CAPCOG Ozone Monitoring Network Review for 2018 Monitoring Activities

Prepared by the Capital Area Council of Governments
August 11, 2017

PREPARED UNDER A GRANT FROM THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

The preparation of this report was financed through grants from the State of Texas through the Texas Commission on Environmental Quality. The content, findings, opinions, and conclusions are the work of the author(s) and do not necessarily represent findings, opinions, or conclusions of the TCEQ.

1 Executive Summary

This document explains the methodology CAPCOG used to score and rank its eight monitoring stations for 2018. CAPCOG intends to use the data to prioritize which monitoring stations to operate and the extent of the activities at each monitoring station in 2018. The lowest-ranking CAPCOG-owned monitoring station would be the most likely to not be operated in 2018 or only receive a "basic" level of service in 2018, depending on resources raised from local governments.

The equation below shows the basic principle used in calculating an individual monitoring station's score. The monitor's rank is based on how high its score is.

$$CAMS_X\ Score = (Score1_X \times Weight1) + (Score2_X \times Weight2) + \cdots$$

Example:

CAMS 614:

- Trend Score: 0.38
- Trend Score Weight: 8.4
- Weighted Trend Score: 3.23

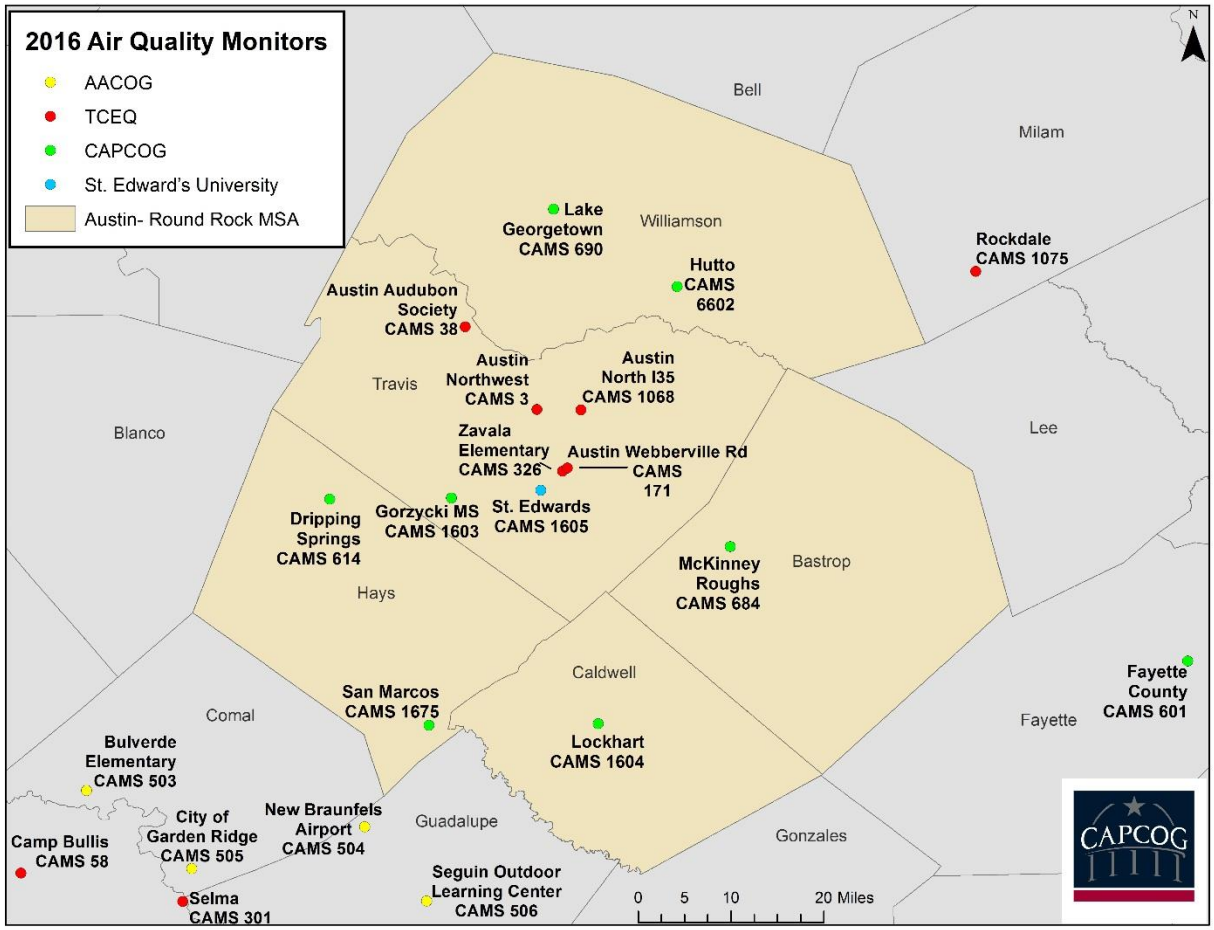
The basis for this analysis is EPA's Network Assessment Guidance (https://www3.epa.gov/ttnamti1/files/ambient/pm25/datamang/network-assessment-guidance.pdf) for the specific methods used and a stakeholder survey CAPCOG conducted in order to weigh the different analyses CAPCOG conducted.

Table of Contents

2 Ozone Monitors in the CAPCOG Region

The following map shows the location of all of the air quality monitors located in the CAPCOG region and nearby.

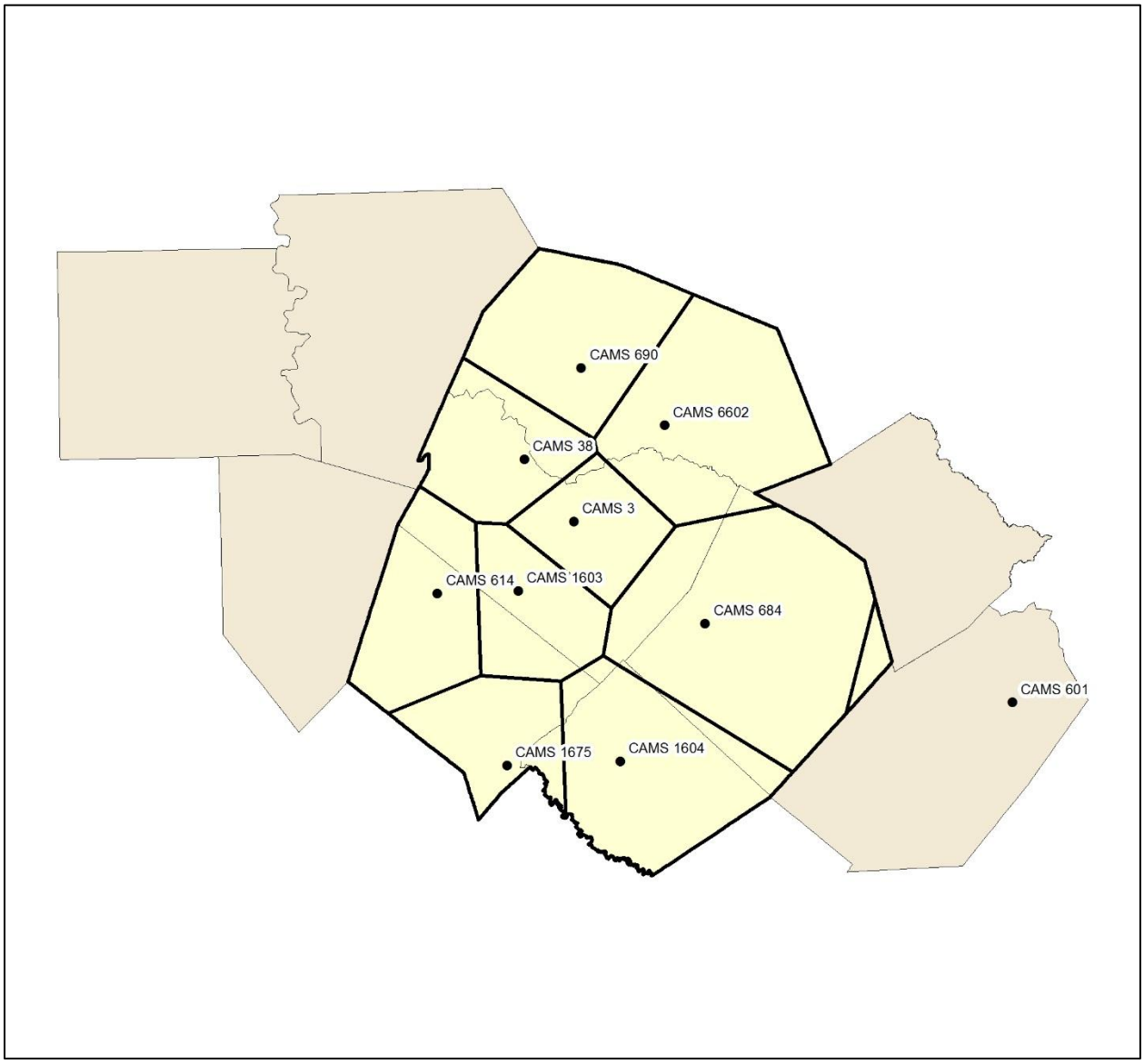
Figure 2-1. Air Quality Monitors in the CAPCOG Region and Adjacent Areas



While the goal of this project is to prioritize CAPCOG ozone monitoring stations within the region, TCEQ's two ozone monitoring stations are also included in this analysis as a point of reference. CAPCOG is assuming, based on TCEQ's most recent monitoring network plan, that CAMS 3 and 38 will continue to collect ozone data to meet regulatory purposes in 2018, so understanding the value of CAPCOG's monitoring stations requires a comparison to the value of the data collected at these two TCEQ stations. Since CAPCOG is unsure of whether or not St. Edwards' University will be operating CAMS 1605 in 2018, and due to data quality concerns about data collected in 2016, CAPCOG did not include CAMS 1605 in this assessment. For this analysis, CAPCOG focused on the value of each given monitoring station to the Austin-Round Rock Metropolitan Statistical Area (MSA), rather than the COG region as a whole, since the Clean Air Coalition only covers the MSA (Bastrop, Caldwell, Hays, Travis, and Williamson Counties).

Several of the analysis in this report rely on "Thiessen Polygons," which CAPCOG generated using ArcGIS software, and which are created based on the geographic area within the MSA closest to each monitoring station. The figure below shows these polygons for the ozone monitors in the CAPCOG region.

Figure 2-2. Thiessen Polygons for CAPCOG Region Ozone Monitors Used in this Analysis



3 CAPCOG Stakeholder Survey on Monitoring

In April and May 2017, CAPCOG conducted a survey of CAC and CACAC members regarding CAPCOG's monitoring program. Respondents were asked to assign scores of 1-10 to various goals for the monitoring program. CAPCOG received a total of 14 responses, but excluded two responses from this analysis, one because the respondent was from outside of the region (from the AACOG region), while the other assigned scores of "10" to everything, meaning that inclusion of the person's score would not

add anything to the prioritization of goals among the ones CAPCOG identified. A total of 24 questions were asked:

- Questions 1-9 covering topics mentioned in EPA's monitoring network assessment guidance
- Questions 10-20 covering the importance of measuring ozone in specific locations in the CAPCOG region
- Questions 21-24 regarding the relative importance of maintaining all 8 of CAPCOG's monitoring stations versus maintaining the same data quality as what CAPCOG achieved in its 2017 monitoring.

The following table shows the average, minimum, and maximum scores assigned to questions 1-21.

Table 3-1. Summary of Survey Results

Question	Avg.	Min.	Max.
1. Locating monitors where people live, work, and play	8.8	7	10
2. Locating monitors in environmental justice areas that have low-income and/or minority populations	8.3	6	10
3. Tracking trends in ozone concentration over time	8.4	6	10
4. Monitor the area of maximum pollutant concentration	8.8	7	10
5. Monitor the region's background levels of pollution concentration	8.3	7	10
6. Characterize ozone transport	8.0	5	10
7. Locating monitors where they will be of maximum value in assisting with air quality forecasting	9.3	7	10
8. Measuring maximum ozone precursor concentrations	6.5	3	9
9. Measuring indicator pollutants that would highlight coal combustion	6.0	3	9
10. Measuring ozone in Bastrop County	7.8	4	10
11. Measuring ozone in Blanco County	5.3	2	9
12. Measuring ozone in Burnet County	5.5	2	9
13. Measuring ozone in Caldwell County	7.0	2	10
14. Measuring ozone in Fayette County	6.8	2	10
15. Measuring ozone in Hays County	7.7	4	10
16. Measuring ozone in Lee County	5.5	3	9
17. Measuring ozone in Llano County	5.2	2	9
18. Measuring ozone in Travis County	8.3	2	10
19. Measuring ozone in Williamson County	8.1	2	10
20. Measuring ozone in all five counties of the Austin-Round Rock MSA	8.5	6	10
21. Maintaining monitoring in all eight of the locations CAPCOG current monitors ozone in the 2018 ozone season	7.8	3	10
22. Maintaining monitoring in all eight of the locations CAPCOG current monitors ozone between 2019 and 2022	8.5	6	10
23. Maintaining the same level of data quality in 2018 as CAPCOG achieved in 2016 and 2017	8.5	6	10
24. Maintaining the same level of data quality in 2019-2022 as it achieved in 2016 and 2017	8.4	6	10

On the questions regarding the quantity of monitors v. quality of monitoring data, the following table summarizes the results.

Table 3-2. Survey Responses Regarding Importance of Number of Monitors v. Quality of Monitoring Data

Survey Response	2018 Ozone Season	2019-2022 Ozone Seasons
Number More Important than Quality	1	4
Quality More Important than Number	5	3
Number and Quality Equally Important	6	5
Number at Least as Important as Quality	7	9
Quality at Least as Important as Number	11	8

4 Plan for Funding Monitoring Activities in 2018

While these data appear to indicate that, to the extent that survey respondents said it was more important to maintain data quality than to maintain all 8 monitoring stations in the region, CAPCOG's need to proceed with local funding requests for 2018 prior to finalization of this analysis necessitated a different approach. Under this approach, CAPCOG would fund a "basic" level of monitoring activities involving scaled-back quality assurance and control in 2018 at all 8 monitoring stations in priority order, and then would fund a "full" level of monitoring activities at all 8 monitoring stations beyond the "basic" level in priority order.

The "basic" level of monitoring would involve measuring ozone from May 1, 2018 – October 31, 2018, with instrument calibrations at the beginning, middle, and end of the season without using data validation services throughout the ozone season. This time frame was chosen to match the range of months when the CAPCOG region has recorded 8-hour ozone concentrations over 70 ppb between 2014 and 2016. The "full" level of monitoring would involve measuring ozone from March 1, 2018 – November 15, 2018, with monthly instrument calibrations and contractor data validation services. This would cover almost the full regulatory ozone monitoring season, which runs through the end of November.

5 Baseline Scoring Methodology

CAPCOG's proposed methodology involves the use of 21 different weighted scores, with weights being based on the average value survey respondents gave to a related goal. The scores would include:

1. Population Score
2. Environmental Justice (EJ) Score
3. Trend Score
4. High Ozone Score
5. Background Ozone Score
6. Ozone Transport Score
7. Forecast Score
8. Precursor Score
9. Indicator Score

10. Bastrop County Score
11. Blanco County Score
12. Burnet County Score
13. Caldwell County Score
14. Fayette County Score
15. Hays County Score
16. Lee County Score
17. Llano County Score
18. Travis County Score
19. Williamson County Score
20. MSA Score
21. Uniqueness Score

5.1 Population Score

The population score prioritizes monitors based on the number of people closest to each monitoring station and corresponds to goal 1 in CAPCOG's survey: "Locating monitors where people live, work, and play." This metric is designed to represent the "public reporting of the AQI" purpose in EPA's monitoring network assessment, which is described as follows:

"Monitors located where people live, work, and play are important for addressing exposure and protecting public health."

This metric also corresponds to the "Population Served" site-by-site analysis technique described in Table 2-2 of EPA's guidance document. CAPCOG created Thiessen polygons and used the latest Census Bureau data for block-group populations within the Austin-Round Rock MSA to calculate the number of MSA residents living closest to TCEQ's two ozone monitors and CAPCOG's 8 ozone monitors

$$Population\ Score = \frac{Austin - Round\ Rock\ MSA\ Population\ Closest\ to\ CAMS_X}{Austin - Round\ Rock\ MSA\ Population}$$

Weight: 8.8 (average from survey respondents)

Table 5-1. Monitor Population Scoring

Station	Population Served	Unweighted Score	Weighted Score
3	638,787	0.33	2.94
38	255,424	0.13	1.18
601	4,489	0.00	0.02
614	42,644	0.02	0.20
684	110,560	0.06	0.51
690	127,617	0.07	0.59
1603	343,533	0.18	1.58
1604	40,723	0.02	0.19
1675	115,017	0.06	0.53
6602	233,649	0.12	1.08
Basis	**1,912,443**	**1.00**	**8.80**

5.2 Environmental Justice (EJ) Score

The EJ score prioritizes monitors based on the number of low-income and minority population people closest to each monitoring station and corresponds to goal 2 in CAPCOG's survey: "Locating monitors in environmental justice areas that have low-income and/or minority populations." This goal is intended to represent the environmental justice purpose stated in EPA's monitoring network assessment guidance, which is described as follows:

"*Monitoring in areas that have large low-income and/or minority populations may be of particular value for assessing environmental justice issues.*"

This metric also corresponds to the "Population Served" site-by-site analysis technique described in Table 2-2 of EPA's guidance document.

EPA uses six different demographic groups in its "EJSCREEN" tool: [1]

- Low-Income (defined as household income less than or equal to twice the federal poverty level)
- Minority (defined as non-Hispanic White alone in terms of Hispanic ethnicity and race)
- Less than high school education (people age 25 or older with less than a high school diploma)
- Linguistic isolation (all members of a household age 14 and over speak a non-English language and also speak English less than "very well")
- Individuals under the age of 5
- Individuals over age 64

Since EPA's monitoring network guidance only referenced low-income and minority populations, CAPCOG only used these two factors in calculating the EJ score.

Since CAPCOG only asked a single question regarding the priority placed on EJ monitoring, CAPCOG created a composite EJ score using the average of a "minority EJ score" and a "low-income EJ score." These scores were based on the share of each target EJ population within the MSA closest to each monitoring station (similar to the method for the population score). These two scores were then averaged in order to calculate the composite EJ score.

$$EJ\ Score = \frac{Minority\ EJ\ Score + LowIncome\ EJ\ Score}{2}$$

$$Minority\ EJ\ Score = \frac{Number\ of\ Minority\ Residents\ Closest\ to\ CAMS_X}{Number\ of\ Minority\ Residents\ in\ Austin - Round\ Rock\ MSA}$$

$$LowIncome\ EJ\ Score = \frac{Number\ of\ Low - Income\ Residents\ Closest\ to\ CAMS_X}{Number\ of\ Low - Income\ Residents\ in\ Austin - Round\ Rock\ MSA}$$

Weight: 8.3 (average from survey respondents)

[1] https://www.epa.gov/ejscreen/overview-demographic-indicators-ejscreen

Table 5-2. EJ Scoring

Station	Minority Population Served	Unweighted Minority EJ Score	Low-Income Population Served	Unweighted Low-Income EJ Score	EJ Score	Weighted EJ Score
3	338,911	0.39	242,902	0.43	0.41	3.37
38	81,101	0.09	42,171	0.07	0.08	0.69
601	319	0.00	405	0.00	0.00	0.00
614	6,505	0.01	5,623	0.01	0.01	0.07
684	58,450	0.07	38,824	0.07	0.07	0.56
690	31,409	0.04	22,630	0.04	0.04	0.31
1603	159,864	0.18	93,042	0.16	0.17	1.43
1604	23,033	0.03	16,812	0.03	0.03	0.23
1675	58,392	0.07	48,386	0.08	0.08	0.63
6602	118,448	0.14	59,184	0.10	0.12	0.99
Basis	**876,433**	**1.00**	**569,977**	**1.00**	**1.00**	**8.30**

5.3 Trend Score

The trend score prioritizes monitors based on the number of ozone seasons the monitor has been in service and corresponds to goal 3 in CAPCOG's survey, "Tracking trends in ozone concentrations over time." This represents the "trend tracking" purpose in EPA's monitoring network guidance, which is described as follows:

"Monitors with long histories are valuable for understanding and tracking long-term trends."

Proposed scoring:

$$Trend\ Score = \frac{Number\ of\ O_3\ Seasons\ CAMS_X\ has\ been\ in\ Service\ through\ 2016}{Max\#\ of\ O_3\ Seasons\ any\ CAMS\ has\ been\ in\ Service\ in\ Austin-Round\ Rock\ MSA\ through\ 2016}$$

For the purpose of measuring the number of ozone seasons a monitor has been in service, the following rules apply:

- CAMS 3 = 38 seasons (January 1, 1979 – December 31, 2016)
- CAMS 38 = 20 seasons (February 28, 1997 – December 31, 2016)
- CAPCOG monitors # seasons based on # of years in which a maximum daily 8-hour ozone average is recorded in 75% of the days between May 1 and October 30
- CAMS 1675 shall be considered a continuation of the data collection at CAMS 675
- The temporary monitoring at CAMS 1603 and CAMS 1604 that is not included in LEADS is not included in this analysis.

Weight: 8.4 (average from survey respondents)

Table 5-3. Monitor Trend Scoring

Station	Ozone Seasons	Unweighted Score	Weighted Score
3	38	1.00	8.40
38	20	0.53	4.42
601	14	0.37	3.09
614	14	0.37	3.09
684	10	0.26	2.21
690	9	0.24	1.99
1603	3	0.08	0.66
1604	4	0.11	0.88
1675	5	0.13	1.11
6602	6	0.16	1.33
Basis	**38**	**1.00**	**8.40**

5.4 High Ozone Score

The High Ozone Score is based on a monitor's value in measuring high ozone within the region and corresponds to goal 4 in CAPCOG's survey: "Monitor the area of maximum pollutant concentration." This represents the "Monitor the area of maximum pollutant concentration" purpose in EPA's monitoring network assessment guidance, which is described as follows:

"*Monitors located downwind of maximum emissions.*"

CAPCOG's score is based on how often a monitoring station measured the region's highest maximum daily 8-hour ozone average (MDA8) on days when at least one MDA8 in the region was considered "moderate" (≥55 ppb) or higher. The equation used is as follows:

$$High\ O_3\ Score = \frac{Days\ CAMS_X\ Measured\ Max\ MDA8\ on\ Days\ Regional\ Max \geq 55\ ppb\ 2015-2016}{Days\ Regional\ Max\ \geq 55\ ppb\ 2015-2016}$$

Only days when all 10 monitors in the region were in service were used in this analysis.

Weight: 8.8 (average from survey respondents)

Table 5-4. Monitor High Ozone Scoring

Station	Days Max MDA8 when Regional MDA8 ≥ 55pb	Unweighted Score	Weighted Score
3	41	0.40	3.54
38	9	0.09	0.78
601	13	0.13	1.12
614	12	0.12	1.04
684	1	0.01	0.09
690	14	0.14	1.21
1603	7	0.07	0.60
1604	10	0.10	0.86
1675	9	0.09	0.78
6602	3	0.03	0.26
Basis	**102**	**1.00**	**8.80**

5.5 Background Score

The Background Score is based on a monitor's value in measuring the lowest ozone within the region and corresponds with goal 5 in CAPCOG's survey: "Monitor the region's background levels of pollution concentration." This represents the "Monitor the background concentration" purpose in EPA's monitoring network assessment guidance, which is described as:

"*Properly sited background monitors routinely measure the lowest expected values in the region. These monitors are used to assess regional v. local contribution.*"

CAPCOG's score is based on how often a monitoring station measured the region's lowest MDA8 on days when at least one MDA8 in the region was considered moderate or higher. The equation used is as follows:

$$Low\ O_3\ Score = \frac{Days\ CAMS_X\ Measured\ Minimum\ MDA8\ on\ Days\ Regional\ Max \geq 55\ ppb\ 2015-2016}{Days\ Regional\ Max\ \geq 55\ ppb\ 2015-2016}$$

Only days when all 10 monitors in the region were in service were used in this analysis.

Weight: 8.3 (average from survey respondents)

Table 5-5. Monitor Background Ozone Scoring

Station	Days Min. MDA8 when Regional MDA8 ≥ 55pb	Unweighted Score	Weighted Score
3	2	0.02	0.16
38	7	0.07	0.57
601	26	0.25	2.12
614	4	0.04	0.33
684	25	0.25	2.03
690	10	0.10	0.81
1603	3	0.03	0.24
1604	28	0.27	2.28
1675	6	0.06	0.49
6602	16	0.16	1.30
Basis	**102**	**1.00**	**8.30**

5.6 Ozone Transport Score

The Ozone Transport Score is based on a monitor's value in measuring the lowest OR the highest ozone within the region and corresponds with goal 6: "Characterize ozone transport." This score is intended to represent the "Transport/Border Characterization" purpose in EPA's monitoring network assessment guidance. This is described as:

"*Sites located near political boundaries or between urban or industrial areas are useful for characterizing transport of pollutants between jurisdictions.*"

CAPCOG's method for calculating this score in the baseline methodology involves the use of the data in the "high ozone score" and the "low ozone score", in that this score would represent that importance

for a given monitor in being able to calculate the extent of local contribution on any given day when there was an ozone problem:

$$O_3\ Transport\ Score = \frac{Days\ CAMS_X\ Measured\ Max\ MDA8\ on\ Days\ Regional\ Max \geq 55\ ppb\ 2015-2016 + Days\ CAMS_X\ Measured\ Min\ MDA8\ on\ Days\ Regional\ Max \geq 55\ ppb\ 2015-2016}{Days\ Regional\ Max\ \geq 55\ ppb\ 2015-2016}$$

Only days when all 10 monitors in the region were in service were used in this analysis.

Weight: 8.0 (average from survey respondents)

Table 5-6. Monitor Transport Scoring

Station	Days Min. or Max. MDA8 when Regional MDA8 ≥ 55pb	Unweighted Score	Weighted Score
3	43	0.42	3.37
38	16	0.16	1.25
601	39	0.38	3.06
614	16	0.16	1.25
684	26	0.25	2.04
690	24	0.24	1.88
1603	10	0.10	0.78
1604	38	0.37	2.98
1675	15	0.15	1.18
6602	19	0.19	1.49
Basis	**102**	**1.00**	**8.00**

5.7 Forecast Score

The Forecast Score is based on a monitor's value in forecasting ozone within the region. This corresponds with goal 7 in CAPCOG's survey: "Locating monitors where they will be of maximum value in assisting with air quality forecasting." EPA's network assessment guidance describes the "forecasting assistance" purpose for monitoring as follows:

"*Upwind monitors are useful for air quality forecasting. For forecasting ozone, NO_X measurements are helpful. For $PM_{2.5}$ measurements, continuous monitors are helpful*."

Since only TCEQ conducts NO_X monitoring in the region, CAPCOG focused on scoring a monitoring station by how often it represented background O_3 concentrations. This score is the same as the "background ozone" score (#5).

$$Forecast\ O_3\ Score = \frac{Days\ CAMS_X\ Measured\ Minimum\ MDA8\ on\ Days\ Regional\ Max \geq 55\ ppb\ 2015-2016}{Days\ Regional\ Max\ \geq 55\ ppb\ 2015-2016}$$

Only days when all 10 monitors in the region were in service were used in this analysis.

Weight: 9.3 (average from survey respondents)

Table 5-7. Monitor Forecast Scoring

Station	Days Min. or MDA8 when Regional MDA8 ≥ 55pb	Unweighted Score	Weighted Score
3	2	0.02	0.18
38	7	0.07	0.64
601	26	0.25	2.37
614	4	0.04	0.36
684	25	0.25	2.28
690	10	0.10	0.91
1603	3	0.03	0.27
1604	28	0.27	2.55
1675	6	0.06	0.55
6602	16	0.16	1.46
Basis	**102**	**1.00**	**9.30**

5.8 Precursor Score

The Precursor Score is based on a monitor's value in measuring NO_X or VOC concentrations. This corresponds with goal 8 in CAPCOG's survey: "measuring maximum ozone precursor concentrations." This represents the "Monitor the area of maximum precursor emissions" purpose in EPA's guidance, which is described as:

"*For secondary pollutants such as ozone, monitors located in areas of maximum precursor emissions are useful for modeling and control strategy design.*"

CAPCOG's scoring involves assigning each ozone monitor a "1" or a "0," depending on whether or not it also includes NO_X or VOC sampling.

- Value = 1 if the station has NO_X or VOC sampling
- Value = 0 if the station has neither NO_X nor VOC sampling

Since only CAMS 3 has both ozone and precursor measurements, this metric doesn't provide any differentiation between CAPCOG monitoring stations, but it does increase the value of CAMS 3 relative to CAPCOG's monitoring stations.

Weight: 6.5 (average from survey respondents)

Table 5-8. Monitor Precursor Scoring

Station	Has NO_X Monitoring = 1	Unweighted Score	Weighted Score
3	1	1.00	6.50
38	0	0.00	0.00
601	0	0.00	0.00
614	0	0.00	0.00
684	0	0.00	0.00
690	0	0.00	0.00
1603	0	0.00	0.00

Station	Has NO_X Monitoring = 1	Unweighted Score	Weighted Score
1604	0	0.00	0.00
1675	0	0.00	0.00
6602	0	0.00	0.00
Basis	**1**	**1.00**	**6.50**

5.9 Indicator Score

The Indicator Score is based on a monitor's value in measuring tracer elements that could be used to track a plume from coal combustion in order to enable analysis of its co-incidence with high ozone. This corresponds with goal 9 in CAPCOG's survey: "measuring indicator pollutants that would highlight coal combustion," and the "monitor surrogate pollutants" purpose in EPA's guidance. This purpose is described as:

"*Some measurements are useful as surrogates for other pollutants that are not widely monitored.*"

In this case, SO_2 would be an indicator of coal combustion. CAPCOG's scoring involves assigning a "1" or a "0" to each station, depending on whether it includes SO_2 sampling.

- Value = 1 if the station has SO_2 sampling
- Value = 0 if the station does not have SO_2 sampling

Since only CAMS 3 has SO_2 measurements, this metric doesn't provide any differentiation between CAPCOG monitoring stations, but it does increase the value of CAMS 3 relative to CAPCOG's monitoring stations.

Weight: 6.0 (average from survey respondents)

Table 5-9. Monitor Indicator Scoring

Station	Has SO_2 Monitoring = 1	Unweighted Score	Weighted Score
3	1	1.00	6.00
38	0	0.00	0.00
601	0	0.00	0.00
614	0	0.00	0.00
684	0	0.00	0.00
690	0	0.00	0.00
1603	0	0.00	0.00
1604	0	0.00	0.00
1675	0	0.00	0.00
6602	0	0.00	0.00
Basis	**1**	**1.00**	**6.00**

5.10 County-Specific Scores

CAPCOG created a number of county-specific scores. These scores were based on a monitor's value in measuring ozone concentrations in Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Llano, Travis, and Williamson Counties, and are based on goals 10-19 in CAPCOG's survey.

Proposed scoring:

- Value = 1 if the station is in the county
- Value = 0 if the station is not in the county

Proposed weights:

- **Bastrop County: 7.8** (average from survey respondents)
- **Blanco County: 5.0** (average from survey respondents)
- **Burnet County: 5.5** (average from survey respondents)
- **Caldwell County: 7.0** (average from survey respondents)
- **Fayette County: 6.8** (average from survey respondents)
- **Hays County: 7.7** (average from survey respondents)
- **Lee County: 5.5** (average from survey respondents)
- **Llano County: 5.2** (average from survey respondents)
- **Travis County: 8.3** (average from survey respondents)
- **Williamson County: 8.1** (average from survey respondents)

Table 5-10. Monitor County-Specific Scoring

Station	Weighted Score
3	8.3
38	8.3
601	6.8
614	7.7
684	7.8
690	8.1
1603	8.3
1604	7.0
1675	7.7
6602	8.1

5.11 MSA Score

The MSA Score is based on a monitor's value in measuring ozone concentrations in the Austin-Round Rock MSA. This score is based on goal 20, "measuring ozone in all five counties of the Austin-Round Rock MSA."[2]

[2] Note – the proposed method for this score does not discount the value of any individual monitor in the MSA, but rather, serves to reduce the score of any monitor located outside of the MSA relative to a monitor located within the MSA.

CAPCOG's scoring involves assigning each monitor located in the MSA a value of "1" and any monitor located outside of the MSA a value of "0:"

$$MSA\ Score\ (if\ monitor\ in\ MSA) = 1$$

$$MSA\ Score\ (if\ monitor\ not\ in\ MSA) = 0$$

Weight: 8.5 (average from survey respondents)

Table 5-11. Monitor MSA Scoring

Station	Weighted Score
3	8.5
38	8.5
601	0.0
614	8.5
684	8.5
690	8.5
1603	8.5
1604	8.5
1675	8.5
6602	8.5

5.12 Uniqueness Score

The Uniqueness Score is based on the extent to which a monitor is providing unique data. This metric was not surveyed, and therefore does not correspond to a specific goal beyond being efficient with the use of resources. However, it does correspond the "monitor-to-monitor correlation" technique described in Table 2-2 of EPA's guidance document. If a monitor has a high correlation to another monitor, it is less important for the 1st monitor's data to be collected.

CAPCOG's score is based on the highest site-to-site correlation for a given monitor relative to another ozone monitor in the region.

$$Uniqueness\ Score = 1 - Max\ Absolute\ Value\ of\ Correlation\ Coefficient\ on\ Days\ Regional\ Max \geq 55\ ppb\ 2010 - 2016$$

Weight: 10

Table 5-12. Monitor Uniqueness Scoring

Station	Highest Correlation	Unweighted Score	Weighted Score
3	0.86	0.14	1.44
38	0.86	0.14	1.44
601	0.72	0.28	2.85
614	0.80	0.20	2.03
684	0.76	0.24	2.39
690	0.78	0.22	2.16

Station	Highest Correlation	Unweighted Score	Weighted Score
1603	0.82	0.18	1.82
1604	0.67	0.33	3.31
1675	0.82	0.18	1.82
6602	0.78	0.22	2.18
Basis	**1.00**	**1.00**	**10.00**

5.13 Baseline Scoring and Ranking

The following table shows the composite baseline scoring and ranking for all monitors in the region.

Table 5-13. Composite Baseline Scoring and Ranking

Station	Composite Score	Rank (all stations)	Rank (CAPCOG stations)
3	52.71	1	n/a
38	27.76	4	n/a
601	21.44	10	8
614	24.58	7	5
684	28.41	3	2
690	26.46	6	4
1603	24.20	8	6
1604	28.79	2	1
1675	23.27	9	7
6602	26.68	5	3

6 Alternative Scenarios Evaluated

6.1 Consideration of Cost

One of the CACAC members requested consideration of the marginal cost of operating each monitoring station in ranking the monitors. Scenario 2 accomplishes this by dividing the total score for each monitoring station by the estimated marginal cost of operating the station in 2018. This produces a "points/$" metric that is then used to rank each monitoring stations.

The marginal cost for each monitoring station included:

- Site set-up costs (including supplemental insurance costs for CAMS 1603)
- Routine maintenance costs
- Monthly calibration costs
- Data validation costs
- Site shut-down costs

CAPCOG is currently paying for rental of an ozone analyzer located at CAMS 1604, but CAPCOG's equipment could be shifted among its sites without added costs, meaning that this equipment rental

cost does not constitute an incremental cost for the operation of CAMS 1604 as much as it represents an incremental cost to operating the 8th-ranked station, regardless of which one that might be.

Table 6-1. Composite Scoring and Ranking Using Cost-Effectiveness

Station	Composite Score	Incremental Cost for 2018	Points per $1,000	Rank (CAPCOG stations)
601	21.44	$14,340.34	1.49	7
614	24.58	$13,581.75	1.81	5
684	28.41	$13,337.97	2.13	1
690	26.46	$13,199.38	2.00	4
1603	24.20	$16,844.70	1.44	8
1604	28.79	$13,632.21	2.11	2
1675	23.27	$14,340.34	1.66	6
6602	26.68	$13,581.75	2.08	3

6.2 Removal of Consideration of Environmental Justice

One of the CACAC members was opposed to the inclusion of Environmental Justice as a consideration in ranking the monitors. In an e-mail to CAPCOG staff, this member stated: "I don't think EJ should be anywhere near a scientific assessment of the efficacy and cost effectiveness of the monitors. I would not support such an ill-defined and, [in my opinion], morally indefensible construct to my [elected officials]."

This particular CACAC member had not completed a survey, but CAPCOG decided to produce a scenario showing what the ranking would be without any consideration of environmental justice. This ultimately did not change the rankings in a very meaningful way.

Table 6-2. Composite Scoring and Ranking Not Considering EJ Scoring

Station	Composite Score	Rank (all stations)	Rank (CAPCOG stations)
3	49.33	1	n/a
38	27.07	4	n/a
601	21.43	10	8
614	24.51	7	5
684	27.85	3	2
690	26.15	5	3
1603	22.77	8	6
1604	28.55	2	1
1675	22.64	9	7
6602	25.69	6	4

6.3 Alternative Metric Used for Scoring Transport

In the methodology presented to the CACAC, the metric used to score the value each monitor had for characterizing ozone transport was the number of days that a monitoring station recorded *either* the highest or lowest MDA8 value on a day when MDA8 was 55 ppb or higher in the region. Since use of the highest and lowest MDA8 values are already used for questions 4 and 5, the use of this combined metric

has the effect of double-weighting these metrics. It also doesn't necessarily capture the intent of the "transport/border characterization" monitoring purpose described in Table 2-1 of EPA's monitoring network assessment guidance: "Sites located near political boundaries or between urban or industrial areas are useful for characterizing transport of pollutants between jurisdictions."[3]

In order to provide a metric that might be a more direct indication of the value of a monitor in demonstrating transport into and out of the region, CAPCOG calculated the closest distances from each monitoring station to the MSA boundary. These were then divided by the distance of CAMS 3 to the border, given CAMS 3's proximity to the center of the MSA (it is located 0.19 miles further away from the nearest MSA boundary than the geographic centroid for the MSA. The equation for the alternative transport scoring is shown below.

$$Alternative\ Transport = 1 - \frac{Distance\ of\ CAMS_X\ to\ MSA\ border}{Distance\ of\ CAMS\ 3\ to\ MSA\ border}$$

This score therefore reflects the extent to which a given monitor is closer to the MSA border than CAMS 3.

Table 6-3. Alternative Scoring for Transport

Station	Distance to MSA Border	Score	Weighted Score
3	21.60	0.00	0.00
38	13.45	0.38	3.02
601	17.78	0.18	1.41
614	8.22	0.62	4.96
684	19.37	0.10	0.83
690	15.21	0.30	2.37
1603	18.91	0.12	1.00
1604	10.07	0.53	4.27
1675	2.32	0.89	7.14
6602	15.81	0.27	2.15
Basis	**21.60**	**1.00**	**8.00**

This alternative scoring produced the following scores and rankings.

Table 6-4. Composite Scoring and Ranking Using Alternative Transport Scoring

Station	Composite Score	Rank (all stations)	Rank (CAPCOG stations)
3	49.33	1	n/a
38	29.53	3	n/a
601	19.79	10	8
614	28.28	5	3
684	27.19	7	5
690	26.95	8	6
1603	24.42	9	7

[3] https://www3.epa.gov/ttnamti1/files/ambient/pm25/datamang/network-assessment-guidance.pdf

Station	Composite Score	Rank (all stations)	Rank (CAPCOG stations)
1604	30.07	2	1
1675	29.24	4	2
6602	27.34	6	4

6.4 Combination

CAPCOG created one additional set of scores and rankings combining the consideration of cost, a reduced weighting of the EJ score as a criteria, and the alternative transport score. For reducing the weight of the EJ score, CAPCOG added a "0" value to the EJ score criteria to include the average for that weighting. This changed the weight of that metric from 8.3 to 7.7.

Table 6-5. Composite Scoring and Ranking Using Cost-Effectiveness, Reduced EJ Weighting, and Alternative Transport Metric

Station	Composite Score	Rank	Incremental Cost for 2018	Points per $1,000	Rank (CAPCOG stations)
3	49.09	1	n/a	n/a	n/a
38	29.48	3	n/a	n/a	n/a
601	19.79	10	$14,340.34	1.38	8
614	28.27	5	$13,581.75	2.08	3
684	27.15	7	$13,337.97	2.04	5
690	26.93	8	$13,199.38	2.04	6
1603	24.31	9	$16,844.70	1.44	7
1604	30.06	2	$13,632.21	2.20	1
1675	29.19	4	$14,340.34	2.08	2
6602	27.26	6	$13,581.75	2.12	4

7 Summary of Alternative Rankings

The following table shows a summary of the alternative rankings produced in this analysis, along with the range of ranks across the five scenarios.

Table 7-1. Composite Scoring and Ranking Using Cost-Effectiveness, Reduced EJ Weighting, and Alternative Transport Metric

Station	1. Baseline	2. Consider Cost	3. No EJ Score	4. Alt. Transport Metric	5. Combo	Low	High
601	8	7	8	8	8	8	7
614	5	5	5	3	3	5	3
684	2	1	2	5	5	5	1
690	4	4	3	6	6	6	3
1603	6	8	6	7	7	8	6
1604	1	2	1	1	1	2	1
1675	7	6	7	2	2	7	2
6602	3	3	4	4	4	4	3

8 Finalization of Rankings

CAPCOG sought endorsement of the "baseline" (scenario 1) or "combination" (scenario 5) ranking proposed in this document from the Clean Air Coalition (CAC) at its August 9, 2017, meeting. Since the funding that will enable this monitoring to occur in 2018 will be provided by CAC members, this provided the group with an opportunity to ensure that CAPCOG's plans for its 2018 activities are consistent with the committee's priorities and perspectives. The CAC voted unanimously to endorse the "combination" ranking.