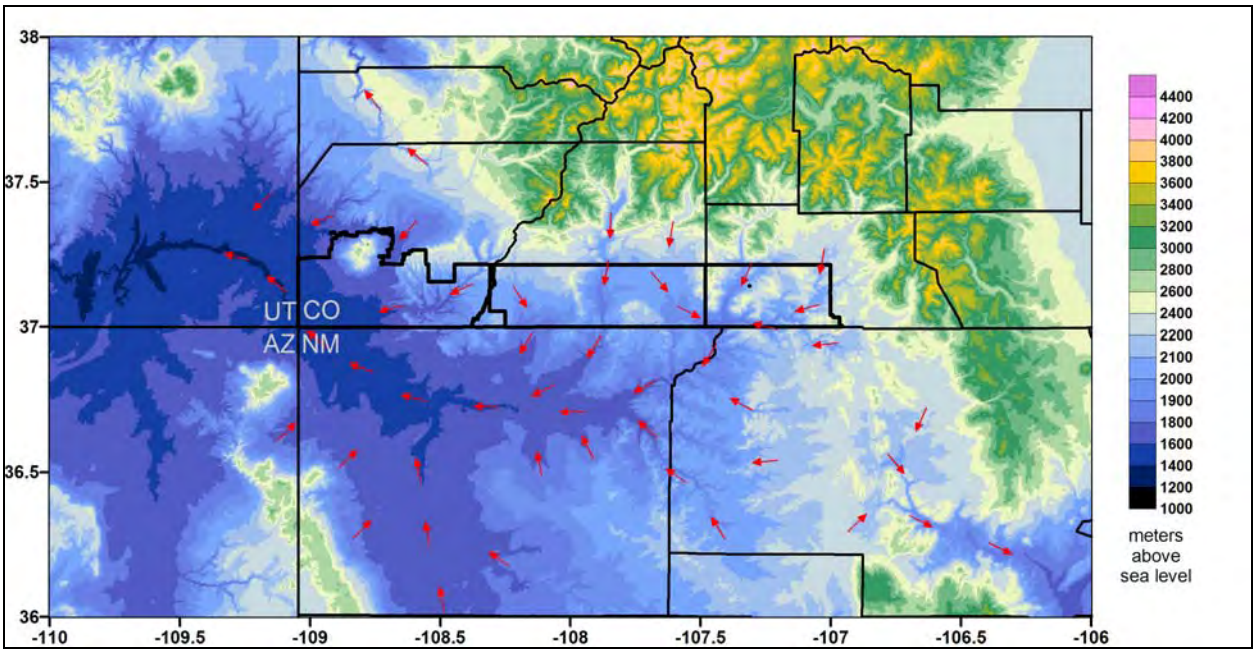


Figure 2-10: Summer afternoon wind roses

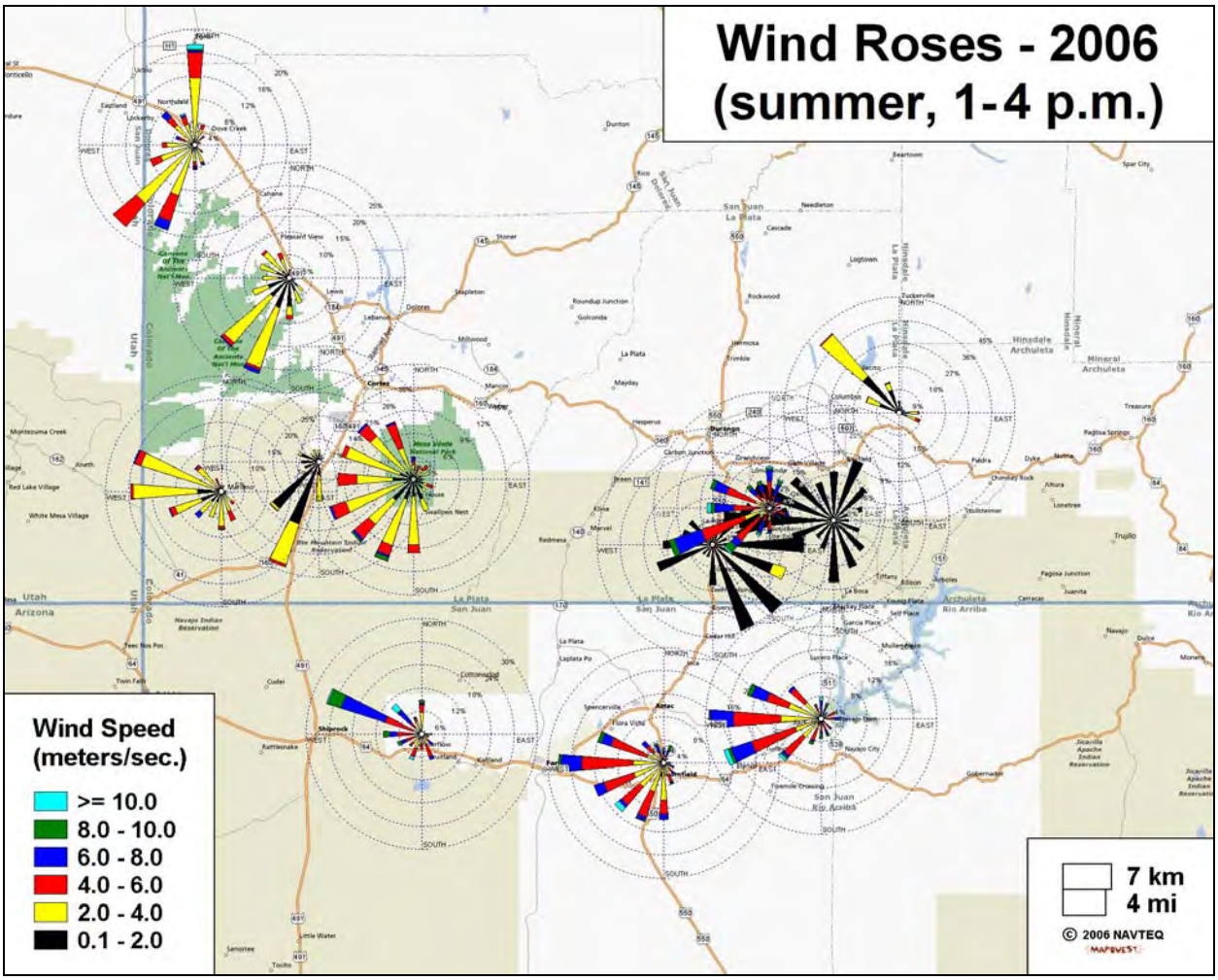
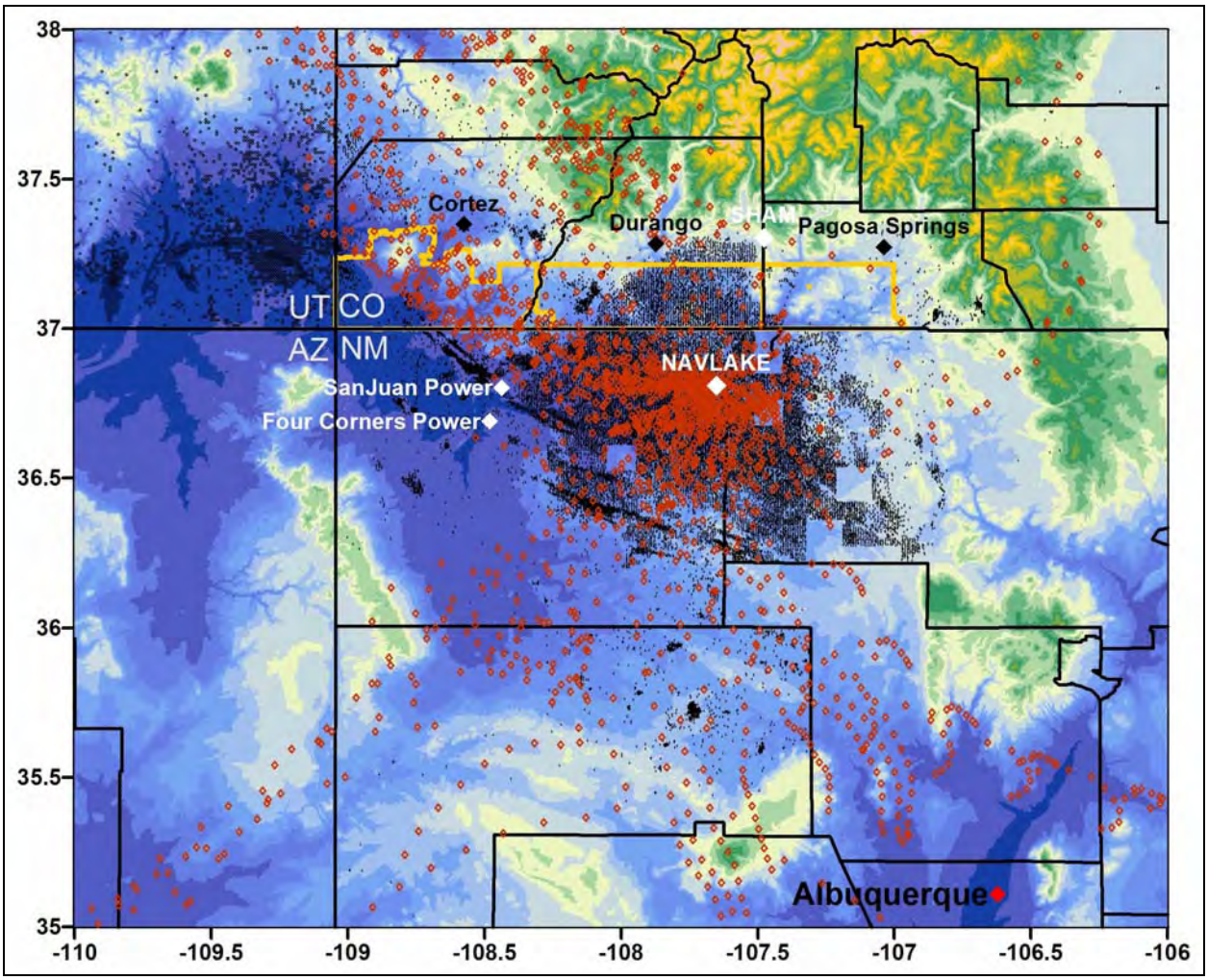
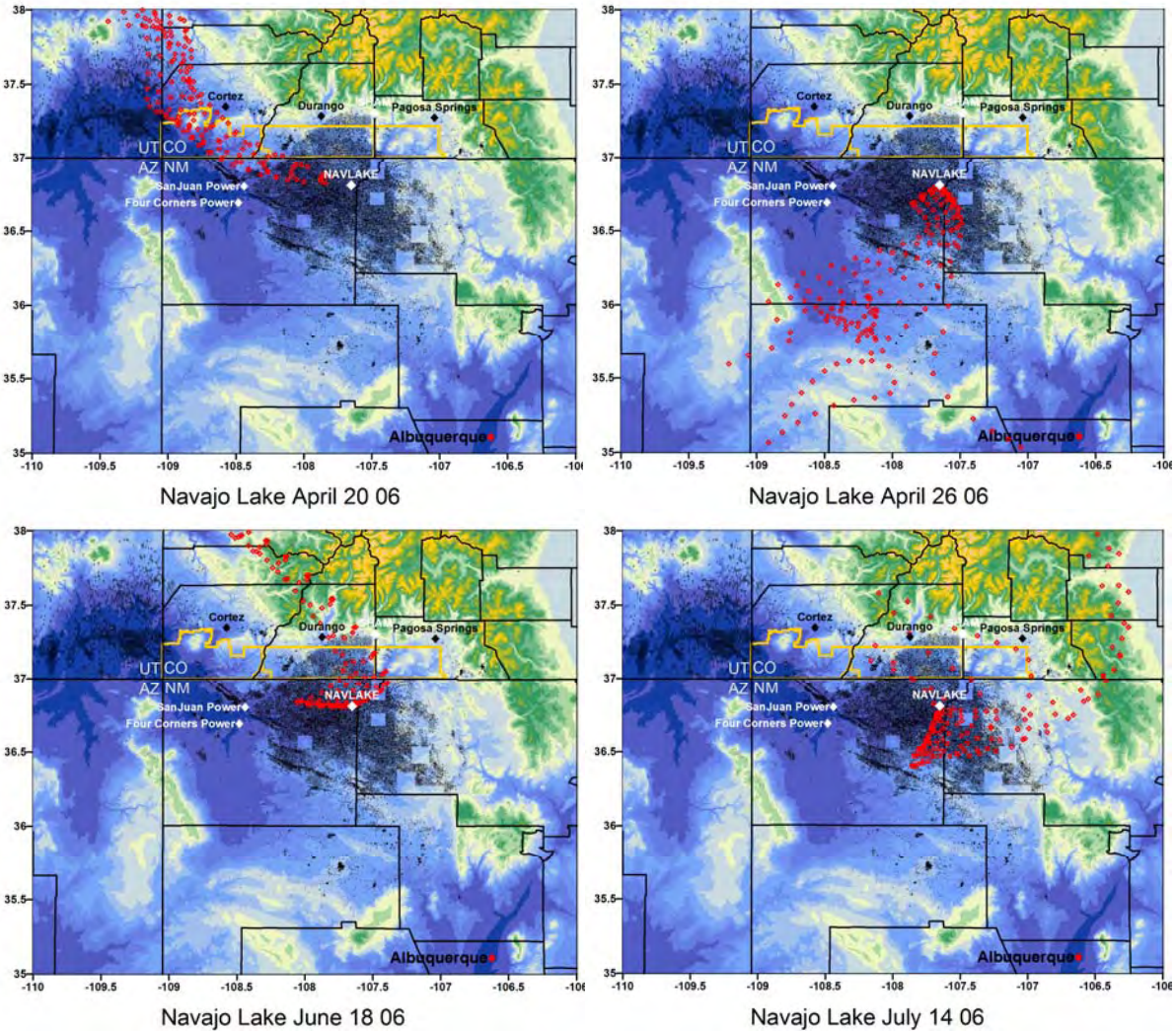


Figure 2-11: HYSPLIT 24-hour back trajectory points for the Navajo Lake monitor



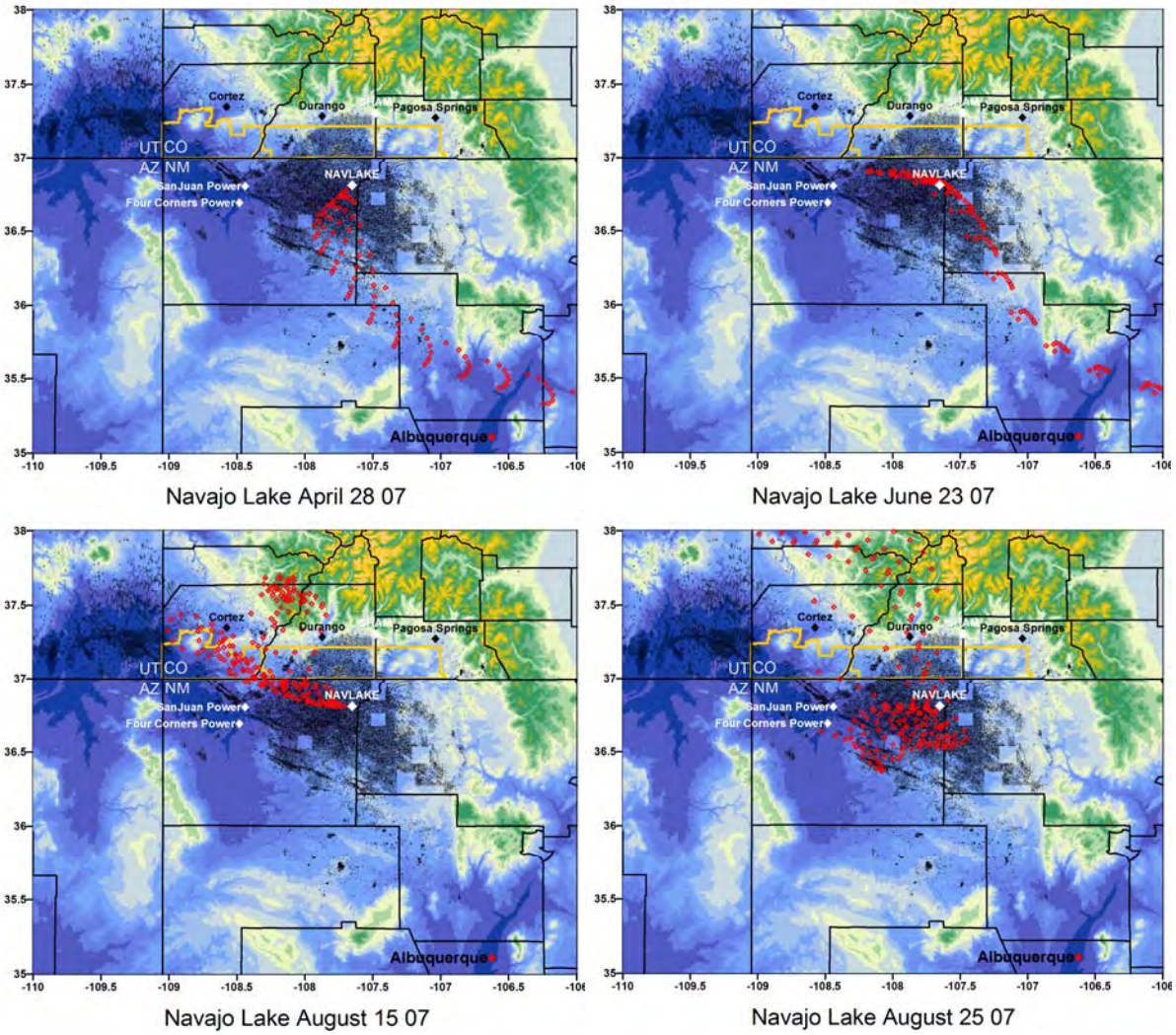
The above Figure represents 13 high days in 2006-2008, for each hour affecting the daily maximum 8-hour concentration. (Oil and gas well locations are represented by black dots.)

Figure 2-12: HYSPLIT 24-hour back trajectory points for the Navajo Lake monitor



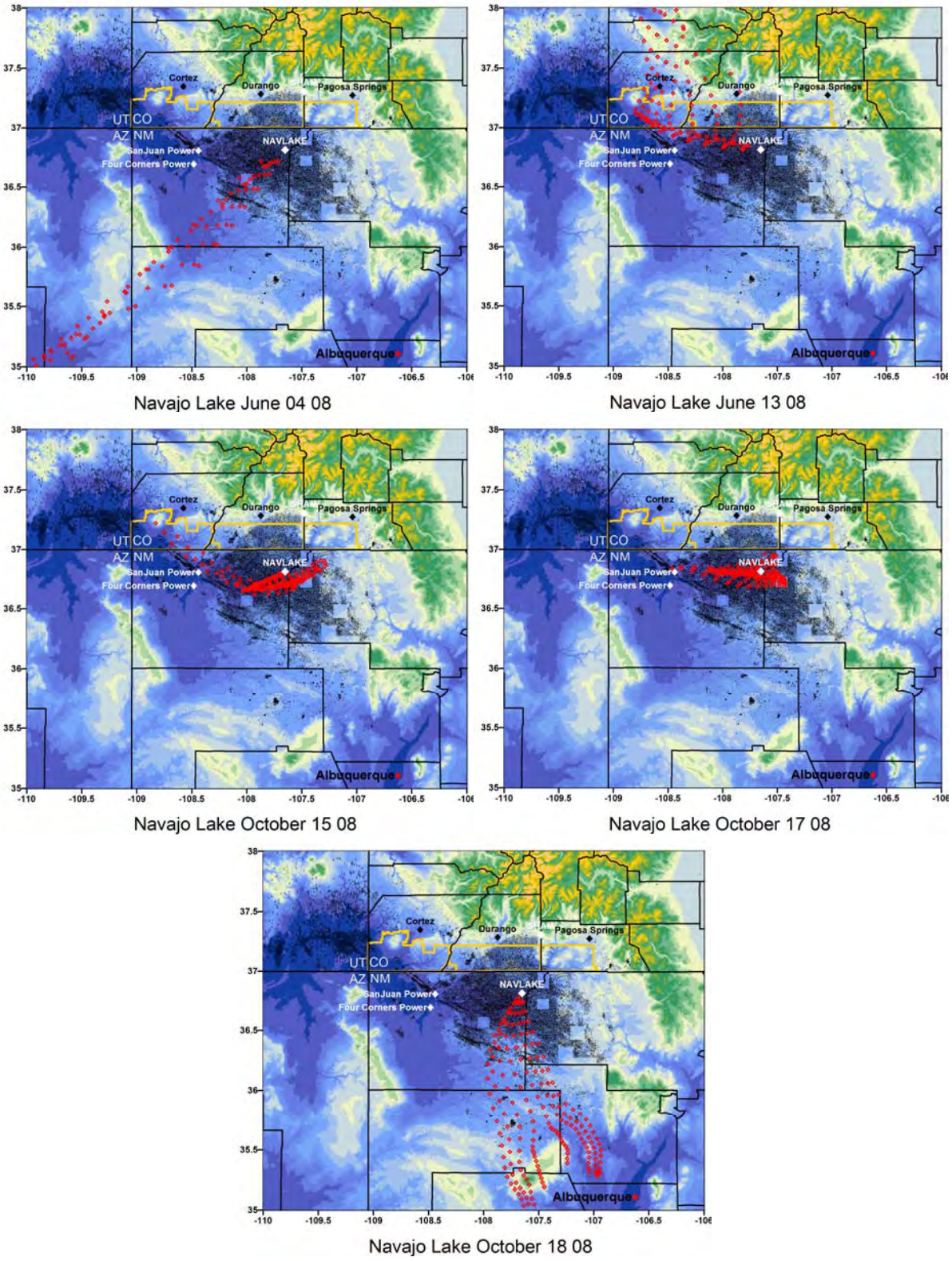
The above Figures represent 4 high days in 2006, for each hour affecting the daily maximum 8-hour concentration. (Oil and gas well locations are represented by black dots.)

Figure 2-13: HYSPLIT 24-hour back trajectory points for the Navajo Lake monitor



The above Figures represent 4 high days in 2007, for each hour affecting the daily maximum 8-hour concentration. (Oil and gas well locations are represented by black dots.)

Figure 2-14: HYSPLIT 24-hour back trajectory points for the Navajo Lake monitor

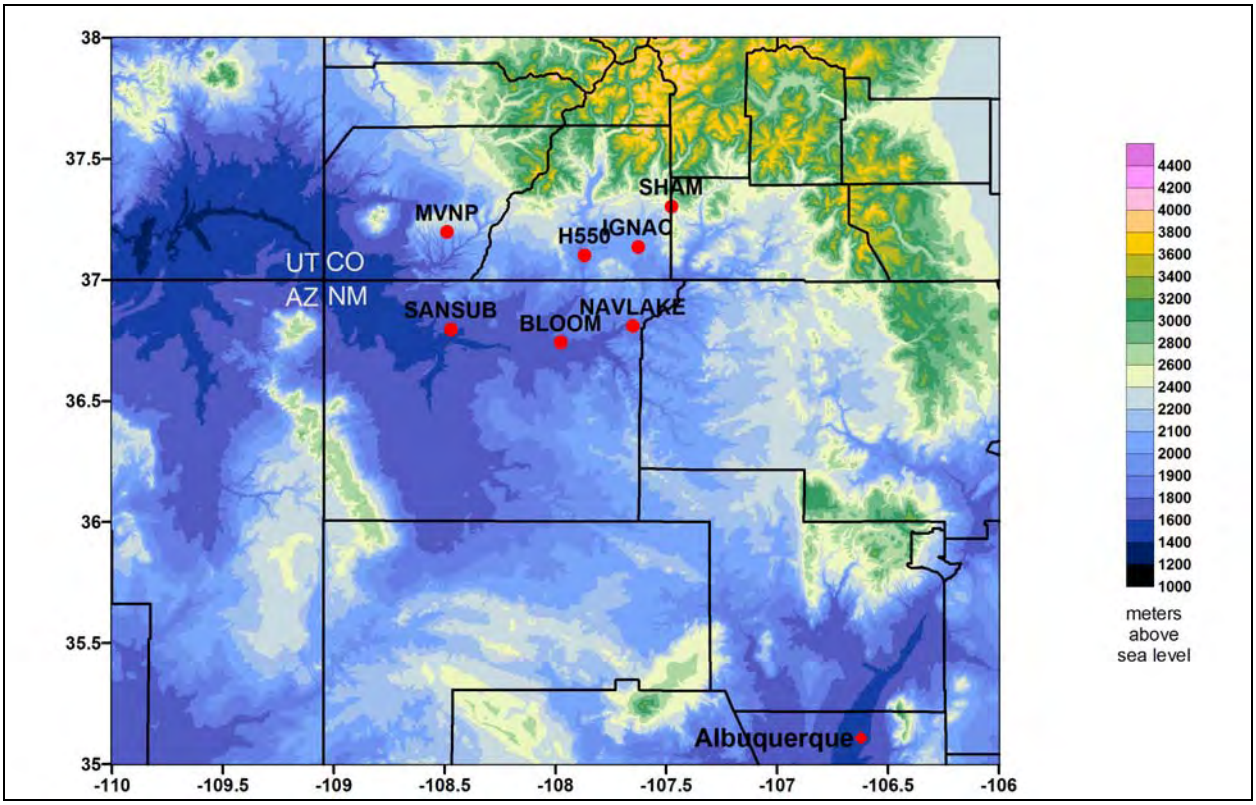


The above Figures represent 5 high days in 2008, for each hour affecting the daily maximum 8-hour concentration. (Oil and gas well locations are represented by black dots.)

Factor #7: Geography/Topography

The Four Corners area is defined by higher mountains to the north and east, and lower canyon areas to the west (see Figure 2-15). With higher elevations to the south as well, the northwest portion of New Mexico is in a bowl or basin, with the San Juan River being the primary drainage path, flowing to the west. The southwest counties in Colorado are generally mountainous to the north with mesas and desert valleys in the south, and much of this area is also within this basin. Much of the gas development is located in the lower areas of the basin.

Figure 2-15: Topography and ozone monitors



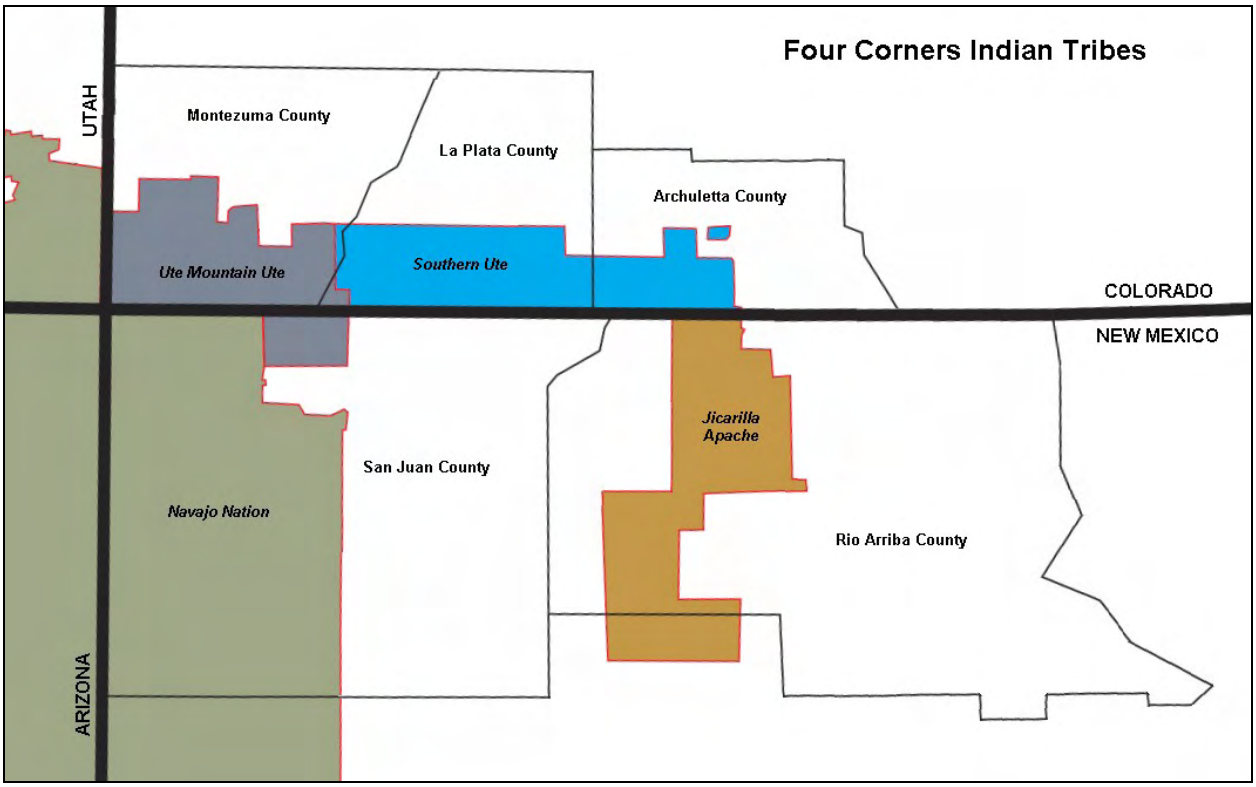
Factor #8: Jurisdictional Boundaries

The portion of Southwest Colorado associated with this analysis includes three counties: Archuleta, La Plata and Montezuma. Two Indian Tribal Nations are also located in the area, the Southern Ute and Ute Mountain Ute. As indicated in Figure 2-16, the Southern Ute Indian Tribal (SUIT) lands extend along the Colorado-New Mexico border from just inside southeastern Montezuma County, across all of southern La Plata County, and in to part of southwestern Archuleta County. The Ute Mountain Ute Indian Tribal lands extend along the Colorado-New Mexico border in southern Montezuma County and just into southwestern La Plata County, with a portion extending into New Mexico.

The portion of Northwest New Mexico associated with this analysis includes two counties: Rio Arriba and San Juan. Three Indian Tribal Nations are also located in the area, Jicarilla Apache, Navajo and Ute Mountain Ute. The Jicarilla Apache Indian Tribal lands are located along the New Mexico-Colorado border and much of the western portion of Rio Arriba County. The Navajo Nation tribal lands comprise the entire western portion of San Juan County. A small portion of the Ute Mountain Ute Indian Tribal lands extend into northern San Juan County, with the main portion of the reservation located in Colorado.

The State of Colorado's Air Quality Control Commission and Air Pollution Control Division exercise air quality jurisdiction in all three southwest Colorado counties beyond the external boundaries of the Tribal lands. Air quality regulatory authority for the SUIT Reservation is generally exercised at the present by the U.S. EPA and the SUIT/State of Colorado Environmental Commission (Public Law 108-336, 10/18/2004). The SUIT has approved a Tribal Title V operating permit regulation and is developing a minor source air permit regulation. Colorado is supportive of the SUIT's efforts to develop and implement a full and effective air program, and this should be considered and supported during designations for the area. Moreover, Colorado would note for EPA's consideration that including multi-jurisdictional lands within Colorado in a non-attainment area would add notable complexity in the management of a non-attainment area for, as described in this document, a peripheral geographic area with respect to non-attainment at the Navajo Lake, New Mexico, monitor.

Figure 2-16: Four Corners Counties and Indian Tribes



Factor #9: Level of Control of Emission Sources

In May 2008, Colorado implemented regulations requiring retrofit controls on oil and gas emission sources (larger condensate tanks and dehydrators) along with stringent emission standards for new and relocated reciprocating internal combustion engines (RICE) on non-Tribal lands in the State. In December 2008, the Colorado Air Quality Control Commission adopted State-wide retrofit emission controls on existing RICE over 500 horsepower that will result in VOC and NOx reductions. A list of the existing controls on oil and gas sources for Colorado is presented in Table 2-8.

Additionally, the Colorado Oil & Gas Conservation Commission recently adopted State-wide emission control requirements for pneumatic devices in natural gas services and natural gas well completions, which will further reduce VOC emissions from non-Tribal Colorado sources in the San Juan Basin region. As a result, there are few additional emissions control strategies that could be added, and be effective, for relevant emissions points in southwest Colorado. This is an important consideration for recommending that this area of Colorado be designated as attainment for ozone.

Table 2-8: Oil and gas emissions controls in Colorado

State of Colorado Oil and Gas Emissions Controls Requirements
RICE Engine Standards Equivalent to federal NSPS for NOx, VOC and CO on New or Modified engines between 100 to 500 HP after January 1st 2008.
RICE Engine Standards Equivalent to federal NSPS for NOx, VOC and CO on New or Modified engines over 500 HP after July 1st 2007.
90% control requirement on all Glycol Dehydrators with VOC emissions >= 15 tpy after May 1, 2008.
95% control requirement on all Condensate Tanks with VOC emissions >= 20 tpy after May 1, 2008.
Retrofit control requirement (up to $5000 per combined ton of NOx & VOC reduced) on all existing RICE over 500 HP after July 1, 2010.
To be implemented: Colorado Oil and Gas Conservation Commission rules (from House Bill 1341).

Summary Conclusions for Southwest Colorado:

The data and analysis presented in the nine factors provide documentation and compelling evidence supporting a finding that southwest Colorado should be designated as attainment/unclassifiable for the 2008 ozone NAAQS, despite recorded violations of the ozone standard at a nearby monitor in New Mexico. It is important to note that only areas over which Colorado has direct air quality jurisdiction are included in this attainment/unclassifiable finding and recommendation. The Southern Ute Indian Tribe, and the Southern Ute Indian Tribe/State of Colorado Environmental Commission, as well as the Ute Mountain Ute Indian Tribe, are distinct nations or entities and consequently such Tribal lands are specifically excluded from this designation recommendation.

A summary of the reasons for lands in Archuleta, La Plata and Montezuma counties over which Colorado has direct air quality jurisdiction to be designated as attainment/unclassifiable are:

1. Ozone monitoring in Colorado shows attainment of the 2008 NAAQS.
2. Emissions data of ozone precursors indicate that Colorado only contributes a minor amount to the area. Power plants and oil/gas sources in northwest New Mexico are much larger contributors in the area, and control of those emissions are likely to bring the Navajo Lake, New Mexico, monitor into attainment, given that it only exceeded the NAAQS by 2 parts per billion.
3. Oil/gas emissions sources in Colorado are already well controlled, and tighter controls are being implemented, based on recent actions by the Colorado Air Quality Control Commission and Colorado Oil and Gas Conservation Commission.
4. Back-trajectory analyses show significant residence times for air parcels over ozone precursor source areas within New Mexico.
5. Population density, expected population growth and traffic volumes in Colorado are lower than in northwest New Mexico.

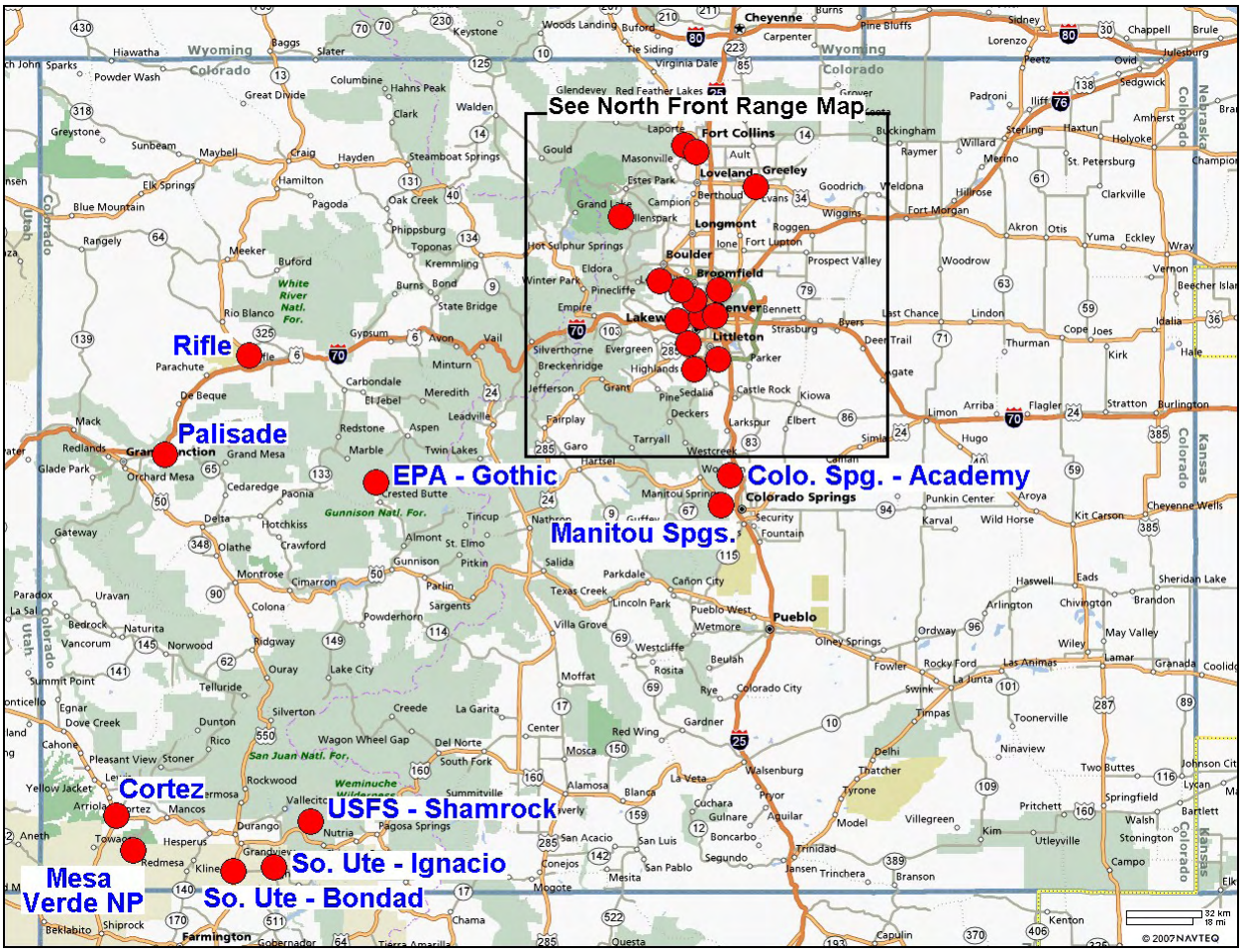
SECTION 3

Remainder of Colorado

SECTION 3: Remainder of Colorado

Map of Ozone Monitor Locations

Figure 3-1: Ozone Monitoring Sites for Areas Outside of the Denver Metro/North Front Range Region



Ozone Monitoring Data from CDPHE and Other Agency Sites:

Table 3-1: Ozone Monitoring Data for Areas Outside of the Denver Metro/North Front Range Region

4th Maximum 8-Hour Ozone Values and 3-Year Averages							
Site Name	**AQS#**	**Year**				**3-Year Average 2005-2007 (ppm)**	**3-Year Average 2006-2008* (ppm)**
		2005 (ppm)	**2006 (ppm)**	**2007 (ppm)**	**2008* (ppm)**		
CDPHE-APCD Sites							
Co. Spg.-Acad.	08-041-0013	0.077	0.072	0.072	0.070	0.073	0.071
Manitou Spgs.	08-041-0016	0.075	0.076	0.072	0.072	0.074	0.073
Rifle	08-045-0012	n/a	n/a	n/a	0.066	n/a	n/a
Palisade	08-077-0020	n/a	n/a	n/a	0.070	n/a	n/a
Cortez	08-083-0006	n/a	n/a	n/a	0.064	n/a	n/a
Other Agency Sites							
Gothic	08-051-????	0.069	0.070	0.065	0.066	0.068	0.067
SUIT-Ignacio	08-067-7001	n/a	n/a	n/a	0.067	n/a	n/a
SUIT-Hwy. 550	08-067-7003	0.066	0.063	0.071	0.067	0.066	0.067
USFS-Shamrock	08-067-????	0.075	0.074	0.069	0.069	0.072	0.070
Mesa Verde NP	08-083-0101	0.076	0.074	0.070	0.069	0.073	0.071
* Note: Data are through October 2008.							

Private Ozone Monitoring Data Following 40 CFR 58 requirements:

EnCana – Canyon site, up Parachute Creek (Garfield County)
Jan. 2007 to current, 4th max 8-hr = 0.068 ppm (only 2007 currently available)

EnCana – Mountain site, by Rio Blanco, north of Rifle (Rio Blanco County)
Jan. 2007 to current, 4th max 8-hr = 0.068 ppm (only 2007 currently available)

Golden Energy Services – Portland, near Florence (Fremont County)
Sept. 2005 to Sept. 2006, 4th max 8-hr = 0.053 ppm

Tri-State Power – Holly, northwest of Holly (Prowers County)
July 2007 to June 2008, 4th max 8-hr = 0.064 ppm

Ozone Monitoring Trends for Areas Outside of the Denver Metro/North Front Range Region:

Figure 3-2: Ozone Monitoring Trends for Southeastern Colorado

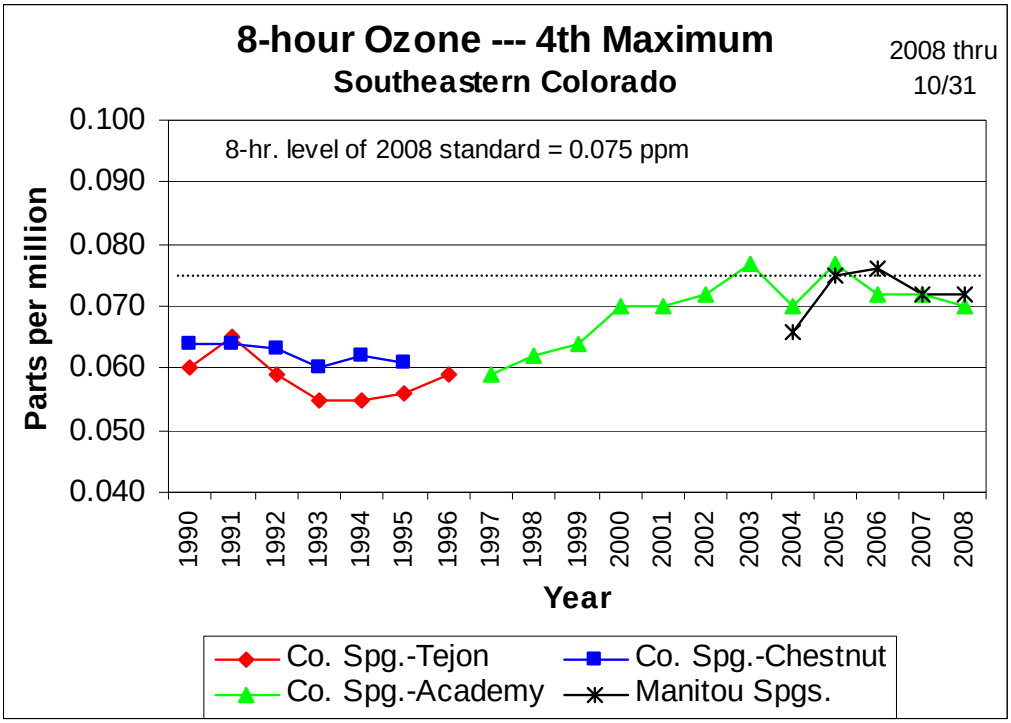
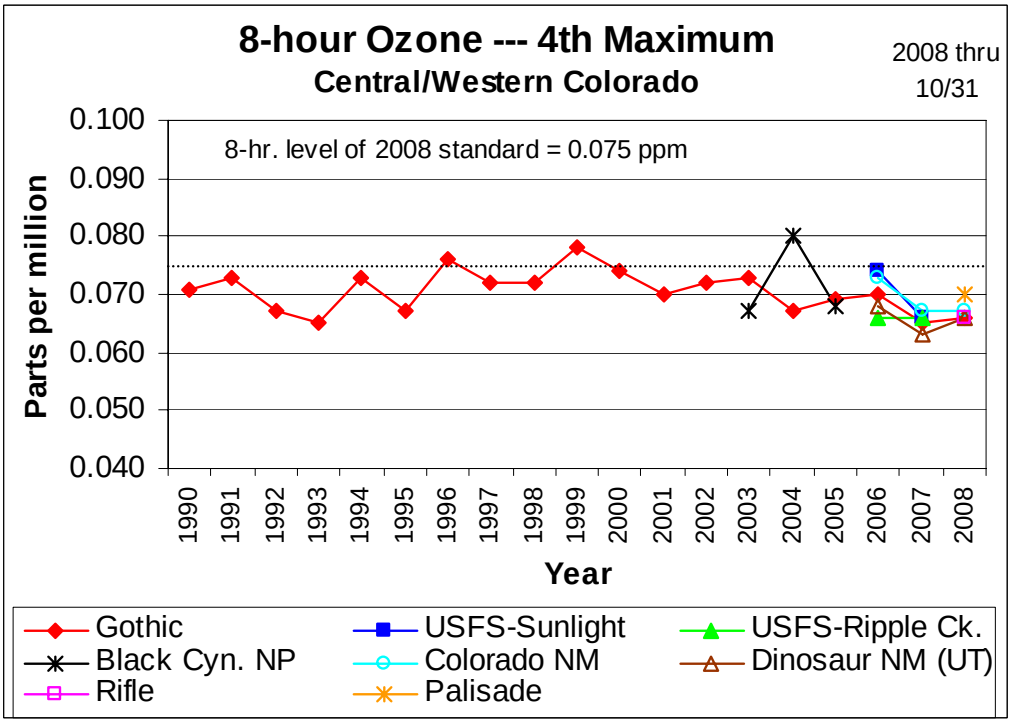


Figure 3-3: Ozone Monitoring Trends for Central/Western Colorado

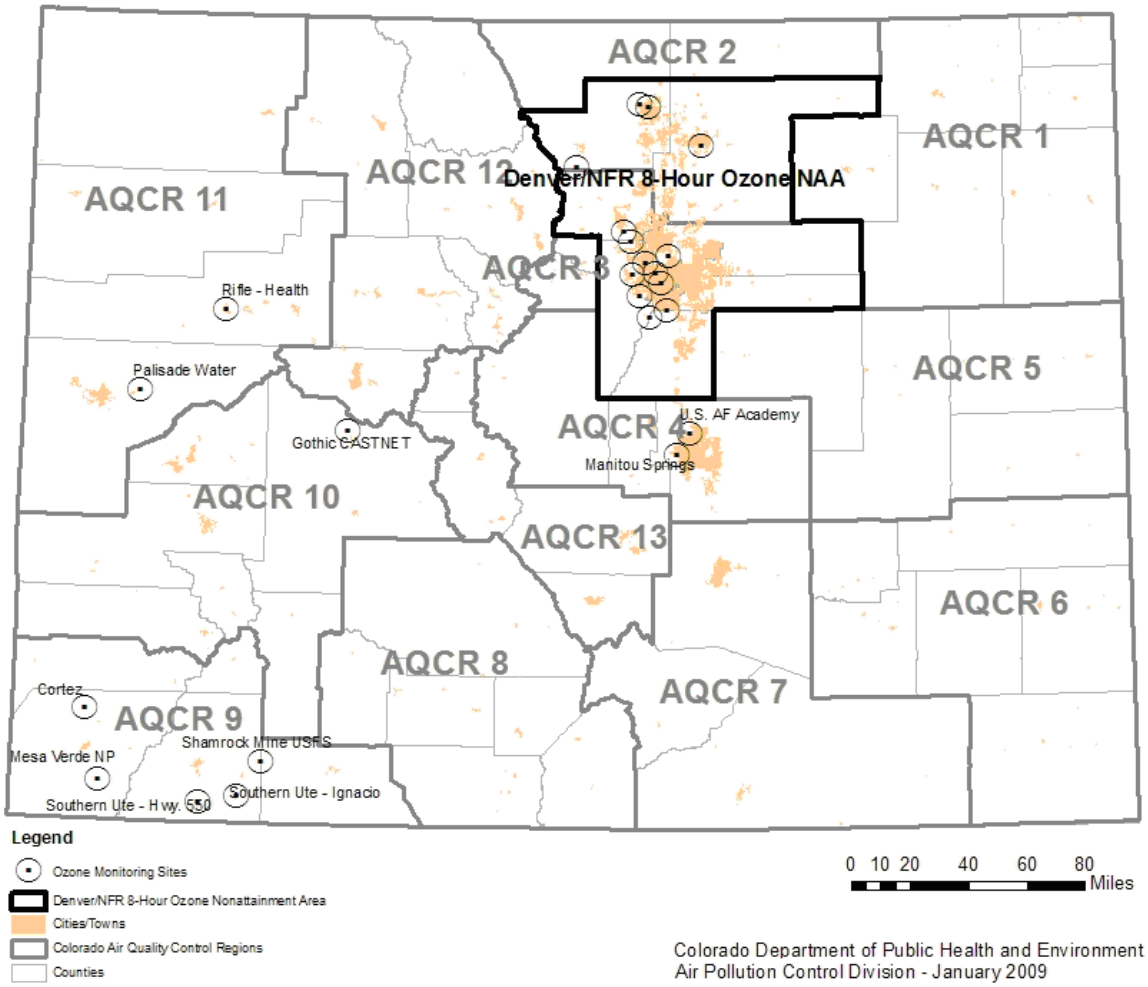


Though there are population centers and emission sources throughout Colorado that can cause or contribute to elevated ozone levels, the State presumes that the rest of the State is attaining the 2008 8-hour ozone standard. This is borne out when reviewing the ambient air monitoring data presented above and examining precursor emissions in the State's air quality control regions.

The Counties that make up AQCRs 4 (Park, Teller, El Paso) and 11 (Mesa, Garfield, Rio Blanco, Moffat) contain the highest ozone precursor emissions in the State, outside of the Denver Metro/North Font Range nonattainment area. Some counties within these AQCRs contain ozone monitors, all of which measure ozone levels below the 2008 8-hour ozone standard. It is therefore reasonable to presume that that if these regions with the greatest amount of emissions are not showing violations of the 2008 ozone standard, counties and AQCRs with less emissions (and without monitoring data) are also likely to be in attainment. Therefore, the State recommends that all counties and AQCR's outside of the Denver Metro/North Font Range nonattainment area be designated as attainment/unclassifiable.

AQCRs and Ozone Monitoring Sites in Colorado:

Figure 3-4: Ozone Monitoring Sites in Colorado



Statewide Ozone Precursor Emissions by County:

In support of our conclusion that the rest of the state should be designated as attainment/unclassifiable, the following figures and table are included that present statewide emissions for VOCs and NOx for each county.

Figure 3-5: 2006 VOC Emissions Map by County

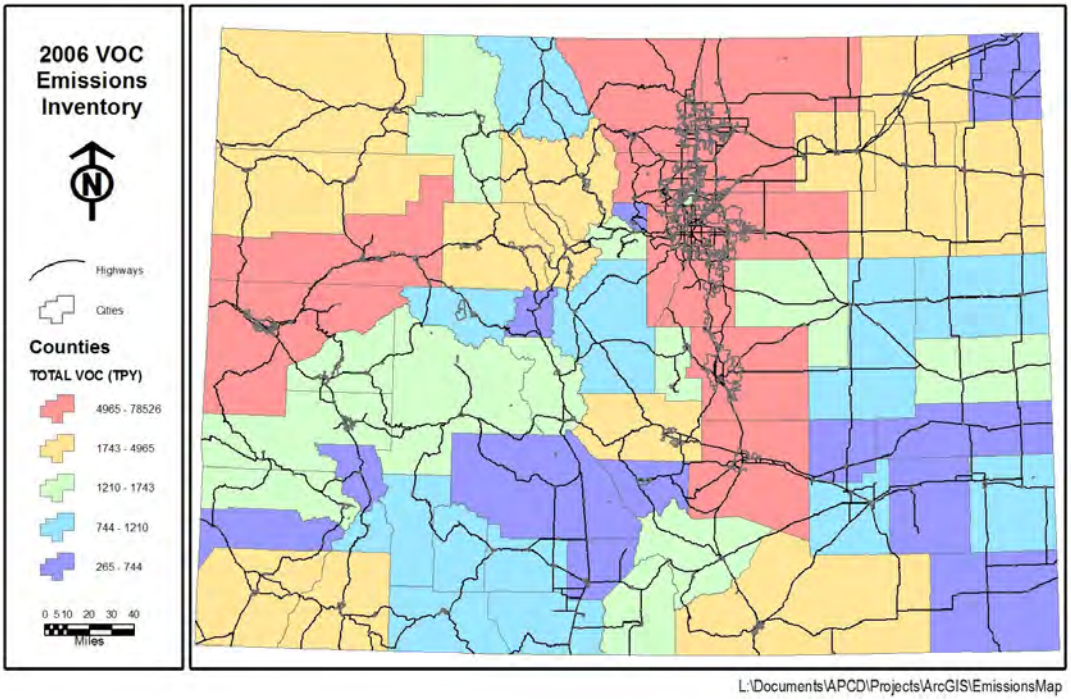


Figure 3-6: 2006 NOx Emissions Map by County

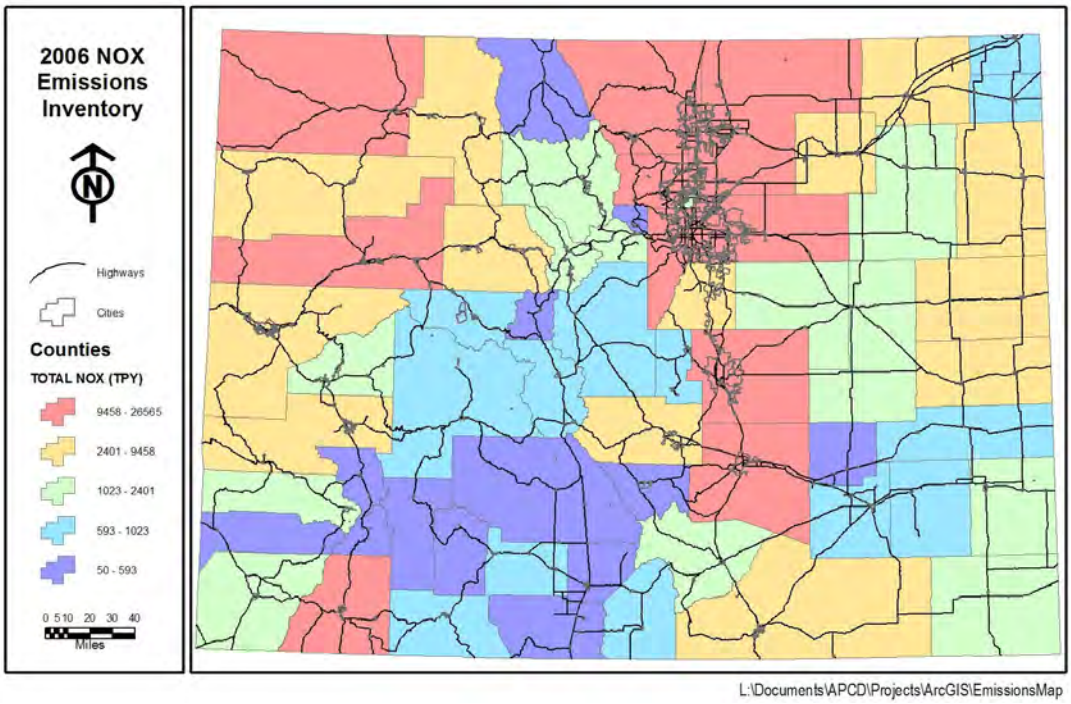


Table 3-2: County-Level Population &Ozone Precursor Emissions by AQCR in Colorado

COUNTY	AQCR	Recommened 8-Hour Ozone Designation	Population [July 2007]	Total 2006 NOx [tpy]	Total 2006 VOC [tpy]	Total Precursors	Precursor Rank
LOGAN	1	Attainment/Unclassifiable	21,879	2,956	2,586	5,543	23
MORGAN	1	Attainment/Unclassifiable	28,573	7,794	2,270	10,065	17
PHILLIPS	1	Attainment/Unclassifiable	4,601	618	265	884	60
SEDGWICK	1	Attainment/Unclassifiable	2,509	876	276	1,153	54
WASHINGTON	1	Attainment/Unclassifiable	4,833	2,078	4,965	7,043	20
YUMA	1	Attainment/Unclassifiable	9,973	4,935	4,909	9,844	18
CLEAR CREEK	3	Attainment/Unclassifiable	9,412	1,768	1,448	3,217	30
GILPIN	3	Attainment/Unclassifiable	5,137	461	309	771	62
EL PASO	4	Attainment/Unclassifiable	587,590	22,378	22,999	45,377	2
PARK	4	Attainment/Unclassifiable	17,005	670	1,210	1,880	44
TELLER	4	Attainment/Unclassifiable	22,883	879	1,287	2,165	39
CHEYENNE	5	Attainment/Unclassifiable	1,995	3,302	1,462	4,764	25
ELBERT	5	Attainment/Unclassifiable	23,092	1,439	1,291	2,731	36
KIT CARSON	5	Attainment/Unclassifiable	8,144	2,724	1,030	3,754	27
LINCOLN	5	Attainment/Unclassifiable	5,722	1,559	990	2,549	38
BACA	6	Attainment/Unclassifiable	4,188	1,377	744	2,121	40
BENT	6	Attainment/Unclassifiable	5,926	908	617	1,525	49
CROWLEY	6	Attainment/Unclassifiable	7,189	304	270	575	64
KIOWA	6	Attainment/Unclassifiable	1,469	770	498	1,268	52
OTERO	6	Attainment/Unclassifiable	19,129	1,023	1,004	2,027	42
PROWERS	6	Attainment/Unclassifiable	13,407	2,401	771	3,172	31
HUERFANO	7	Attainment/Unclassifiable	7,958	1,633	1,223	2,855	34
LAS ANIMAS	7	Attainment/Unclassifiable	16,568	5,640	2,151	7,792	19
PUEBLO	7	Attainment/Unclassifiable	155,723	14,077	6,540	20,618	11
ALAMOSA	8	Attainment/Unclassifiable	15,760	593	661	1,254	53
CONEJOS	8	Attainment/Unclassifiable	8,388	587	986	1,573	47
COSTILLA	8	Attainment/Unclassifiable	3,548	702	1,398	2,101	41
MINERAL	8	Attainment/Unclassifiable	993	281	1,072	1,353	50
RIO GRANDE	8	Attainment/Unclassifiable	12,594	625	906	1,530	48
SAGUACHE	8	Attainment/Unclassifiable	6,921	528	573	1,101	57
ARCHULETA	9	Attainment/Unclassifiable	12,625	637	955	1,592	45
DOLORES	9	Attainment/Unclassifiable	1,937	457	670	1,127	56
LA PLATA	9	Attainment/Unclassifiable	49,758	9,864	4,941	14,806	13
MONTEZUMA	9	Attainment/Unclassifiable	25,561	1,647	2,222	3,869	26
SAN JUAN	9	Attainment/Unclassifiable	571	97	1,207	1,304	51
DELTA	10	Attainment/Unclassifiable	30,959	1,202	1,671	2,873	33
GUNNISON	10	Attainment/Unclassifiable	15,048	1,013	1,585	2,598	37
HINSDALE	10	Attainment/Unclassifiable	870	50	1,008	1,058	59
MONTROSE	10	Attainment/Unclassifiable	40,263	3,134	1,741	4,875	24
OURAY	10	Attainment/Unclassifiable	4,510	405	676	1,080	58
SAN MIGUEL	10	Attainment/Unclassifiable	7,684	1,106	1,743	2,849	35
GARFIELD	11	Attainment/Unclassifiable	55,063	13,682	21,490	35,172	5
MESA	11	Attainment/Unclassifiable	140,416	7,803	7,040	14,843	12
MOFFAT	11	Attainment/Unclassifiable	13,928	19,448	3,166	22,614	8
RIO BLANCO	11	Attainment/Unclassifiable	6,434	5,467	4,837	10,304	16
EAGLE	12	Attainment/Unclassifiable	52,532	3,456	3,217	6,673	22
GRAND	12	Attainment/Unclassifiable	14,383	1,540	1,745	3,285	29
JACKSON	12	Attainment/Unclassifiable	1,476	263	885	1,149	55
PITKIN	12	Attainment/Unclassifiable	16,607	615	970	1,585	46
ROUTT	12	Attainment/Unclassifiable	23,060	9,458	1,467	10,925	15
SUMMIT	12	Attainment/Unclassifiable	28,611	1,485	1,917	3,402	28
CHAFFEE	13	Attainment/Unclassifiable	16,942	660	1,347	2,007	43
CUSTER	13	Attainment/Unclassifiable	4,100	197	521	719	63
FREMONT	13	Attainment/Unclassifiable	48,005	4,747	2,055	6,802	21
LAKE	13	Attainment/Unclassifiable	8,190	231	580	811	61
ADAMS	NAA	Non-Attainment	424,379	26,565	17,309	43,874	3
ARAPAHOE	NAA	Non-Attainment	551,733	11,928	14,402	26,329	7
BOULDER	NAA	Non-Attainment	294,654	11,491	10,129	21,620	10
BROOMFIELD	NAA	Non-Attainment	53,691	1,358	1,552	2,911	32
DENVER	NAA	Non-Attainment	596,582	19,845	17,509	37,354	4
DOUGLAS	NAA	Non-Attainment	275,121	7,306	7,256	14,562	14
JEFFERSON	NAA	Non-Attainment	538,323	14,051	17,566	31,616	6
LARIMER	NAA	Non-Attainment	288,244	10,916	11,035	21,951	9
WELD	NAA	Non-Attainment	244,515	25,395	78,526	103,922	1
			4,919,884	Top 5 Emissions	Top 5 Emissions	Top 5 Emissions	

Summary Conclusions for Remainder of Colorado:

The State recommends that the remainder of the State be designated as attainment/unclassifiable for the revised 8-hour ozone standard. This recommendation is based on (1) monitoring information that indicates compliance with the revised standard (see Figures 3-1 through 3-3), (2) relatively low population levels (see Table 3-2), and (3) precursor emission levels that are presumed to not result in violations of the 2008 8-hour ozone standard.