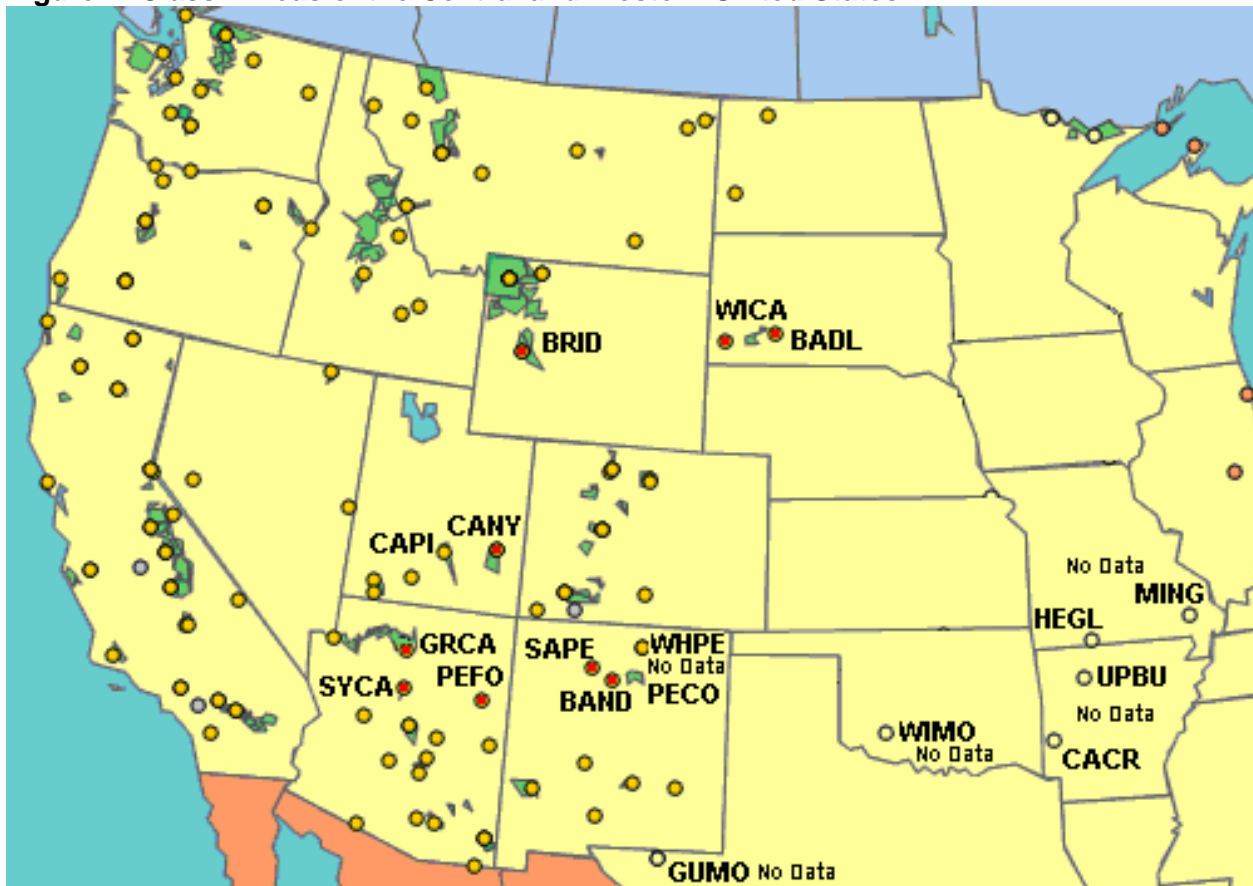


## Analysis of Colorado visibility impacts on nearby Class I Areas

The below map (Figure 1) provides a four letter abbreviation to the Class I Areas that are nearby to Colorado. Class I areas to the east of us are fairly distant and the Western Regional Air Partnership (WRAP) does not have Particulate Matter Source Apportionment Technology (PSAT) modeling available. Until such modeling is available, it is difficult to predict our impact on these areas, but given the distances involved is safe to assume that only the Wichita Mountains National Wildlife Refuge (WIMO) site may experience some relatively minor impact from Colorado. The Wheeler Peak (WHPE) and Pecos (PECO) Wilderness Areas also do not have PSAT modeling but it is reasonable to assume that the PSAT results for SAPE and BAND should be similar.

**Figure 1: Class I Areas of the Central and Western United States**



The Class I Areas (CIAs) denoted with a red dot were evaluated for Colorado impacts that are discussed below. It is assumed that only the nearby out-of-state Class I areas with red circles are noticeably impacted by Colorado which is supported by the PSAT modeling for the CIAs more distant from the State.

The below listed PSAT modeling summary tables for sulfate (Table 1) and nitrate (Table 2) indicate the Colorado visibility impacts in percent and the relative rank. For purposes of identifying Colorado visibility impacts that may be of concern to surrounding States, the Division proposes a threshold criterion to include  $\geq 5.0\%$  or a ranking in the top 5 among source regions. In the below tables, all Colorado visibility impacts satisfying these criterion are shaded in purple.

**Table 1: PM Source Apportionment Technology (PSAT) Modeling Results for Sulfate**

			Colorado Impact							
			Sulfate							
			Best Days				Worst Days			
			2002		2018		2002		2018	
Class I Area	CIA Code	State	Impact	Rank	Impact	Rank	Impact	Rank	Impact	Rank
Petrified Forest National Park	PEFO1	AZ	0.4%	16	0.2%	16	1.3%	11	1.0%	12
Grand Canyon National Park	GRCA2	AZ	0.5%	18	0.3%	17	0.9%	15	0.7%	15
Sycamore Canyon Wilderness	SYCA1	AZ	0.3%	16	0.0%	16	0.8%	11	0.5%	12
San Pedro Parks Wilderness	SAPE1	NM	4.3%	5	3.4%	6	1.4%	12	1.2%	13
Bandelier National Monument	BAND1	NM	3.3%	8	2.6%	8	1.5%	12	1.3%	12
Wind Cave National Park	WICA1	SD	1.9%	11	1.1%	12	3.3%	7	3.1%	7
Badlands National Park	BADL1	SD	0.8%	12	0.4%	14	2.1%	10	2.2%	10
Canyonlands National Park	CANY1	UT	2.0%	10	1.2%	12	3.4%	9	2.3%	10
Bridger Wilderness	BRID1	WY	0.0%	17	0.0%	17	0.7%	18	0.5%	18

**Note: Colorado Impacts to nearby Class I Areas >= 5.0% or in the top 5 ranking are shaded in purple**

**Table 2: PM Source Apportionment Technology (PSAT) Modeling Results for Nitrate**

			Colorado Impact							
			Nitrate							
			Best Days				Worst Days			
			2002		2018		2002		2018	
Class I Area	CIA Code	State	Impact	Rank	Impact	Rank	Impact	Rank	Impact	Rank
Petrified Forest National Park	PEFO1	AZ	1.3%	10	1.5%	10	0.0%	11	0.9%	9
Grand Canyon National Park	GRCA2	AZ	1.1%	13	1.2%	11	0.0%	13	0.0%	10
Sycamore Canyon Wilderness	SYCA1	AZ	0.5%	10	0.6%	10	1.3%	11	1.6%	9
San Pedro Parks Wilderness	SAPE1	NM	7.7%	4	7.5%	4	2.7%	8	2.4%	7
Bandelier National Monument	BAND1	NM	6.4%	5	6.3%	5	4.8%	7	5.1%	5
Wind Cave National Park	WICA1	SD	2.8%	10	2.5%	9	5.0%	8	4.1%	8
Badlands National Park	BADL1	SD	2.8%	10	2.6%	8	3.0%	8	2.6%	8
Canyonlands National Park	CANY1	UT	4.6%	4	4.1%	5	6.9%	5	6.9%	6
Bridger Wilderness	BRID1	WY	0.3%	13	0.2%	14	0.6%	16	0.0%	16

**Note: Colorado Impacts to nearby Class I Areas >= 5.0% or in the top 5 ranking are shaded in purple**

For Arizona, the Colorado visibility impacts were evaluated on the three nearest Class I areas including Petrified Forest National Park (PEFO), Sycamore Canyon Wilderness Area (SYCA) and Grand Canyon National Park (GRCA). The single largest Colorado visibility impact identified (1.6% nitrate) occurs at SYCA in 2018. This level of impact is not considered to a significant contributor to visibility degradation thus the Division has determined that no further evaluation of the remaining Arizona Class I areas is necessary considering the relative distance from Colorado.

For New Mexico, the Colorado visibility impacts were evaluated for the two nearest Class I areas with PSAT modeling. As indicated in purple shading, the Colorado impacts to the SAPE site exceeded the threshold criteria on the best days for both sulfate and nitrate. The SAPE sulfate impact on the best days in 2002 appears to be mitigated based on the PSAT modeling projections for 2018. The Colorado visibility impacts at the BAND site exceeded the threshold criteria for nitrate on both the best and worst days. As mentioned above, the Wheeler Peak Wilderness (WHPE) is expected to have similar or perhaps slightly higher impacts (due to closer

proximity) as the BAND and SAPE sites. The Pecos Wilderness (PECO) is south of WHPE on a latitude between BAND and SAPE, so the visibility impacts should be very similar to these areas.

For South Dakota, the Colorado visibility impacts were evaluated for both Class I areas – Wind Cave National Park (WICA) and Badlands National Park (BADL). The WICA site experiences a Colorado visibility impact exceeding the threshold criteria for nitrate on the worst days in 2002 but this impact appears to be mitigated based on the PSAT model projections for 2018. Thus the Division has determined that no further technical evaluation of Colorado visibility impacts is necessary.

For Utah, the Colorado visibility impact was evaluated for the nearest Class I area – Canyonlands National Park (CANY). Further to the west is Capitol Reef National Park (CAPI) but this site currently does not have PSAT Modeling available, thus no attribution analysis was performed. Since the CAPI site is west of the CANY site, it reasonable to assume the any Colorado visibility impacts would be lower. Looking at the PSAT analysis for the CANY site, Colorado has visibility impacts exceeding the threshold criterion for nitrate on the best and worst days.

For Wyoming, the Colorado visibility impact was evaluated for the nearest Class I area - Bridger Wilderness (BRID). The single largest Colorado visibility impact identified (0.7% sulfate) occurs on the worst days at BRID in 2002. This level of impact is not considered to a significant contributor to visibility degradation thus the Division has determined that no further evaluation of the remaining Wyoming Class I areas is necessary considering the relative distance from Colorado.

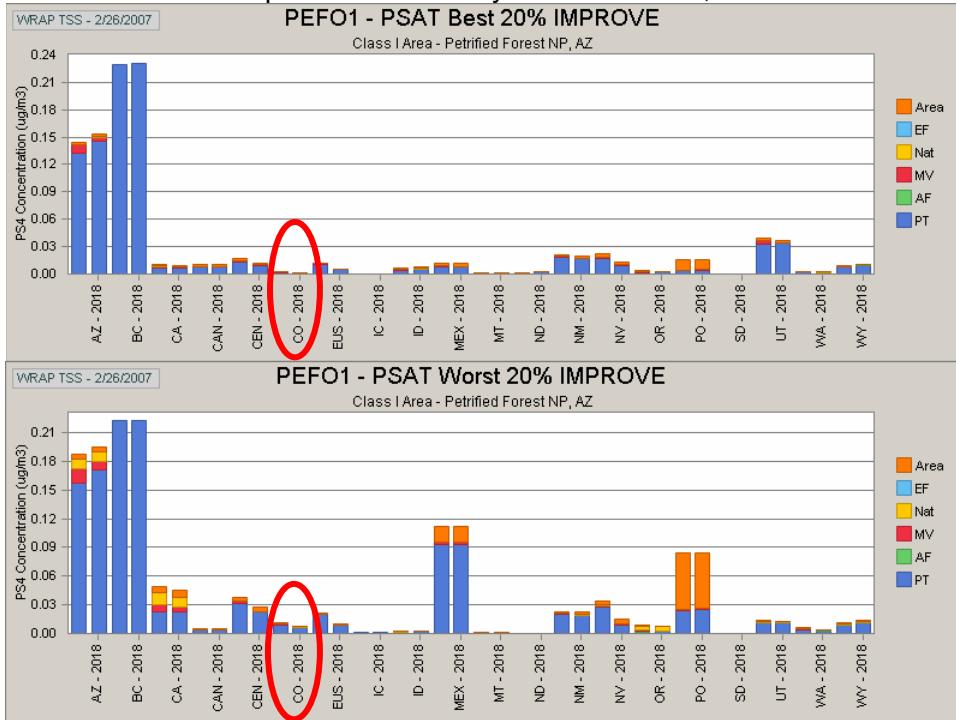
In summary, the Division has identified nitrate visibility impacts of concern at four New Mexico Class I areas (BAND, SAPE, PECO & WHPE) and the Canyonlands National Park (CANY) in Utah. These visibility impacts are at or slightly above the arbitrary threshold criteria established by the Division. The Western Regional Air Partnership (WRAP) Implementation Working Group (IWG) has not formally established threshold criteria on interstate Class I area impacts but an informal threshold of 10% has been suggested among member states. If the Division were to utilize the informal threshold criteria of the WRAP IWG, Colorado would have no visibility impacts on nearby Class I areas exceeding the 10% threshold.

# COLORADO VISIBILITY IMPACTS ON ARIZONA

## Petrified Forest National Park (PEFO) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 0.4%; 2018 = 0.2%

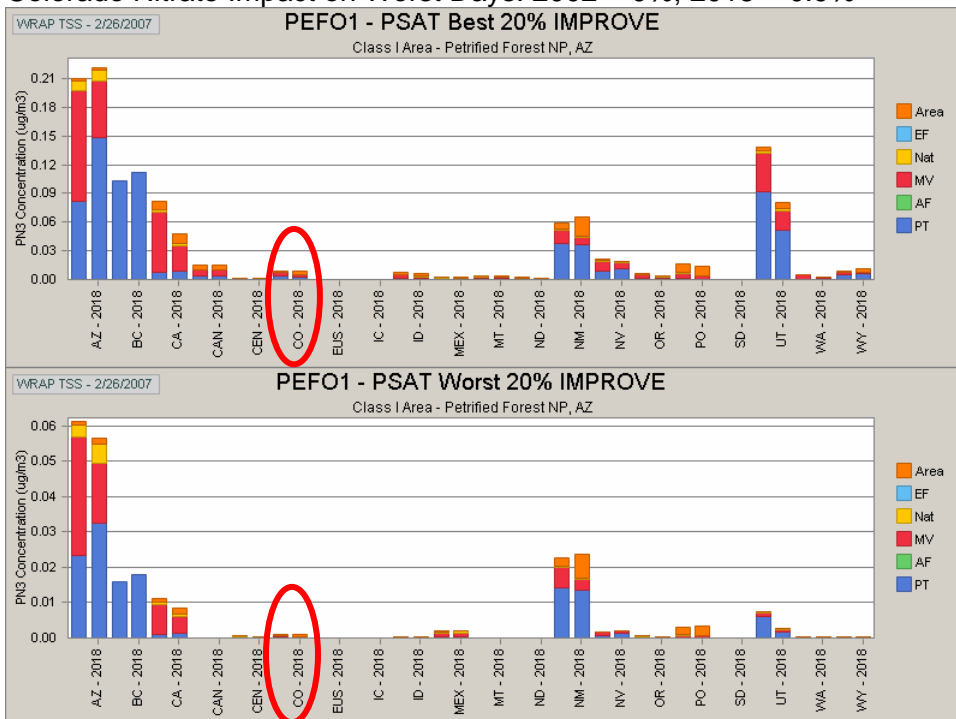
Colorado Sulfate Impact on Worst Days: 2002 = 1.3%; 2018 = 1.0%



## Petrified Forest National Park (PEFO) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 1.3%; 2018 = 1.5%

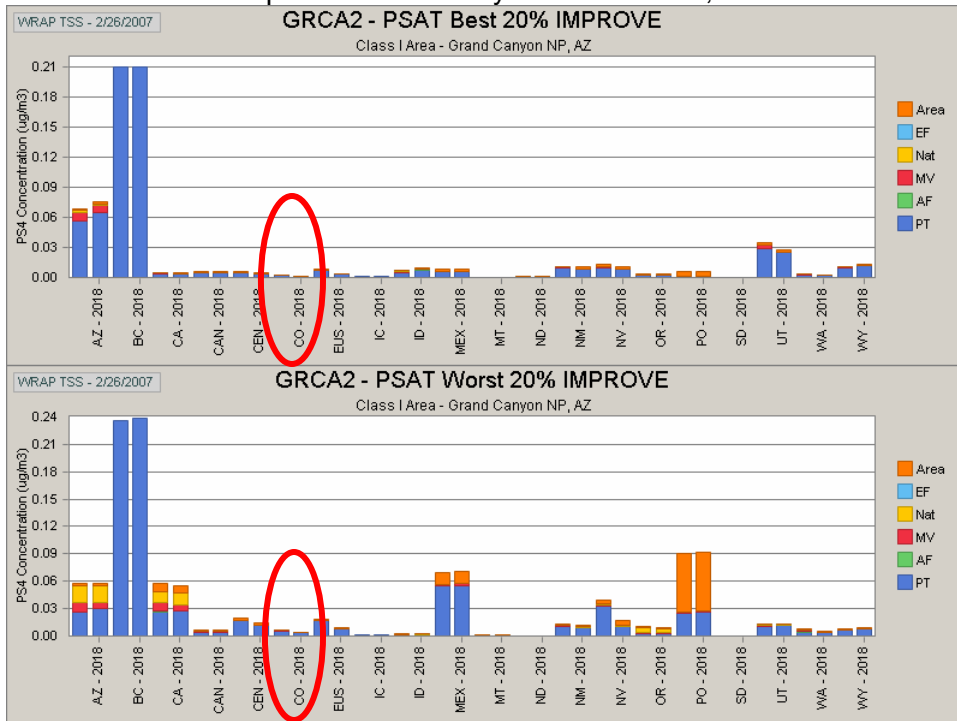
Colorado Nitrate Impact on Worst Days: 2002 = 0%; 2018 = 0.9%



### Grand Canyon National Park (GRCA) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 0.5%; 2018 = 0.3%

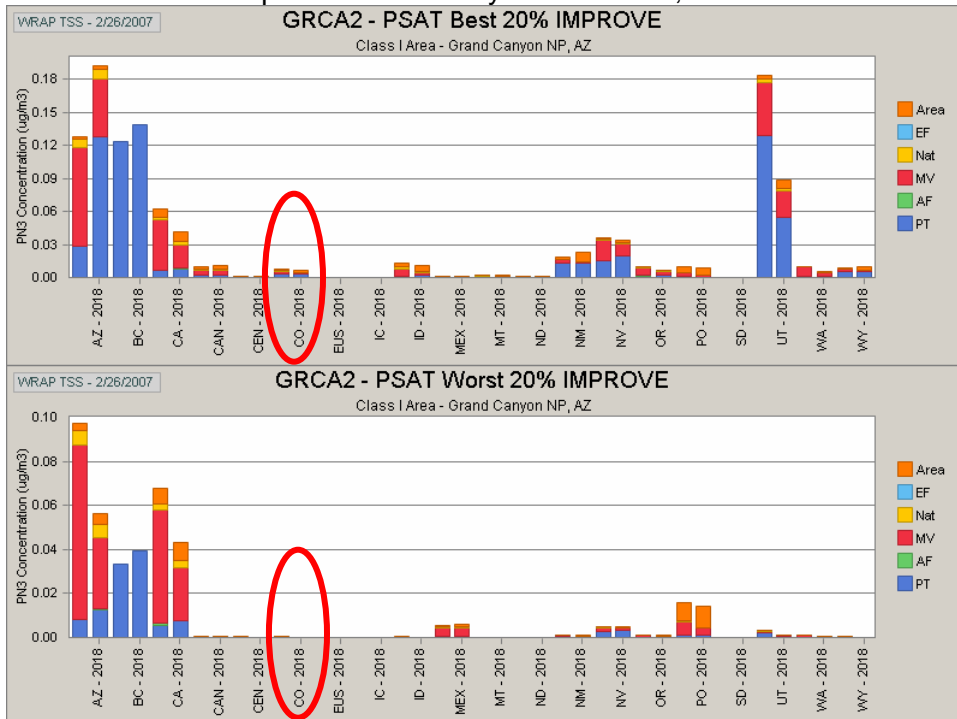
Colorado Sulfate Impact on Worst Days: 2002 = 0.9%; 2018 = 0.7%



### Grand Canyon National Park (GRCA) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 1.1%; 2018 = 1.2%

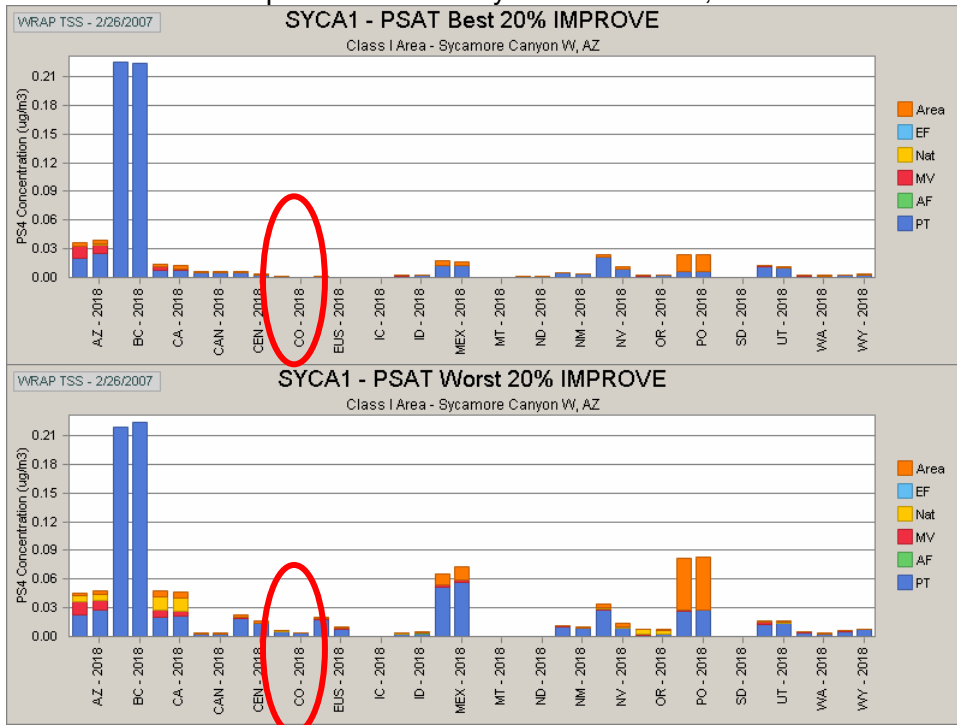
Colorado Nitrate Impact on Worst Days: 2002 = 0%; 2018 = 0%



### Sycamore Canyon Wilderness (SYCA) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 0.3%; 2018 = 0%

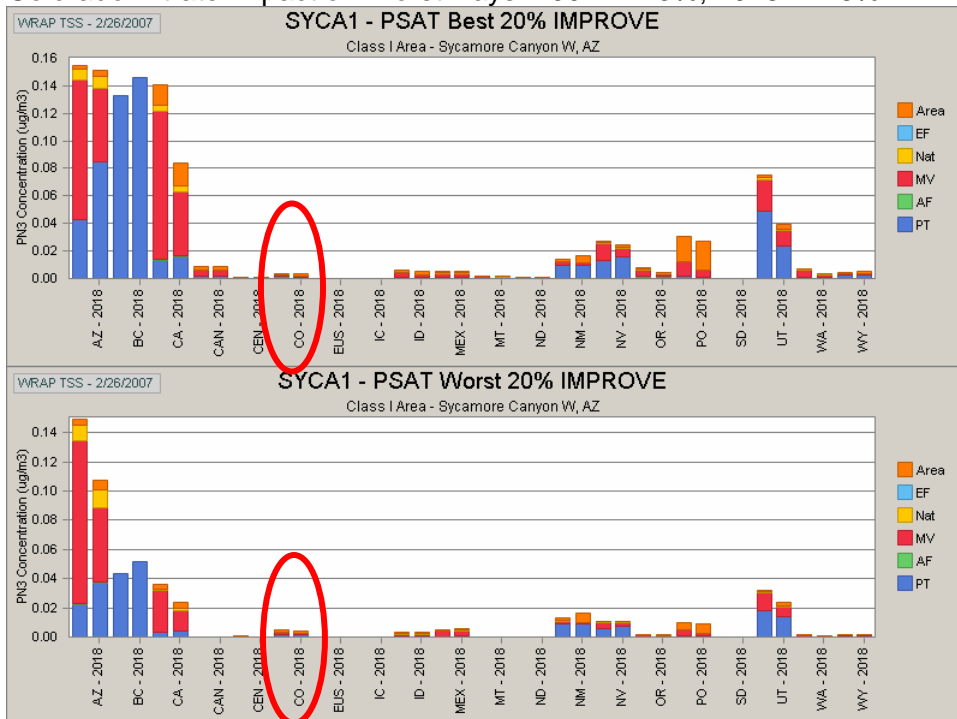
Colorado Sulfate Impact on Worst Days: 2002 = 0.8%; 2018 = 0.5%



### Sycamore Canyon Wilderness (SYCA) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 0.5%; 2018 = 0.6%

Colorado Nitrate Impact on Worst Days: 2002 = 1.3%; 2018 = 1.6%

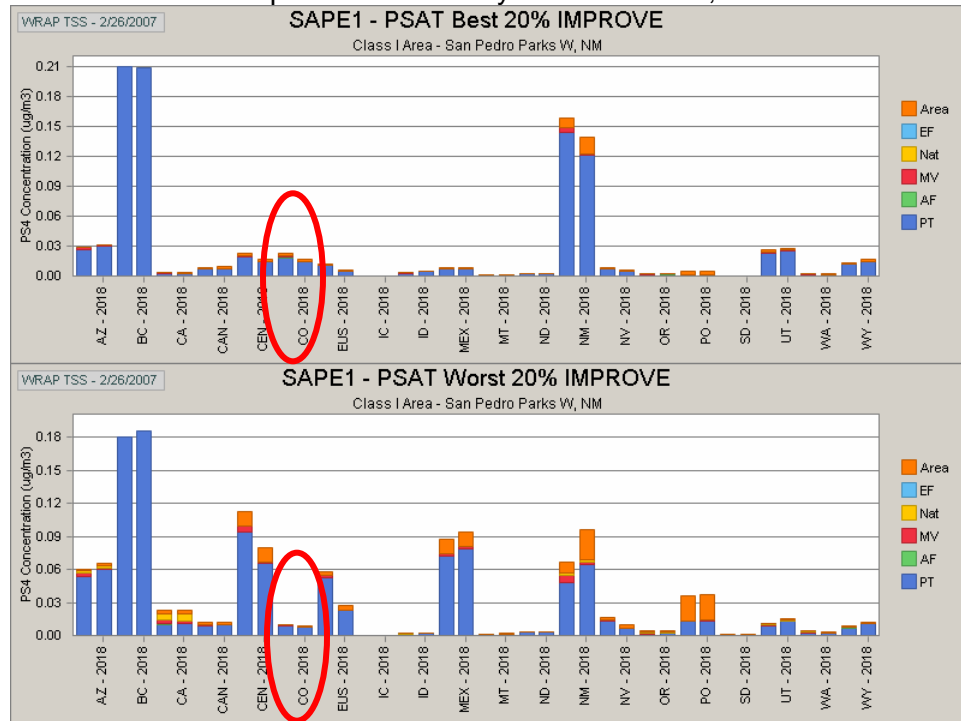


## COLORADO VISIBILITY IMPACTS ON NEW MEXICO

### San Pedro Parks Wilderness (SAPE) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 4.3%; 2018 = 3.4%

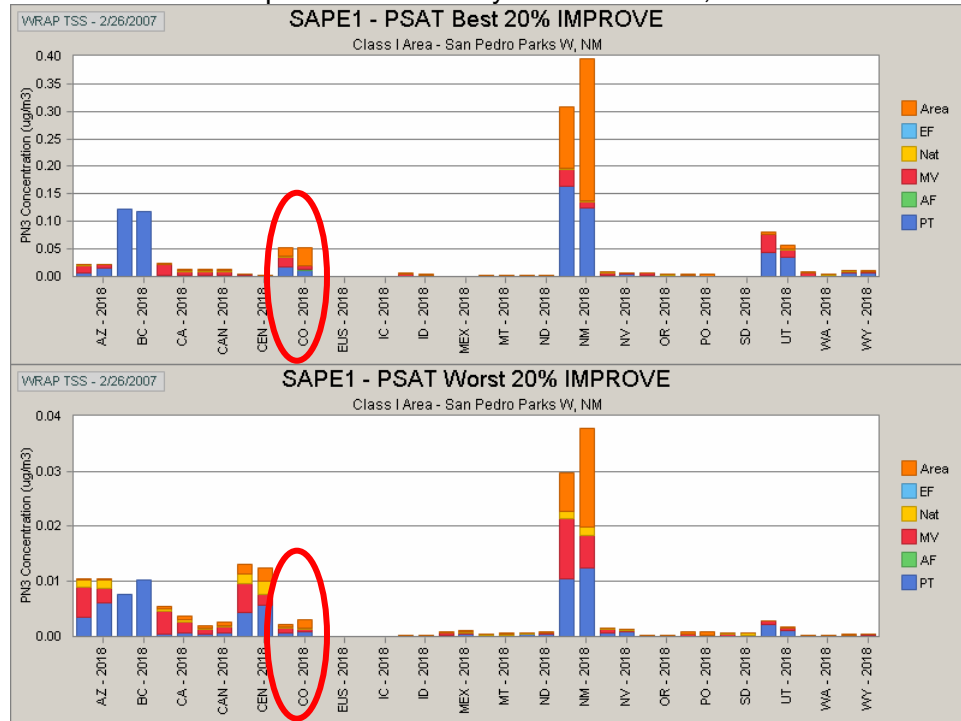
Colorado Sulfate Impact on Worst Days: 2002 = 1.4%; 2018 = 1.2%



### San Pedro Parks Wilderness (SAPE) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 7.7%; 2018 = 7.5%

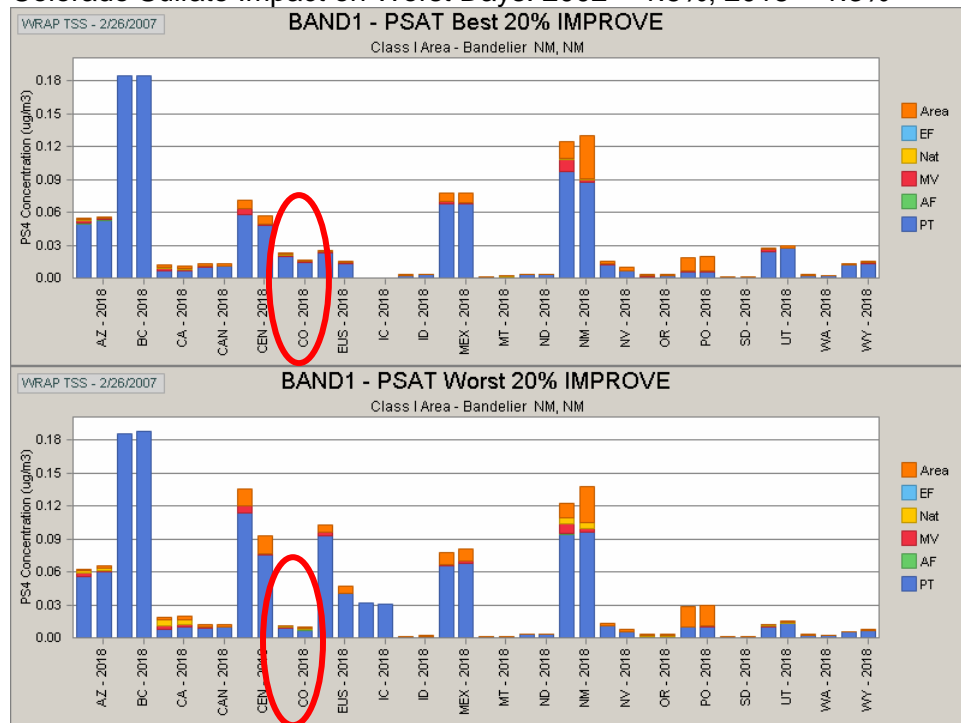
Colorado Nitrate Impact on Worst Days: 2002 = 2.7%; 2018 = 2.4%



### Bandelier National Monument (BAND) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 3.3%; 2018 = 2.6%

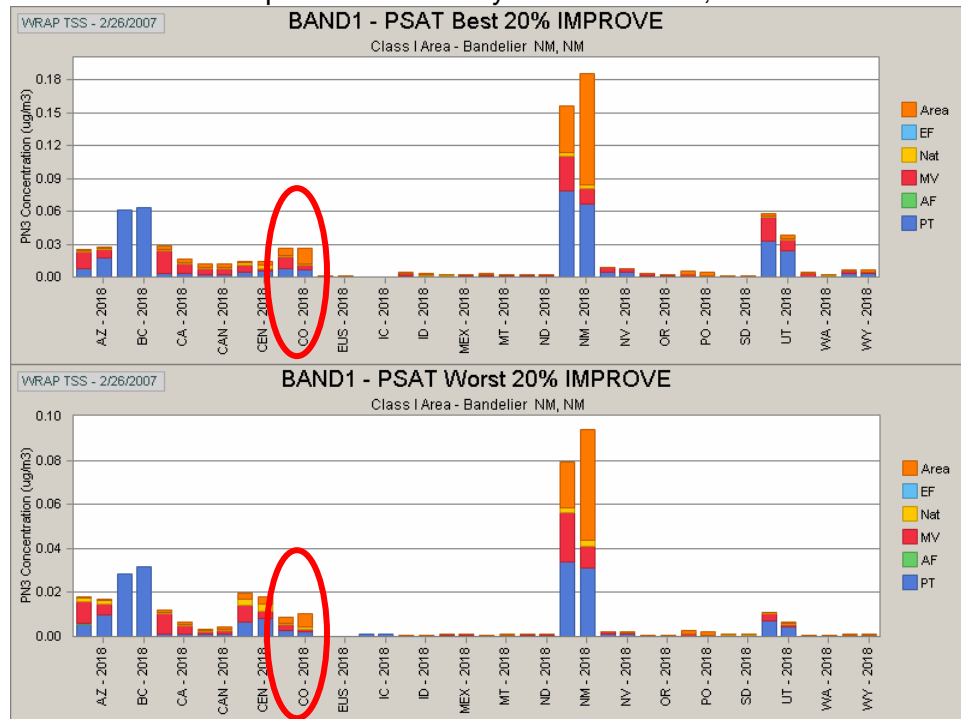
Colorado Sulfate Impact on Worst Days: 2002 = 1.5%; 2018 = 1.3%



### Bandelier National Monument (BAND) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 6.4%; 2018 = 6.3%

Colorado Nitrate Impact on Worst Days: 2002 = 4.8%; 2018 = 5.1%

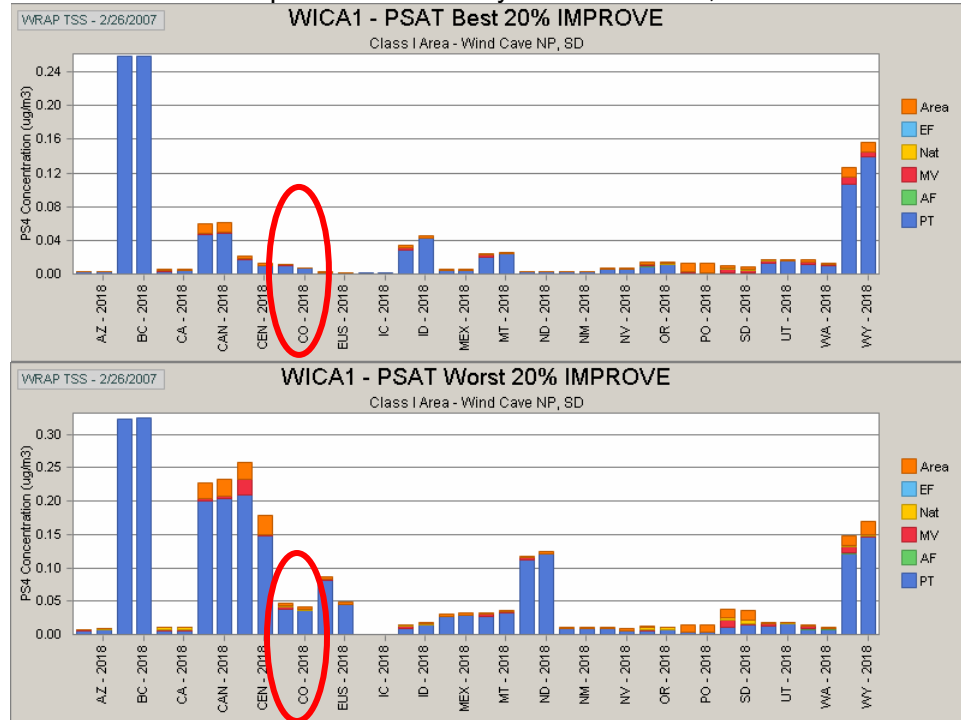


# COLORADO VISIBILITY IMPACTS ON SOUTH DAKOTA

## Wind Cave National Park (WICA) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 1.9%; 2018 = 1.1%

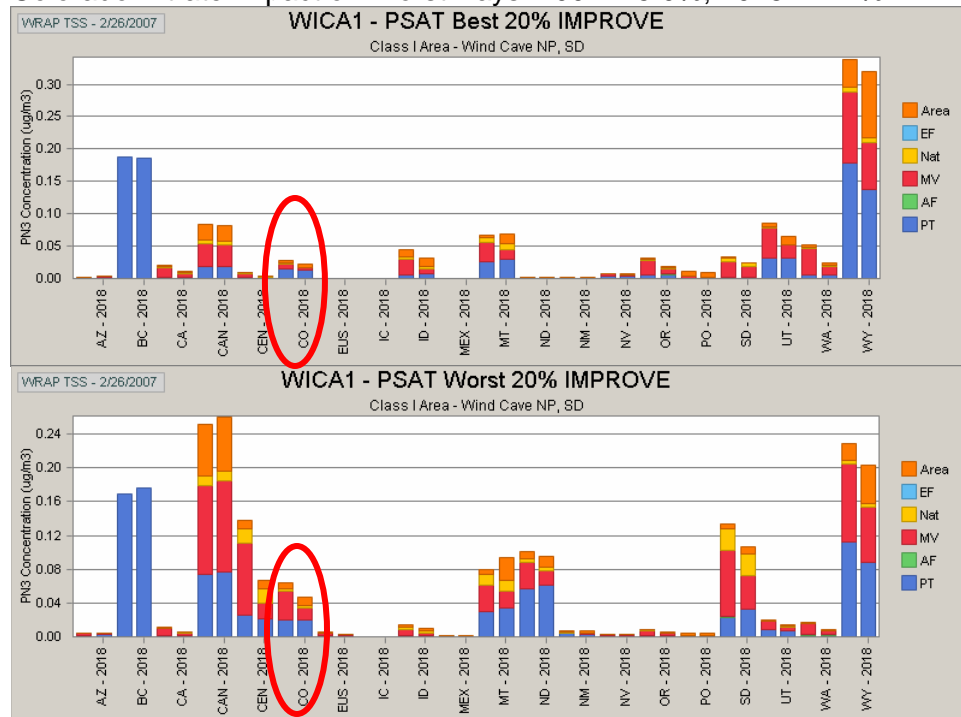
Colorado Sulfate Impact on Worst Days: 2002 = 3.3%; 2018 = 3.1%



## Wind Cave National Park (WICA) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 2.8%; 2018 = 2.5%

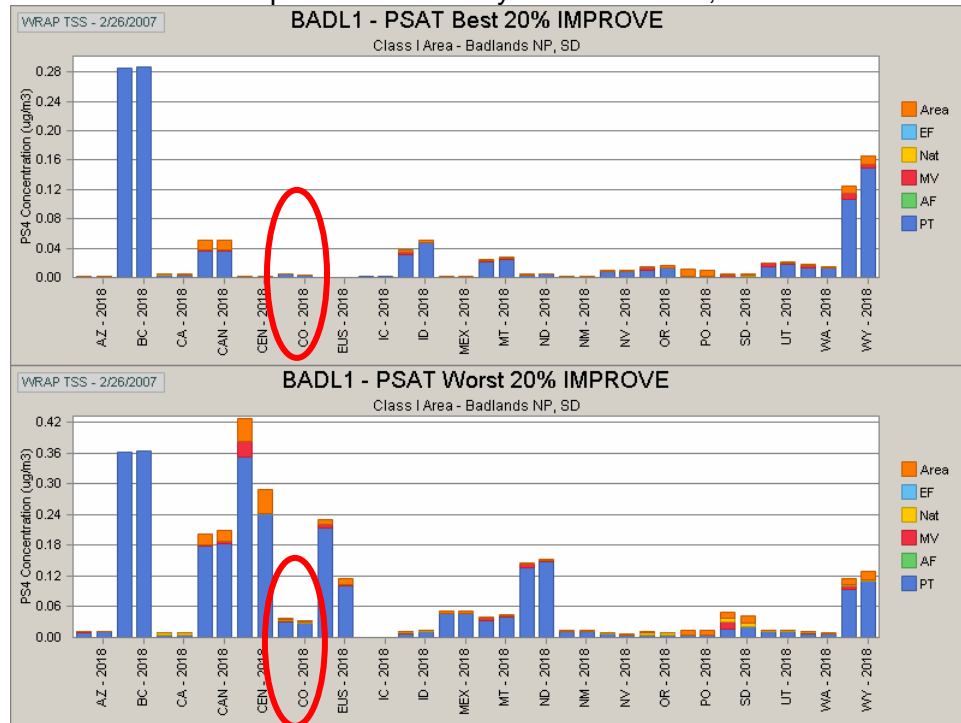
Colorado Nitrate Impact on Worst Days: 2002 = 5.0%; 2018 = 4.1%



### Badlands National Park (BADL) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 0.8%; 2018 = 0.4%

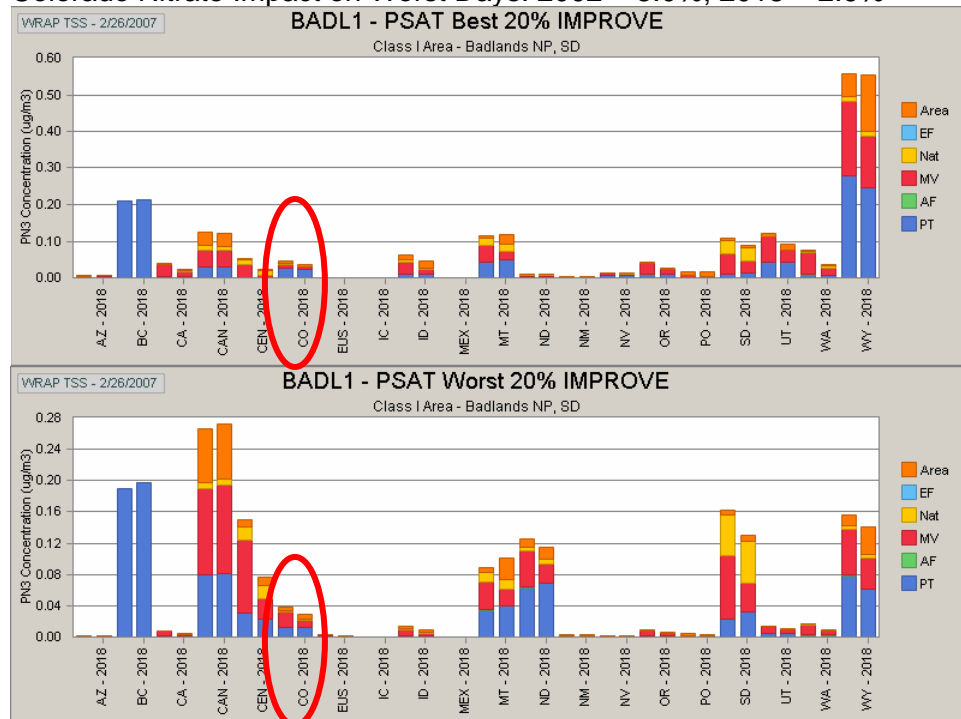
Colorado Sulfate Impact on Worst Days: 2002 = 2.1%; 2018 = 2.2%



### Badlands National Park (BADL) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 2.8%; 2018 = 2.6%

Colorado Nitrate Impact on Worst Days: 2002 = 3.0%; 2018 = 2.6%

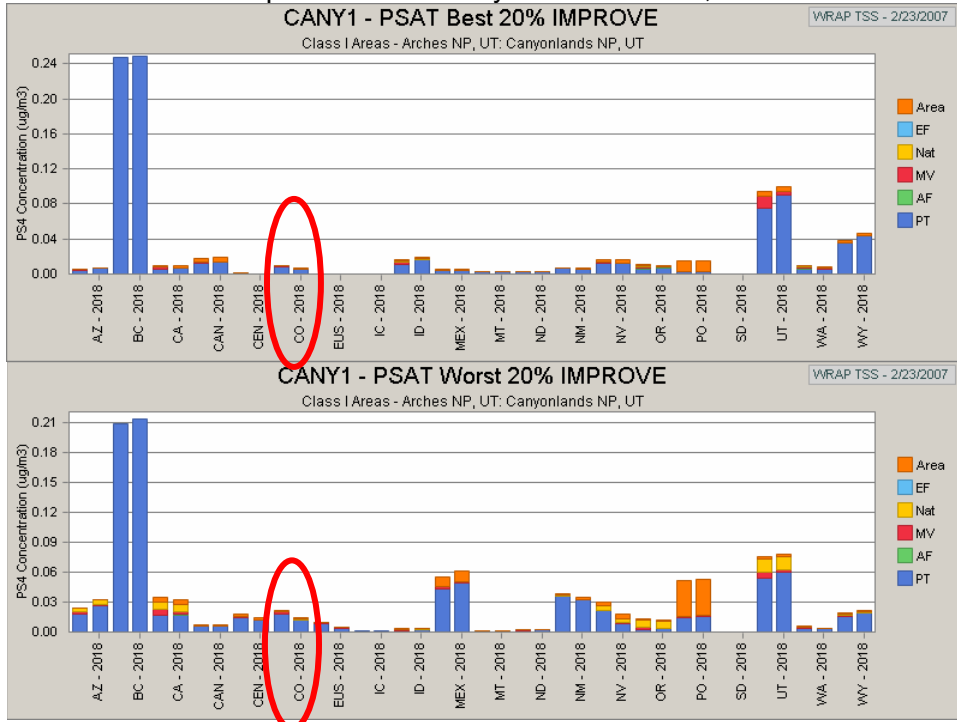


# COLORADO VISIBILITY IMPACTS ON UTAH

## Canyonlands National Park (CANY) - PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 2.0%; 2018 = 1.2%

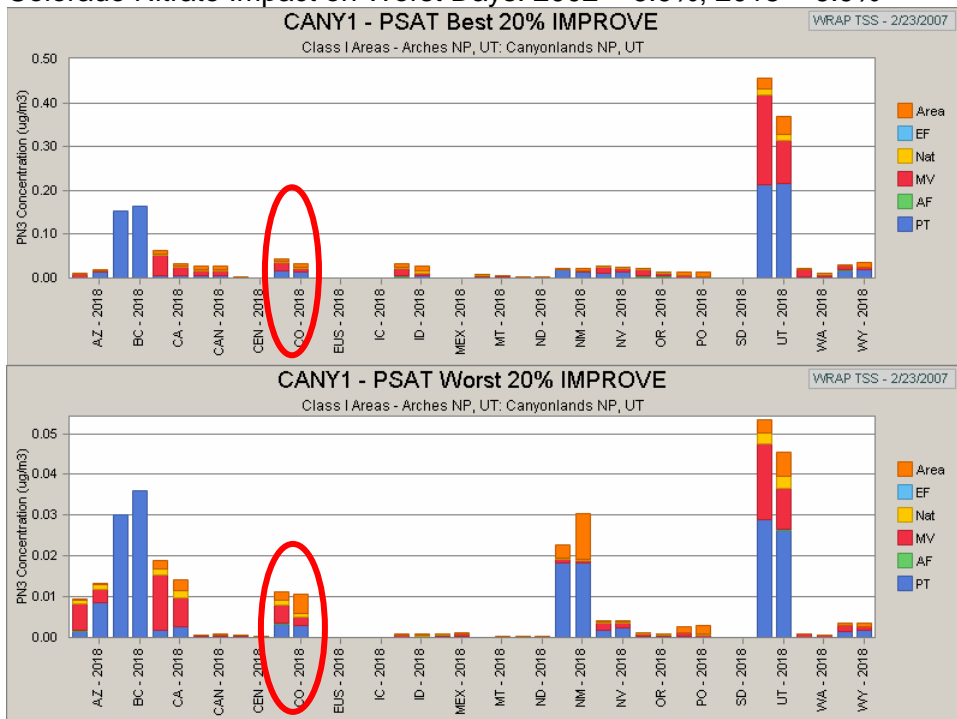
Colorado Sulfate Impact on Worst Days: 2002 = 3.4%; 2018 = 2.3%



## Canyonlands National Park (CANY) - PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 4.6%; 2018 = 4.1%

Colorado Nitrate Impact on Worst Days: 2002 = 6.9%; 2018 = 6.9%



**Capital Reef National Park (CAPI)- PSAT Modeling for PS4 (sulfate)**

Colorado Sulfate Impact on Best Days: No PSAT analysis available

Colorado Sulfate Impact on Worst Days: No PSAT analysis available

**Capital Reef National Park (CAPI)- PSAT Modeling for PN3 (nitrate)**

Colorado Sulfate Impact on Best Days: No PSAT analysis available

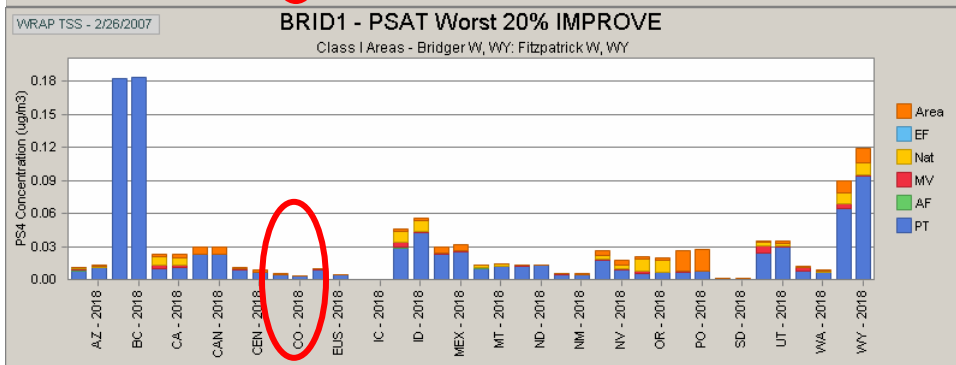
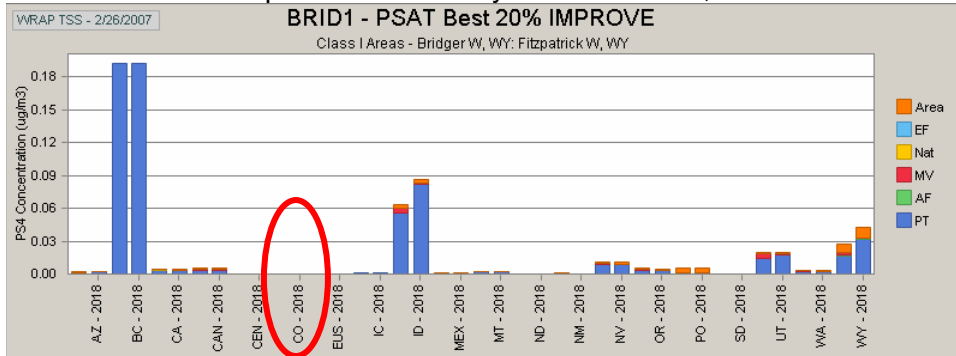
Colorado Sulfate Impact on Worst Days: No PSAT analysis available

# COLORADO VISIBILITY IMPACTS ON WYOMING

## Bridger Wilderness Area (BRID)- PSAT Modeling for PS4 (sulfate)

Colorado Sulfate Impact on Best Days: 2002 = 0.0%; 2018 = 0.0%

Colorado Sulfate Impact on Worst Days: 2002 = 0.7%; 2018 = 0.5%



## Bridger Wilderness Area (BRID)- PSAT Modeling for PN3 (nitrate)

Colorado Nitrate Impact on Best Days: 2002 = 0.3%; 2018 = 0.2%

Colorado Nitrate Impact on Worst Days: 2002 = 0.6%; 2018 = 0%

