

**Texas**  
**Dallas-Fort Worth and Houston-Galveston-Brazoria**  
**Nonattainment Areas**

**Final Area Designations for the**  
**2015 Ozone National Ambient Air Quality Standards**  
**Technical Support Document**

## **1.0 Summary**

This technical support document (TSD) describes the EPA’s final designations for the Dallas-Fort Worth (DFW) and Houston-Galveston-Brazoria (HGB) areas in Texas as nonattainment for the 2015 ozone National Ambient Air Quality Standards (NAAQS).

On October 1, 2015, the EPA promulgated revised primary and secondary ozone NAAQS (80 FR 65292; October 26, 2015). The EPA strengthened both standards to a level of 0.070 parts per million (ppm). In accordance with Section 107(d) of the Clean Air Act (CAA), whenever the EPA establishes a new or revised NAAQS, the EPA must promulgate designations for all areas of the country for that NAAQS.

Under CAA section 107(d), states were required to submit area designation recommendations to the EPA for the 2015 ozone NAAQS no later than 1 year following promulgation of the standards, i.e., by October 1, 2016. Tribes were also invited to submit area designation recommendations. On September 30, 2016, Texas (“the State”) submitted to EPA its recommendations for nonattainment counties. On August 23, 2017, the State submitted updated recommendations. On February 28, 2018, Texas provided comments and further revised its list of recommended nonattainment counties to exclude Rockwall County from the DFW nonattainment area and Liberty and Waller counties from the HGB area.<sup>1</sup>

After considering the State’s original and revised recommendations, as well as public comments received, and based on the EPA’s technical analysis as described in this TSD, the EPA agrees with the State’s updated list of nonattainment counties and the State’s recommendation to designate the areas listed in Table 1 (below), as nonattainment for the 2015 ozone NAAQS. The EPA must designate an area nonattainment if it has an air quality monitor that is violating the standard or if the area has sources of emissions that are contributing to a violation of the NAAQS in a nearby area. Detailed descriptions of the nonattainment boundaries for these areas are found in the supporting technical analysis for each area in Section 3 of this TSD. The analysis provided in Section 3 explains why we agree with the State’s February 2018 recommendation that Rockwall County not be included as part of the DFW nonattainment area and that Liberty and Waller Counties not be included as part of the HGB nonattainment area

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<sup>1</sup> All the state and tribal recommendations submitted to EPA are available at <https://www.epa.gov/ozone-designations/2015-ozone-standards-state-recommendations>.

**Table 1. Texas’s Recommended Nonattainment Areas and the EPA’s Final Designated Nonattainment Areas for the 2015 Ozone NAAQS**

<b>Area</b>	<b>Texas’s Recommended Nonattainment Counties<sup>2</sup></b>	<b>Texas’s Updated Recommended Nonattainment Counties<sup>3</sup></b>	<b>EPA’s Final Nonattainment Counties</b>
Dallas-Fort Worth, TX	Collin County Dallas County Denton County Ellis County Johnson County Kaufman County Parker County Rockwall County Tarrant County Wise County	Collin County Dallas County Denton County Ellis County Johnson County Kaufman County Parker County Tarrant County Wise County	Collin County Dallas County Denton County Ellis County Johnson County Kaufman County Parker County Tarrant County Wise County
Houston-Galveston-Brazoria, TX	Brazoria County Chambers County Fort Bend County Galveston County Harris County Liberty County Montgomery County Waller County	Brazoria County Chambers County Fort Bend County Galveston County Harris County Montgomery County	Brazoria County Chambers County Fort Bend County Galveston County Harris County Montgomery County

On November 6, 2017 (82 FR 54232; November 16, 2017), the EPA signed a final rule designating most of the areas the State did not recommend for designation as nonattainment as attainment/unclassifiable.<sup>4</sup> EPA explains in section 2.0 the approach it is now taking to designate the remaining areas in the State.

The EPA is designating all tribes in accordance with two guidance documents issued in December 2011 by the EPA Office of Air Quality Planning and Standards titled, “Guidance to Regions for Working with Tribes during the National Ambient Air Quality Standards (NAAQS) Designations Process,”<sup>5</sup> and “Policy for Establishing Separate Air Quality Designations for Areas of Indian Country.”<sup>6</sup>

## 2.0 Nonattainment Area Analyses and Boundary Determination

The EPA evaluated and determined the boundaries for each nonattainment area on a case-by-case basis, considering the specific facts and circumstances of the area. In accordance with CAA section 107(d), the EPA is designating as nonattainment the areas with the monitors that are violating the 2015 ozone NAAQS and nearby areas with emissions sources (i.e., stationary, mobile, and/or area sources) that contribute to the violations. As described in the EPA’s designations guidance for the 2015 NAAQS (hereafter referred to as the “ozone

<sup>2</sup> Based on the recommendations in the State’s submittals dated September 30, 2016 and August 23, 2017.

<sup>3</sup> Based on the State’s submittal dated February 28, 2018.

<sup>4</sup> In previous ozone designations and in the designation guidance for the 2015 ozone NAAQS, the EPA used the designation category label Unclassifiable/Attainment to identify both areas that were monitoring attainment and areas that did not have monitors but for which the EPA had reason to believe were likely attainment and were not contributing to a violation in a nearby area. The EPA is now reversing the order of the label to be Attainment/Unclassifiable so that the category is more clearly distinguished from the separate Unclassifiable category.

<sup>5</sup> <https://www.epa.gov/sites/production/files/2016-02/documents/ozone-designation-tribes.pdf>

<sup>6</sup> <https://www.epa.gov/sites/production/files/2016-02/documents/indian-country-separate-area.pdf>

designations guidance”<sup>7</sup> after identifying each monitor indicating a violation of the ozone NAAQS in an area, the EPA analyzed those nearby areas with emissions potentially contributing to the violating area. In guidance issued in February 2016, the EPA provided that using the Core Based Statistical Area (CBSA) or Combined Statistical Area (CSA)<sup>8</sup> as a starting point for the contribution analysis is a reasonable approach to ensure that the nearby areas most likely to contribute to a violating area are evaluated. The area-specific analyses may support nonattainment boundaries that are smaller or larger than the CBSA or CSA.

On November 6, 2017, the EPA issued attainment/unclassifiable designations for approximately 85% of the United States and one unclassifiable area designation.<sup>9</sup> At that time, consistent with statements in the designations guidance regarding the scope of the area the EPA would analyze in determining nonattainment boundaries, EPA deferred designation for any counties in the larger of a CSA or CBSA where one or more counties in the CSA or CBSA was violating the standard and any counties with a violating monitor not located in a CSA or CBSA. In addition, the EPA deferred designation for any other counties adjacent to a county with a violating monitor. The EPA also deferred designation for any county that had incomplete monitoring data, any county in the larger of the CSA or CBSA where such a county was located, and any county located adjacent to a county with incomplete monitoring data.

The EPA is proceeding to complete the remaining designations consistent with the designations guidance (and EPA’s past practice) regarding the scope of the area EPA would analyze in determining nonattainment boundaries for the ozone NAAQS as outlined above. For those deferred areas where one or more counties violating the ozone NAAQS or with incomplete data are located in a CSA or CBSA, in most cases the technical analysis for the nonattainment area includes any counties in the larger of the relevant CSA or CBSA. For counties with a violating monitor not located in a CSA or CBSA, EPA explains in the 3.0 Technical Analysis section, its decision whether to consider in the five-factor analysis for each area any other adjacent counties for which EPA previously deferred action. We are designating all counties not included in five-factor analyses for a specific nonattainment or unclassifiable area analyses, as attainment/unclassifiable. These deferred areas are identified in a separate document entitled “Designations for Deferred Counties and County Equivalents Not Addressed in the Technical Analyses.” which is available in the docket.

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<sup>7</sup> The EPA issued guidance on February 25, 2016 that identified important factors that the EPA intends to evaluate in determining appropriate area designations and nonattainment boundaries for the 2015 ozone NAAQS. Available at <https://www.epa.gov/ozone-designations/epa-guidance-area-designations-2015-ozone-naaqs>

<sup>8</sup> Lists of CBSAs and CSAs and their geographic components are provided at [www.census.gov/population/www/metroareas/metrodef.html](http://www.census.gov/population/www/metroareas/metrodef.html). The Office of Management and Budget (OMB) adopts standards for defining statistical areas. The statistical areas are delineated based on U.S. Census Bureau data. The lists are periodically updated by the OMB. The EPA used the most recent July 2015 update (OMB Bulletin No. 15-01), which is based on application of the 2010 OMB standards to the 2010 Census, 2006-2010 American Community Survey, as well as 2013 Population Estimates Program data.

<sup>9</sup> Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards published on November 16, 2017(82 FR 54232).

## Master Legend

Ozone monitoring site with 2014-2016 design value

- No valid value
- 0 - 0.070 parts per million (ppm)
- 0.071 and above

National Emissions Inventory (NEI) 2014 v1

- Large Point Sources (VOC or NO<sub>x</sub> ≥ 100 gross tons)
- ★ Small Point Sources

Hysplit

Elevation (Meters)

- ~ 100
- ~ 500
- ~ 1,000

  EPA's Final Nonattainment Area Boundary

  Federal American Indian Reservations and Off Reservation Lands

  State Boundaries

  County Boundaries

  CSAs - Combined Statistical Areas

  CBSAs - Metropolitan Statistical Areas

  CBSAs - Micropolitan Statistical Areas

NAAAs-8 Hour Ozone (1997 NAAQS)

- Maintenance (NAAQS revoked)
- Nonattainment (NAAQS revoked)

NAAAs-8 Hour Ozone (2008 NAAQS)

- Nonattainment
- Maintenance

County Population (2010)

- > 5,194,675 to 9,818,605
- > 2,035,210 to 5,194,675
- > 744,344 to 2,035,210
- > 220,000 to 744,344
- 0 to 220,000

Census Tracts Population (2012)

- 0 to 2,825
- > 2,825 to 4,481
- > 4,481 to 6,373
- > 6,373 to 10,145
- > 10,145 to 39,143

Vehicle Miles Traveled - 2014

- 0 - 36,071,088
- 36,071,088.01 - 52,484,020
- 52,484,020.01 - 88,659,368
- 88,659,368.01 - 204,018,496
- 204,018,496.01 - 5,247,588,352

Figures in the remainder of this document refer to the master legend above.

### 3.0 Technical Analyses

This technical analysis identifies the area with monitors that violate the 2015 ozone NAAQS. It also provides EPA's evaluation of these areas and any nearby areas to determine whether those nearby areas have emissions sources that potentially contribute to ambient ozone concentrations at the violating monitors in the area, based on the weight-of-evidence of the five factors recommended in the EPA's ozone designations guidance and any other relevant information. In developing this technical analysis, the EPA used the latest data and information



available to the EPA (and to the states and tribes through the Ozone Designations Mapping Tool and the EPA Ozone Designations Guidance and Data web page).<sup>10</sup> In addition, the EPA considered any additional data or information provided to the EPA by states or tribes.

The five factors recommended in the EPA's guidance are:

1. Air Quality Data (including the design value calculated for each Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitor);
2. Emissions and Emissions-Related Data (including locations of sources, population, amount of emissions, and urban growth patterns);
3. Meteorology (weather/transport patterns);
4. Geography/Topography (including mountain ranges or other physical features that may influence the fate and transport of emissions and ozone concentrations); and
5. Jurisdictional Boundaries (e.g., counties, air districts, existing nonattainment areas, areas of Indian country, Metropolitan Planning Organizations (MPOs)).

Below, EPA applies the five factors separately for each of the two areas in Texas that EPA is designating as nonattainment.

### **3.1 Technical Analysis for the Dallas-Fort Worth Area**

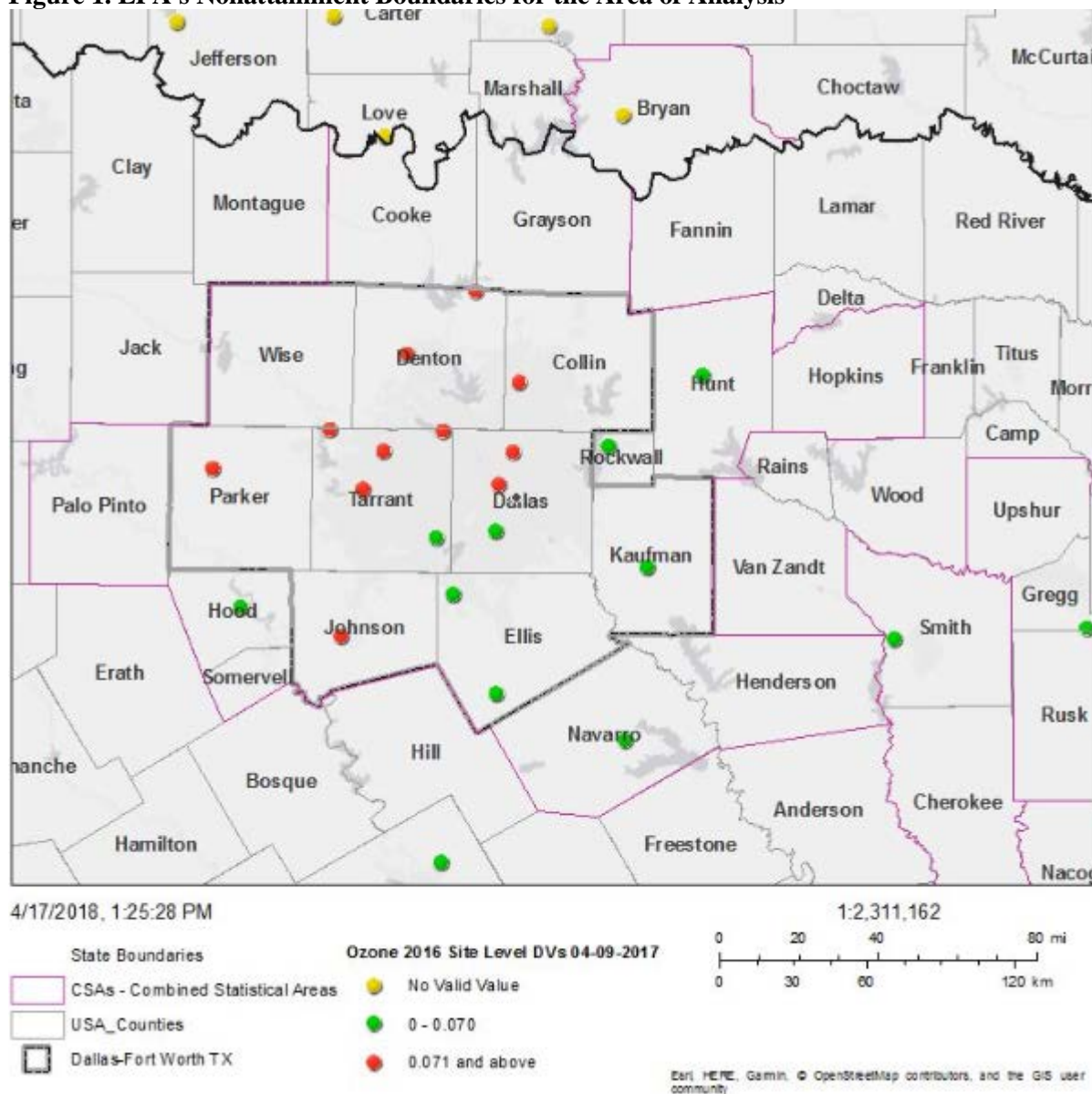
The area of analysis for the DFW area is the Dallas-Fort Worth, TX-OK CSA, which includes Bryan County, OK and the following Texas counties: Collin, Cooke, Dallas, Denton, Ellis, Grayson, Henderson, Hood, Hopkins, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, and Wise. Figure 1 below is a map of the EPA's nonattainment boundary for the DFW area. The map shows the location of the ambient air quality monitors, county, CSA, and other jurisdictional boundaries.

For purposes of the 1997 ozone NAAQS, the following entire counties within the area of analysis were designated nonattainment: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant. For purposes of the 2008 ozone NAAQS, these same nine counties, plus Wise County in its entirety, were designated nonattainment.

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<sup>10</sup> The EPA's Ozone Designations Guidance and Data web page can be found at <https://www.epa.gov/ozone-designations/ozone-designations-guidance-and-data>.

**Figure 1. EPA's Nonattainment Boundaries for the Area of Analysis**



The EPA must designate as nonattainment any area that violates the 2015 ozone NAAQS and any nearby areas that contribute to the violation in the violating area. Collin, Dallas, Denton, Johnson, Parker and Tarrant counties have monitors in violation of the 2015 ozone NAAQS, therefore these counties are included in the final nonattainment area. Based on the analysis below the EPA has determined that Ellis, Kaufman, and Wise counties contribute to the violating area.

The following sections describe the five-factor analysis EPA used to determine which counties should be included as part of the nonattainment area based on contributions to the violating monitors. While the factors are presented individually, they are not independent. The weight-of-evidence of the five-factor analysis process carefully considers the interconnections among the different factors and the dependence of each factor on one or more of the others, such as the interaction between emissions and meteorology for the area being evaluated.

## Factor Assessment

### Factor 1: Air Quality Data

The EPA considered 8-hour ozone design values in parts per million (ppm) for air quality monitors in the DFW area based on data for the 2014-2016 period (i.e., the 2016 design value). This is the most recent three-year period with fully-certified air quality data. The design value (DV) is the 3-year average of the annual 4<sup>th</sup> highest daily maximum 8-hour average ozone concentration.<sup>11</sup> The 2015 NAAQS are met when the DV is 0.070 ppm or less. Only ozone measurement data collected in accordance with the quality assurance (QA) requirements using approved (FRM/FEM) monitors are used for NAAQS compliance determinations.<sup>12</sup> The EPA uses FRM/FEM measurement data residing in the EPA's Air Quality System (AQS) database to calculate the ozone DVs. Individual violations of the 2015 ozone NAAQS that the EPA determines have been caused by an exceptional event that meets the administrative and technical criteria in the Exceptional Events Rule<sup>13</sup> are not included in these calculations. Whenever several monitors are located in a county (or designated nonattainment area), the DV for the county or area is determined by the monitor with the highest valid DV. The presence of one or more violating monitors (i.e. monitors with DVs greater than 0.070 ppm) in a county or other geographic area forms the basis for designating that county or area as nonattainment. The remaining four factors are then used as the technical basis for determining the spatial extent of the designated nonattainment area surrounding the violating monitor(s) based on a consideration of what nearby areas are contributing to a violation of the NAAQS.

The EPA identified monitors where the most recent DVs violate the NAAQS, and examined historical ozone air quality measurement data (including previous DVs) to understand the nature of the ozone ambient air quality problem in the area. Eligible monitors for providing DV data generally include State and Local Air Monitoring Stations that are operated in accordance with 40 CFR part 58, appendix A, C, D and E and operating with an FRM or FEM monitor. These requirements must be met in order to be acceptable for comparison to the 2015 ozone NAAQS for designation purposes. All data from Special Purpose Monitors (SPMs) using an FRM or FEM are eligible for comparison to the NAAQS, subject to the requirements given in the EPA's March 28, 2016 Revision to Ambient Monitoring Quality Assurance and Other Requirements Rule (81 FR 17248).

The 2014-2016 DVs for counties in the area of analysis are shown in Table 2 below.

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<sup>11</sup> The specific methodology for calculating the ozone design values, including computational formulas and data completeness requirements, is described in 40 CFR part 50, appendix U.

<sup>12</sup> The QA requirements for ozone monitoring data are specified in 40 CFR part 58, appendix A. The performance test requirements for candidate FEMs are provided in 40 CFR part 53, subpart B.

<sup>13</sup> The EPA finalized the rule on the Treatment of Data Influenced by Exceptional Events (81 FR 68513) and the guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events in September of 2016. For more information, see <https://www.epa.gov/air-quality-analysis/exceptional-events-rule-and-guidance>.

**Table 2. Air Quality Data (all values in ppm)\***

County**	State Recommended Nonattainment?	AQS Site ID	2014-2016 DV	2014 4 <sup>th</sup> highest daily max value	2015 4 <sup>th</sup> highest daily max value	2016 4 <sup>th</sup> highest daily max value
Bryan (Oklahoma)	No	400130380	N/A			
Collin	Yes	480850005	<b>0.074</b>	0.074	0.077	0.073
Cooke	No	No monitor	N/A			
Dallas	Yes	481130069	0.071	0.066	0.080	0.069
		481130075	<b>0.072</b>	0.070	0.079	0.067
		481130087	0.064	0.063	0.068	0.062
Denton	Yes	481210034	<b>0.080</b>	0.077	0.088	0.076
		481211032	0.076	0.075	0.079	0.075
Ellis	Yes	481390016	0.063	0.062	0.068	0.060
		481391044	0.062	0.060	0.066	0.060
Grayson	No	No monitor	N/A			
Henderson	No	No monitor	N/A			
Hood	No	482210001	0.069	0.073	0.073	0.063
Hopkins	No	No monitor	N/A			
Hunt	No	482311006	0.060	0.062	0.062	0.058
Johnson	Yes	482510003	<b>0.072</b>	0.071	0.073	0.072
Kaufman	Yes	482570005	0.061	0.062	0.064	0.057
Navarro	No	483491051	0.061	0.060	0.064	0.060
Palo Pinto	No	No monitor	N/A			
Parker	Yes	483670081	<b>0.073</b>	0.072	0.079	0.068
Rockwall	No <sup>14</sup>	483970001	0.066	0.066	0.071	0.061
Somervell	No	No monitor	N/A			
Tarrant	Yes	484390075	0.072	0.073	0.078	0.067
		484391002	0.074	0.079	0.079	0.066
		484392003	0.073	0.074	0.076	0.070
		484393009	<b>0.075</b>	0.073	0.079	0.075
		484393011	0.065	0.065	0.069	0.061
Wise	Yes	No monitor	N/A			

\* The highest design value in each county with a violating monitor is indicated in bold type.

\*\* All counties are in Texas, unless otherwise noted.

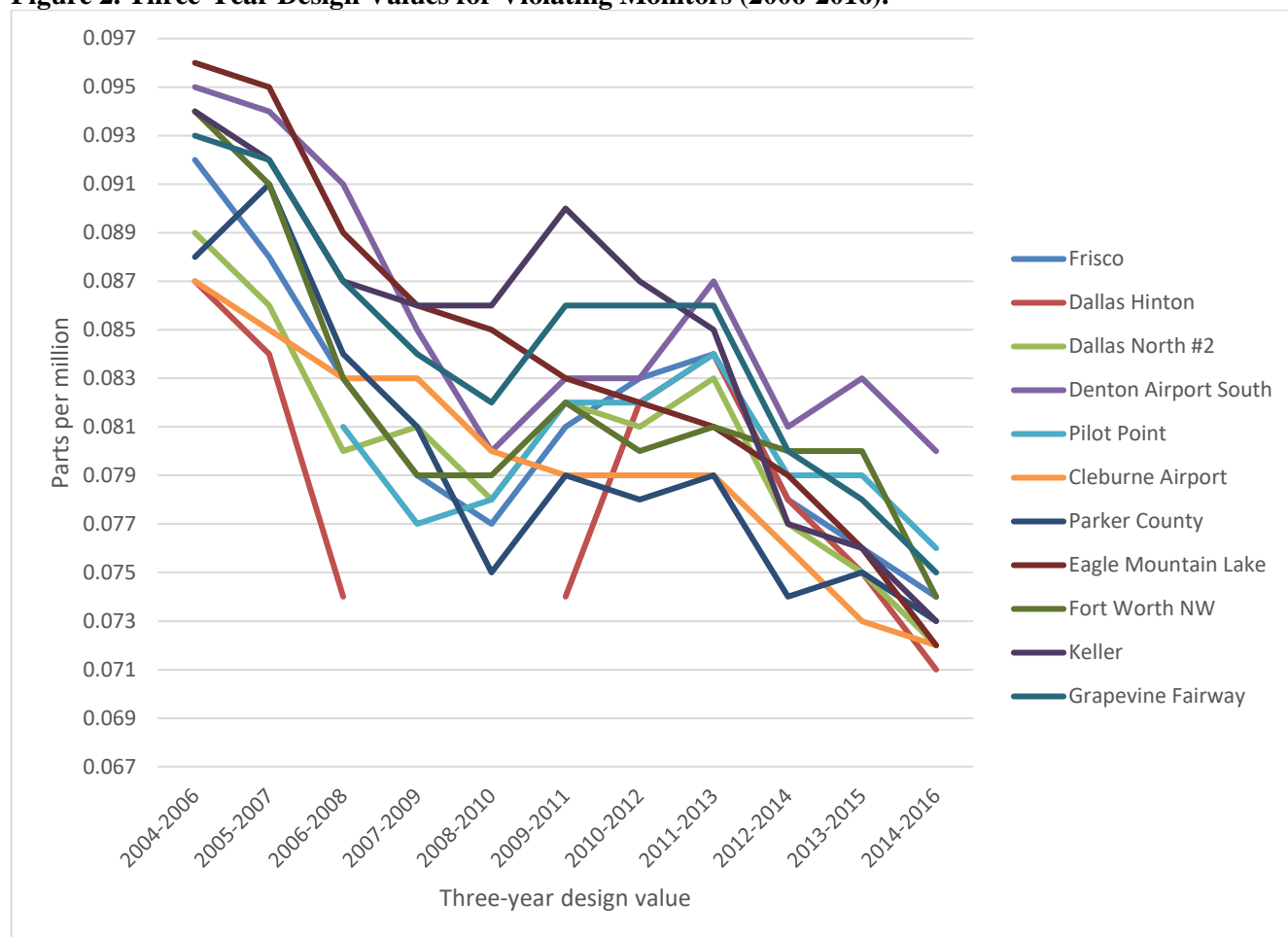
N/A means that the monitor did not meet the completeness criteria described in 40 CFR, part 50, Appendix U, or no data exists for the county.

Six counties in the area of analysis have violating monitors with design values between 0.071 and 0.080 ppm (as shown in Table 2 and Figure 1): Collin, Dallas, Denton, Johnson, Parker and Tarrant. Therefore, these counties are included in the final nonattainment area. All other monitors in the DFW TX-OK CSA have design values between 0.060 and 0.069 ppm. A county must also be designated nonattainment if it contributes to a violation in a nearby area. Each county without a violating monitor that is located near a county with a violating monitor has been evaluated based on the weight-of-evidence of the five factors and other relevant information to determine whether it contributes to the nearby violation.

<sup>14</sup> Texas originally recommended nonattainment for Rockwall County and requested a revision to their recommendation during the 120-day process, due in part to the fact that the Rockwall County monitor is attaining the 2015 ozone NAAQS.

Figure 2 shows the historical trend of DVs for the violating monitors in the DFW TX-OK CSA. As indicated on the map, there are 11 violating monitors located in Collin, Dallas, Denton, Johnson, Parker and Tarrant counties. There are also monitors in Ellis, Hood, Kaufman, Navarro, and Rockwall Counties that are not violating based on air quality data from 2014-2016. As shown in Figure 2 below, with the exception of an increase in the 2009-2011 and 2011-2013 DVs (and an increase in a few of the 2013-2015 DVs), there has been a general downward trend in three-year design values.

**Figure 2. Three-Year Design Values for Violating Monitors (2006-2016).**



## Factor 2: Emissions and Emissions-Related Data

The EPA evaluated ozone precursor emissions of nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOC) and other emissions-related data that provide information on areas contributing to the violating monitors.

### Emissions Data

The EPA reviewed data from the 2014 National Emissions Inventory (NEI). For each county in the area of analysis, the EPA examined the magnitude of large sources (NO<sub>x</sub> or VOC emissions greater than 100 tons per year (tpy)) and small point sources and the magnitude of county-level emissions reported in the NEI. These county-level emissions represent the sum of emissions from the following general source categories: point sources, non-point (i.e., area) sources, non-road mobile, on-road mobile, and fires. Emissions levels from sources in a nearby area indicate the potential for the area to contribute to monitored violations.

Table 3 provides a county-level emissions summary of NOx and VOC emissions for the area of analysis considered for inclusion in the DFW nonattainment area.

**Table 3. Total County-Level NOx and VOC Emissions**

County*	State Recommended Nonattainment?	Total NOx (tpy)	Total VOC (tpy)
Dallas	Yes	41,673	44,695
Tarrant	Yes	33,079	38,600
Collin	Yes	12,341	13,136
Denton	Yes	11,059	16,033
Wise	Yes	10,789	12,777
Ellis	Yes	10,087	5,551
Navarro	No	5,918	3,881
Johnson	Yes	5,683	7,688
Kaufman	Yes	5,391	3,013
Hunt	No	4,876	2,922
Parker	Yes	4,693	6,190
Grayson	No	4,521	6,205
Cooke	No	3,343	6,792
Bryan County, Oklahoma	No	2,812	2,187
Hood	No	2,711	2,575
Henderson	No	2,652	3,843
Hopkins	No	2,517	1,726
Palo Pinto	No	2,382	4,035
Rockwall	No <sup>15</sup>	1,611	1,728
Somervell	No	435	583
Area wide:		168,573	184,160

\* All counties are in Texas, unless otherwise noted.

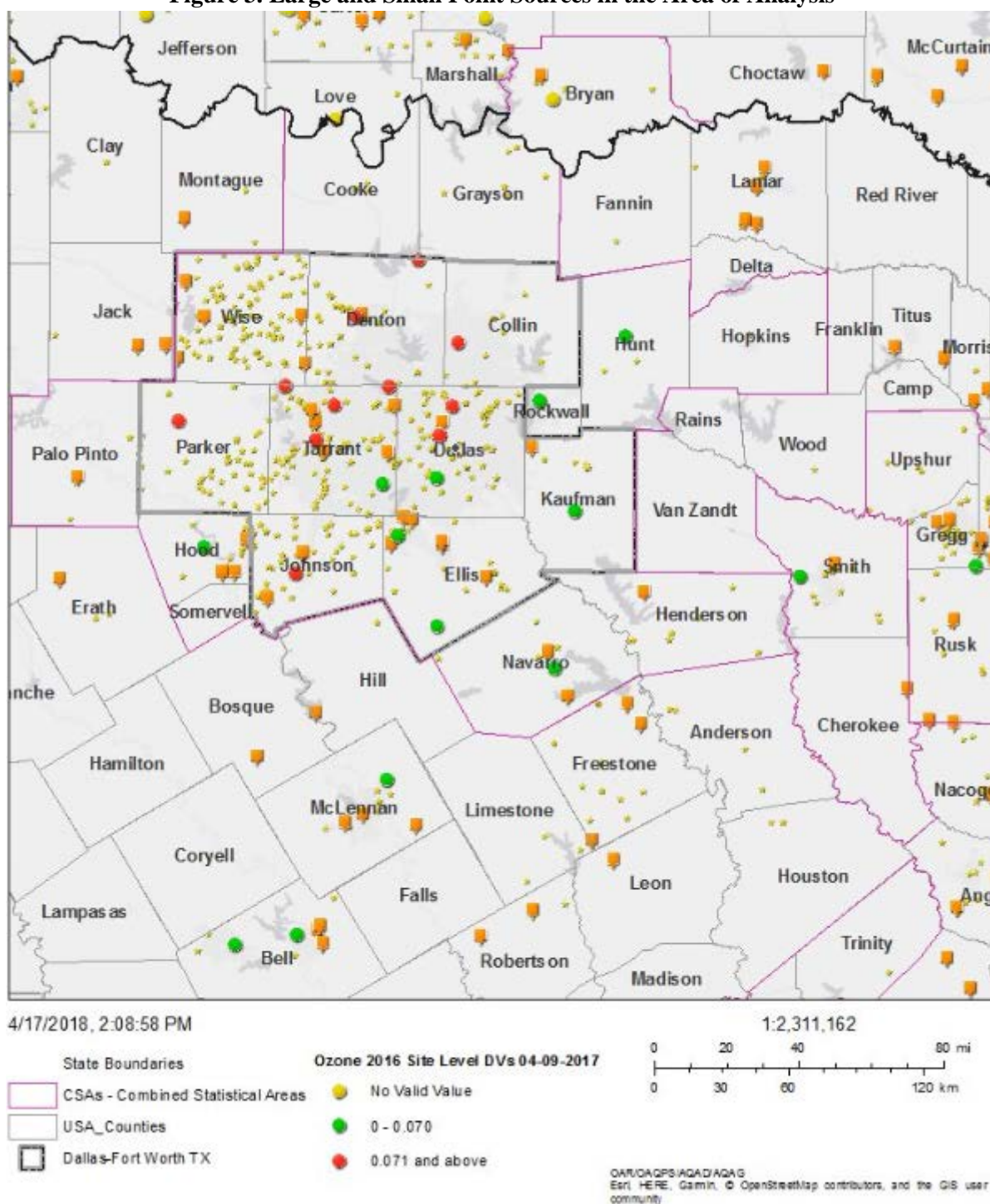
In addition to reviewing county-wide emissions of NOx and VOC in the area of analysis, the EPA also reviewed emissions from large and small point sources. The location of these sources, together with the other factors, can help inform nonattainment boundaries. The locations of the large and small point sources are shown in Figure 3 below.<sup>16</sup> The nonattainment boundary is also shown.

<sup>15</sup> Texas originally recommended nonattainment for Rockwall County and requested a revision to their recommendation during the 120-day process, due in part to the fact that the Rockwall County monitor is attaining the 2015 ozone NAAQS.

<sup>16</sup> The sources shown in this figure are based on the 2014 NEI v1 data.



**Figure 3. Large and Small Point Sources in the Area of Analysis**



In summary, the EPA's analysis of relevant county-level emissions and the geographic locations of the relevant emissions show that Dallas and Tarrant counties have the highest NO<sub>x</sub> emissions in the area of analysis. The counties with the next highest level of NO<sub>x</sub> are Collin, Denton, Wise and Ellis, which emit approximately 25 to 30 percent of the NO<sub>x</sub> sources in Dallas County. The NO<sub>x</sub> emissions in the remaining 14 counties are all less than 15 percent of the level in Dallas County with the lowest emissions in Somervell and Rockwall Counties.

Within the area of analysis, Dallas and Tarrant Counties also have the highest VOC emissions with Collin, Denton, and Wise Counties emitting approximately 29 to 36 percent of the VOC sources in Dallas County. The remaining 15 counties all have lower emissions with Somervell, Hopkins, and Rockwall ranking the lowest. The

large and small point sources are concentrated in the urban core and generally decrease outside of the nonattainment boundary.

### **Population density and degree of urbanization**

In this part of the factor analysis, EPA evaluated the population and vehicle use characteristics and trends of the area as indicators of the probable location and magnitude of non-point source emissions. These include emissions of NO<sub>x</sub> and VOC from on-road and non-road vehicles and engines, consumer products, residential fuel combustion, and consumer services. Areas of dense population or commercial development are an indicator of area source and mobile source NO<sub>x</sub> and VOC emissions that may contribute to violations of the NAAQS. Table 4 below shows the population, population density, and population growth for each county in the area of analysis. Figure 4 below contains a county-level density map of the area of analysis.

**Table 4. Population and Growth\***

County**	State Recommended Nonattainment?	2010 Population	2015 Population	2015 Population Density (per sq. mi.)	Absolute change in population 2010-2015	Population % change 2010-2015
Dallas	Yes	2,368,139	2,553,385	2931	185,246	8
Tarrant	Yes	1,809,034	1,982,498	2296	173,464	10
Collin	Yes	782,341	914,127	1087	131,786	17
Denton	Yes	662,614	780,612	889	117,998	18
Ellis	Yes	149,610	163,632	175	14,022	9
Johnson	Yes	150,934	159,990	221	9,056	6
Parker	Yes	116,927	126,042	140	9,115	8
Grayson	No	120,877	125,467	135	4,590	4
Kaufman	Yes	103,350	114,690	147	11,340	11
Rockwall	No <sup>17</sup>	78,337	90,861	715	12,524	16
Hunt	No	86,129	89,844	107	3,715	4
Henderson	No	78,532	79,545	91	1,013	1
Wise	Yes	59,127	62,953	70	3,826	7
Hood	No	51,182	55,423	132	4,241	8
Navarro	No	47,735	48,323	48	588	1
Bryan (Oklahoma)	No	42,416	44,884	50	2,468	6
Cooke	No	38,437	39,229	45	792	2
Hopkins	No	35,161	36,223	47	1,062	3
Palo Pinto	No	28,111	27,895	29	-216	-1
Somervell	No	8,490	8,739	47	249	3
Area wide:		6,817,483	7,504,362	481	686,879	10

\* U.S. Census Bureau population estimates for 2010 and 2015; see [www.census.gov/data.html](http://www.census.gov/data.html).

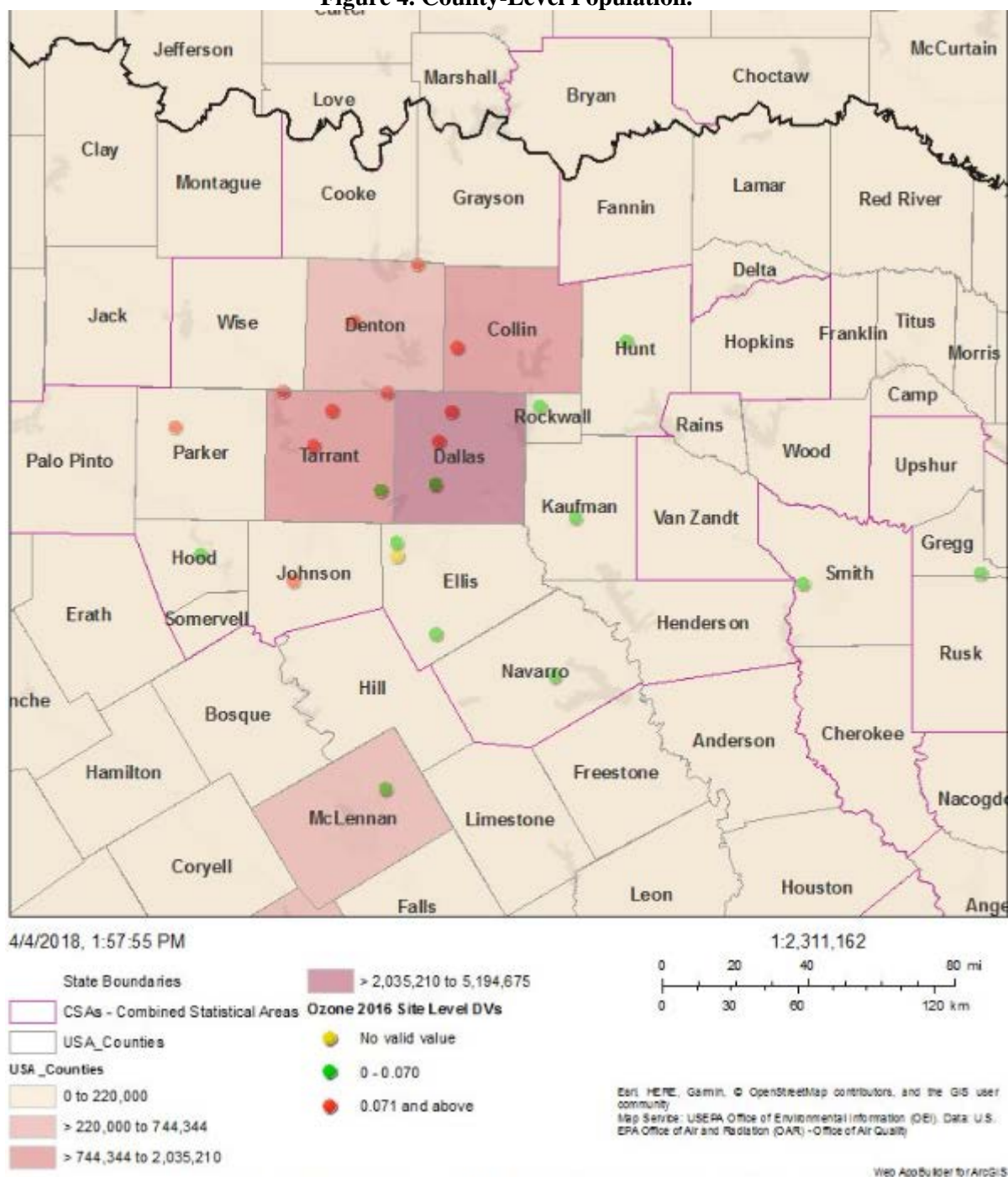
\*\* All counties are in Texas, unless otherwise noted.

Dallas and Tarrant Counties each have populations exceeding one million and population densities of 2931 and 2296, respectively. While Collin and Denton have lower, but still high, populations of approximately 914,127 and 780,612 respectively, they are densely populated (1087 and 889, respectively), too. The remaining counties

<sup>17</sup> Texas originally recommended nonattainment for Rockwall County and requested a revision to their recommendation during the 120-day process, due in part to the fact that the Rockwall County monitor is attaining the 2015 ozone NAAQS.

are significantly less populous and less densely populated (with the exception of Rockwall County); the population in the remaining counties are all less than 7 percent of the level in Dallas County. There has been population growth – the highest growth was in Denton, Collin and Rockwall Counties. Only Palo Pinto experienced a decrease in population. The remaining counties experienced slight to moderate growth.

**Figure 4. County-Level Population.**



### Traffic and Vehicle Miles Travelled (VMT)

The EPA evaluated the commuting patterns of residents and the total vehicle miles traveled (VMT) for each county in the area of analysis. In combination with the population/population density data and the location of main transportation arteries, this information helps identify the probable location of non-point source emissions. A county with high VMT and/or high number of commuters is generally an integral part of an urban area. High

VMT and/or high number of commuters indicates the presence of motor vehicle emissions that may contribute to violations of the NAAQS. Rapid population and/or VMT growth in a county on the urban perimeter may signify increasing integration with the core urban area and thus, could indicate that the associated area source and mobile source emissions may be appropriate to include in the nonattainment area. In addition to VMT, the EPA evaluated worker data collected by the U.S. Census Bureau for the area of analysis.<sup>18</sup> Table 5 below shows the traffic and commuting pattern data, including total VMT for each county, number of residents who work in each county, and the number and percent within each county that commute to counties with violating monitors. Unless otherwise noted, the data in Table 5 are 2014 data.

**Table 5. Traffic and Commuting Patterns**

County*	State Recommended Nonattainment?	2008 Total VMT (Million Miles)	2014 Total VMT (Million Miles)	VMT Growth 2008 to 2014 (percent)	County Residents Who Work	Number Commuting to or Within Counties with Violating Monitor(s)	Percentage Commuting to or Within Counties with Violating Monitor(s)
<b>Dallas</b>	Yes	26,625	25,401	-5%	1,075,478	962,986	89.5
<b>Tarrant</b>	Yes	16,741	16,147	-4%	861,575	770,380	89.4
<b>Collin</b>	Yes	6,198	7,883	27%	423,478	377,467	89.1
<b>Denton</b>	Yes	5,507	6,343	15%	372,251	333,946	89.7
Ellis	Yes	1,893	2,553	35%	75,222	43,286	57.5
Kaufman	Yes	1,548	2,167	40%	51,404	31,595	61.5
<b>Johnson</b>	Yes	1,432	1,870	31%	69,256	56,436	81.5
<b>Parker</b>	Yes	1,280	1,680	31%	52,250	43,379	83.0
Hunt	No	1,046	1,623	55%	35,720	13,811	38.7
Grayson	No	1,364	1,190	-13%	50,777	17,892	35.2
Wise	Yes	969	1,097	13%	25,643	11,954	46.6
Rockwall	No <sup>19</sup>	676	838	24%	40,904	26,004	63.6
Navarro	No	801	809	1%	20,752	5,388	26.0
Henderson	No	768	727	-5%	26,875	4,432	16.5
Cooke	No	636	682	7%	17,241	6,134	35.6
Hopkins	No	608	576	-5%	14,203	1,798	12.7
Hood	No	443	573	29%	22,787	9,228	40.5
Palo Pinto	No	397	382	-4%	9,822	2,692	27.4
Bryan, OK	No	460	602	31%	16,186	522	3.2
Somervell	No	121	98	-19%	3,783	1,316	34.8
Total:		69,513	73,239	5%	3,265,607	2,720,646	83.3

\* All counties are in Texas, unless otherwise noted. Counties with a monitor violating the NAAQS are shown in bold.

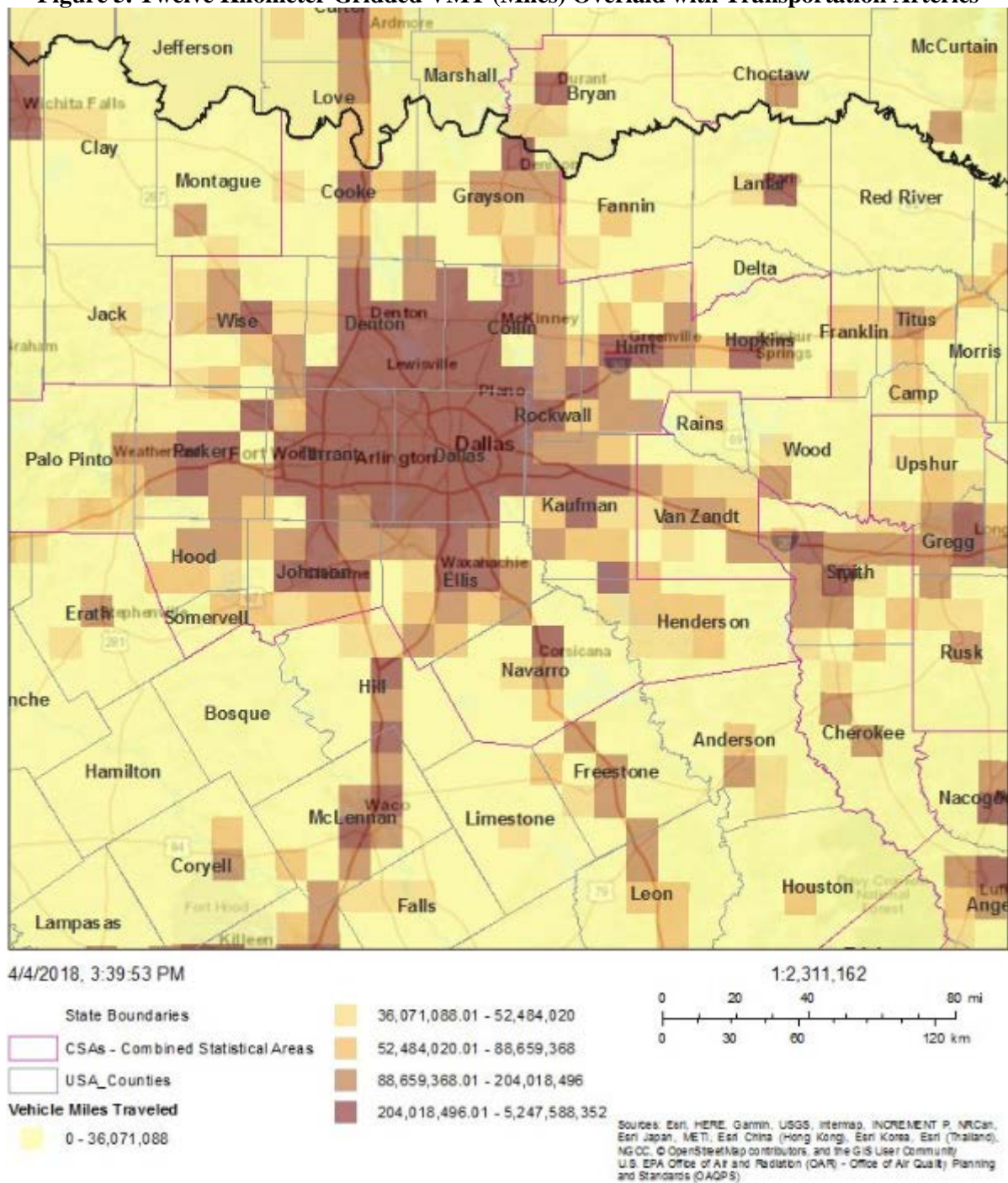
<sup>18</sup> The worker data can be accessed at: <http://onthemap.ces.census.gov/>.

<sup>19</sup> Texas originally recommended nonattainment for Rockwall County and requested a revision to their recommendation during the 120-day process, due in part to the fact that the Rockwall County monitor is attaining the 2015 ozone NAAQS.



To show traffic and commuting patterns, Figure 5 below overlays twelve-kilometer gridded VMT from the 2014 NEI with a map of the transportation arteries.

**Figure 5. Twelve Kilometer Gridded VMT (Miles) Overlaid with Transportation Arteries**



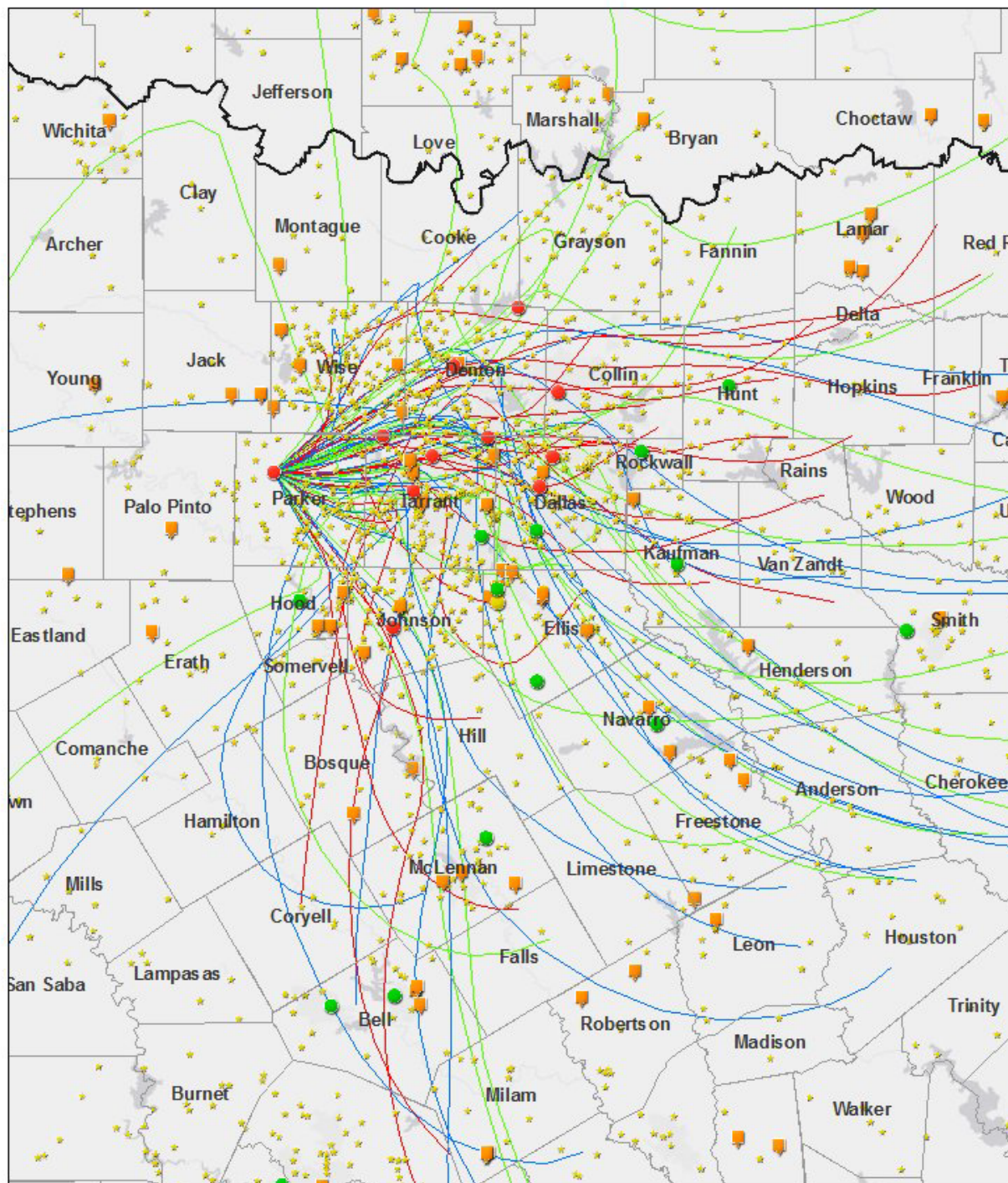
Counties are listed in Table 5 in order of VMT from largest to smallest. The six counties with violating monitors have the first through fourth, seventh, and eighth largest VMT of the 20 counties in the area of analysis. The nine counties that EPA is designating as nonattainment (Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Tarrant, and Wise) account for almost 89% of the VMT in the area of analysis.

### **Factor 3: Meteorology**

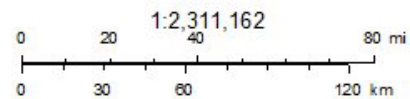
Evaluation of meteorological data helps assess the fate and transport of emissions contributing to ozone concentrations and identify areas potentially contributing to the monitored violations. Results of meteorological data analysis may inform the determination of nonattainment area boundaries. To determine how meteorological conditions, including, but not limited to, weather, transport patterns, and stagnation conditions, could affect the fate and transport of ozone and precursor emissions from sources in the area, the EPA evaluated 2014-2016 (HYbrid Single-Particle Lagrangian Integrated Trajectory) HYSPLITs at 100, 500, and 1000 meters above ground level (AGL) that illustrate the three-dimensional paths traveled by air parcels to a violating monitor. Figures 6a – 6f below show the 24-hour HYSPLIT back trajectories for each exceedance day (i.e., daily maximum 8 hour values that exceed the 2015 ozone NAAQS) for the violating monitors.



Figure 6a. HYSPLIT Back Trajectories for the Violating Monitor in Parker County



12/17/2017, 8:33:39 AM

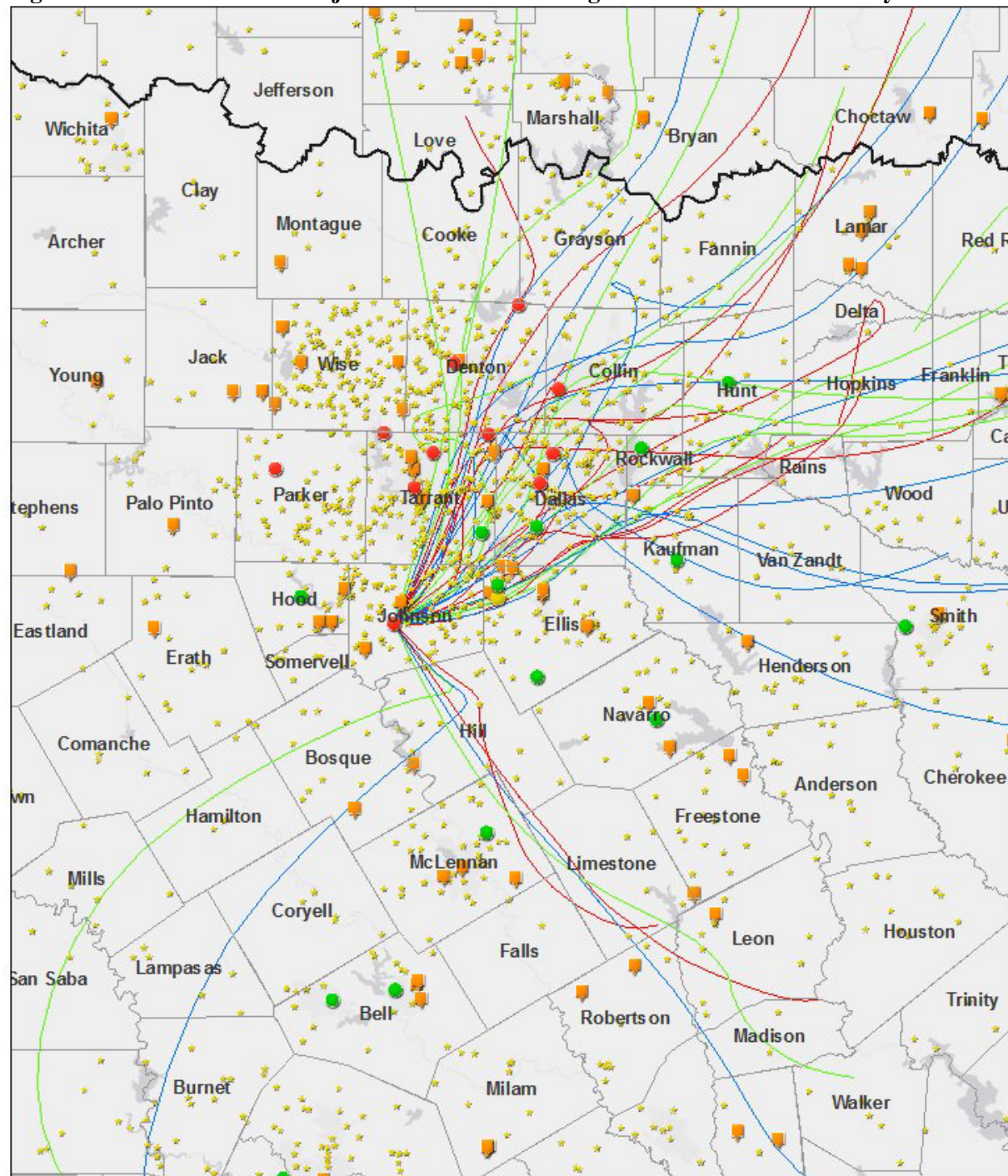


- State Boundaries
- USA\_Counties
- Large Point Sources (VOC GT 100 or NOx GT 100)
- Small Point Sources
- Ozone 2016 Site Level DVs Dallas\_Fort\_Worth\_Arlington\_TX\_483670081
- No valid value
- 0 - 0.070
- 0.071 and above
- 100
- 500
- 1,000

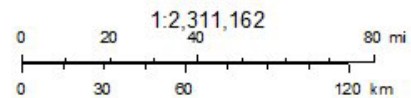
OAR/OAQPS/AQAD/AQAG  
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the  
GIS user community  
Map Service: US EPA Office of Environmental Information (OEI). Data: U.S.  
EPA Office of Air and Radiation (OAR) - Office of Air Quality



Figure 6b. HYSPLIT Back Trajectories for the Violating Monitor in Johnson County



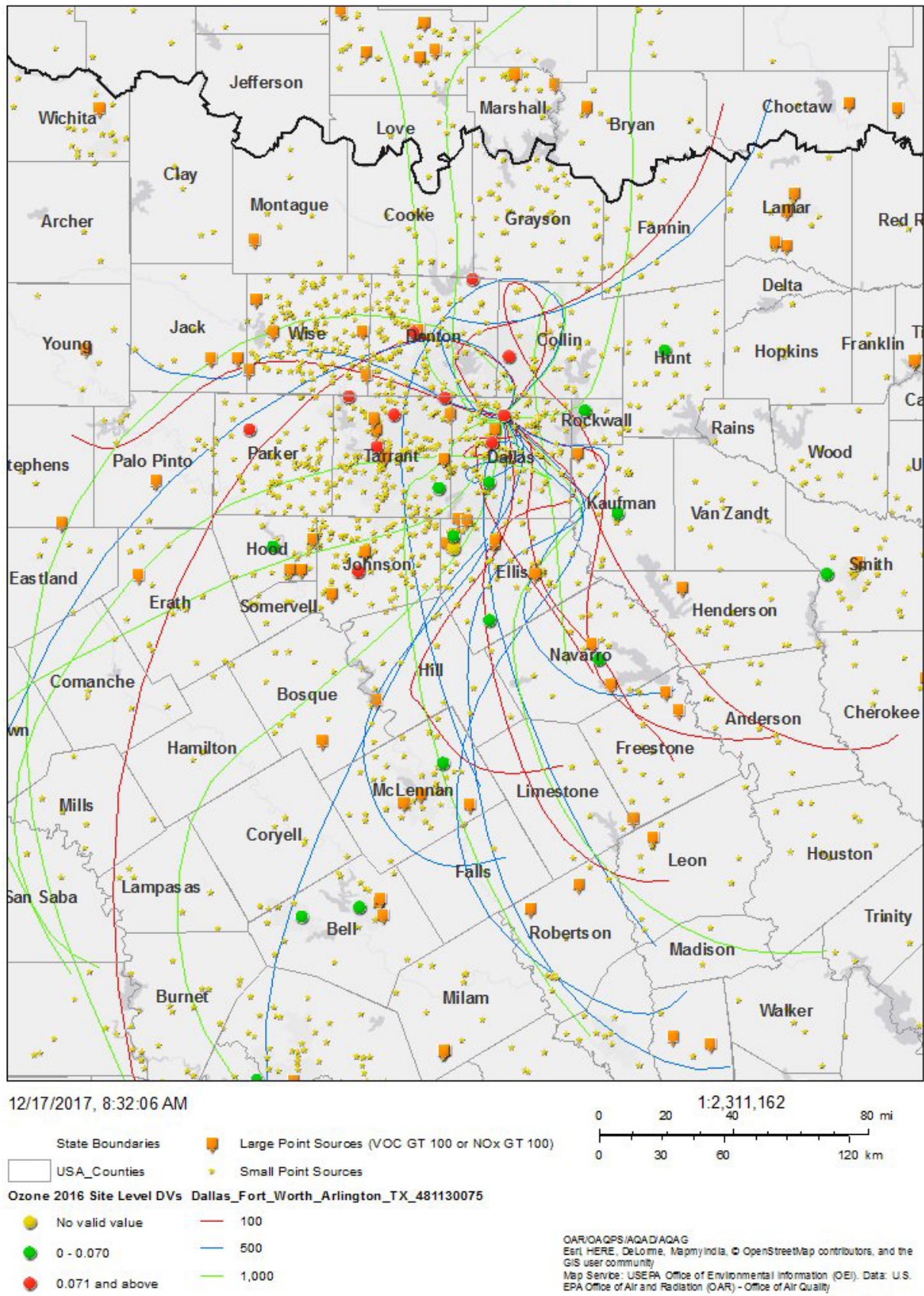
12/17/2017, 8:35:07 AM



OAR/OAQPS/AQAD/AQAG  
 Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the  
 GIS user community  
 Map Service: USEPA Office of Environmental Information (OEI). Data: U.S.  
 EPA Office of Air and Radiation (OAR) - Office of Air Quality



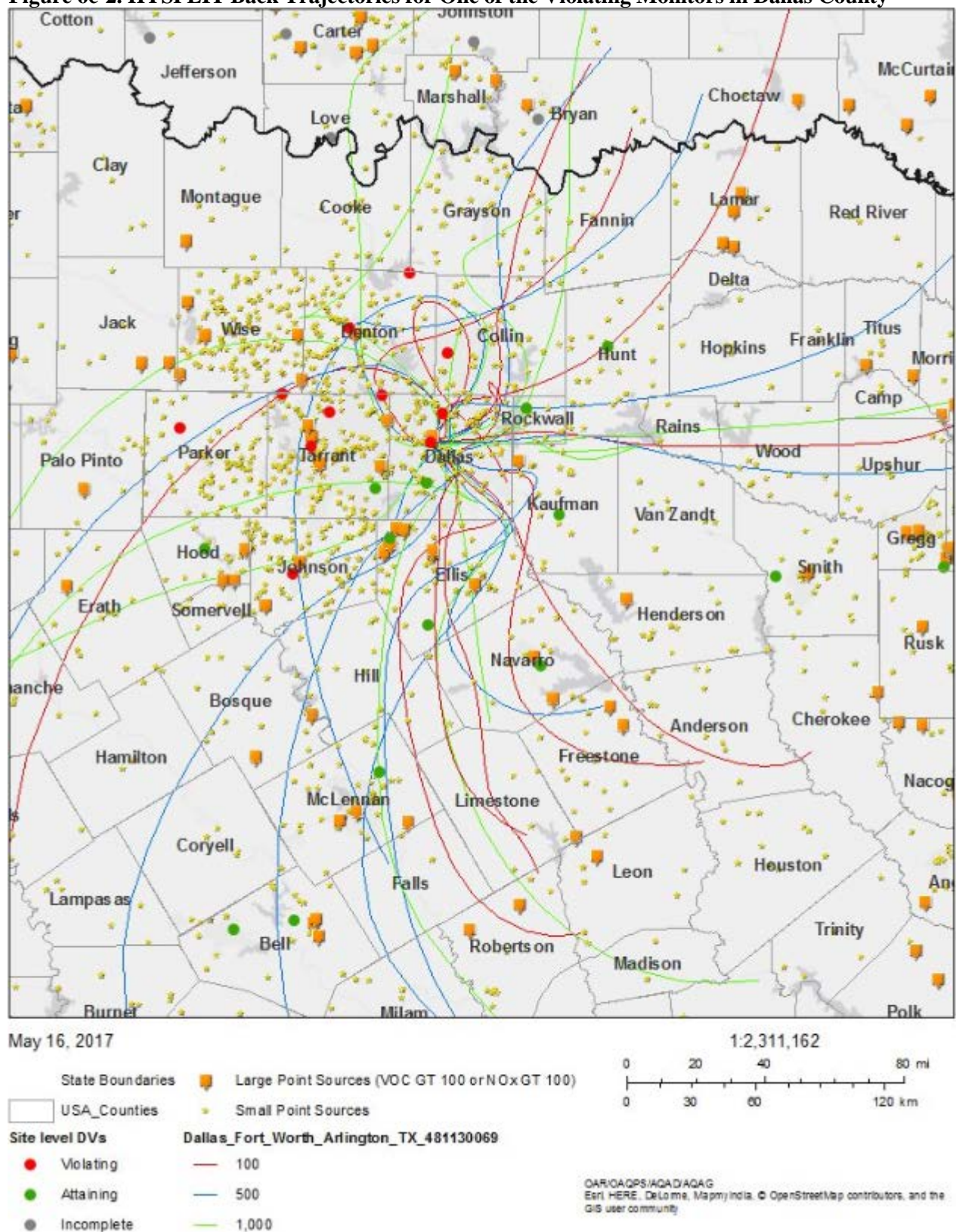
Figure 6c-1. HYSPLIT Back Trajectories for One of the Violating Monitors in Dallas County<sup>20</sup>



<sup>20</sup> This is the Dallas North #2 monitor - it has the higher ozone DV of the two violating monitors in Dallas County.



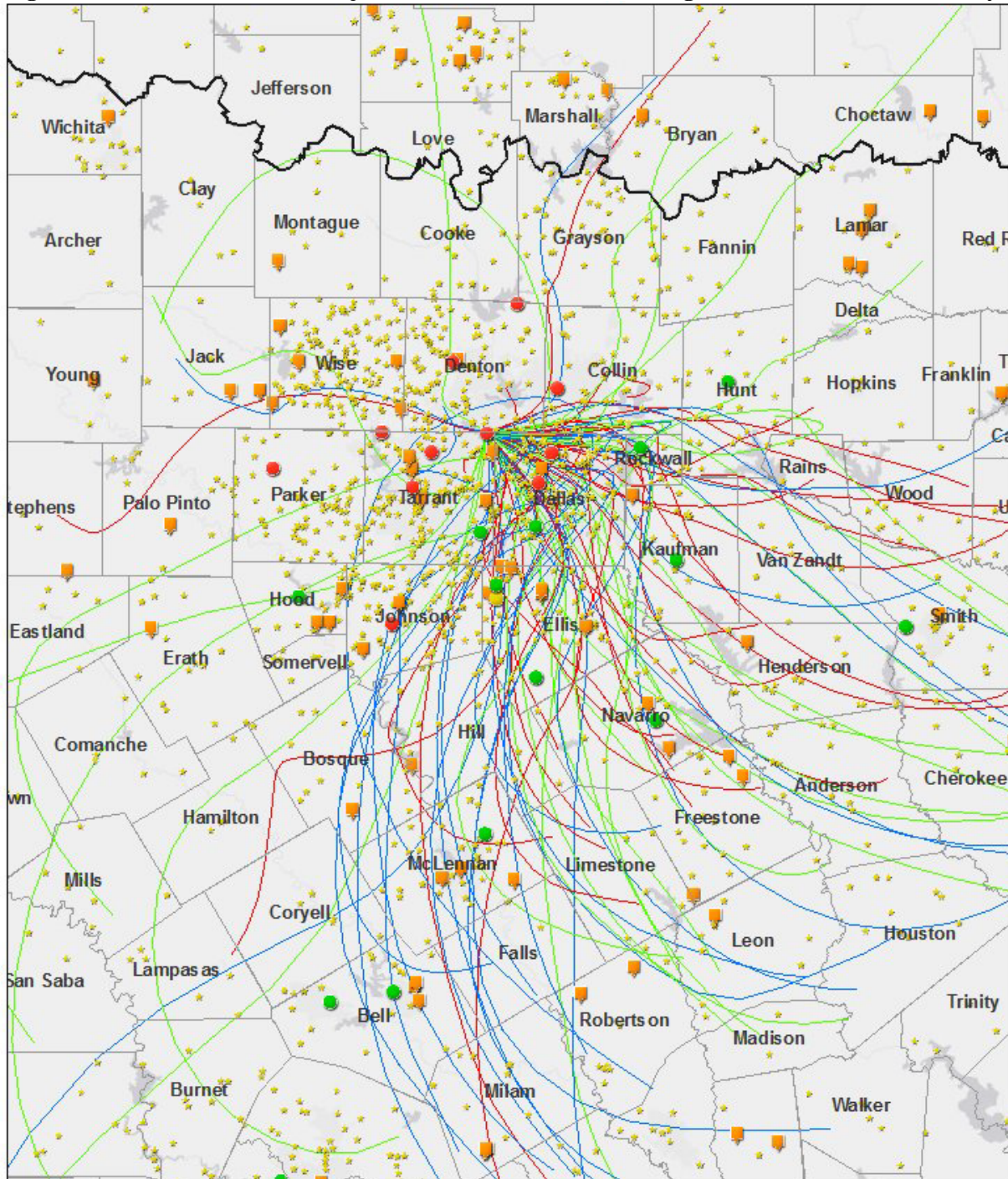
Figure 6c-2. HYSPLIT Back Trajectories for One of the Violating Monitors in Dallas County<sup>21</sup>



<sup>21</sup> This is the second of two violating monitors in Dallas County and is known as the Dallas Hinton monitor.



Figure 6d-1. HYSPLIT Back Trajectories for One of the Violating Monitors in Tarrant County<sup>22</sup>



12/17/2017, 8:39:49 AM



1:2,311,162

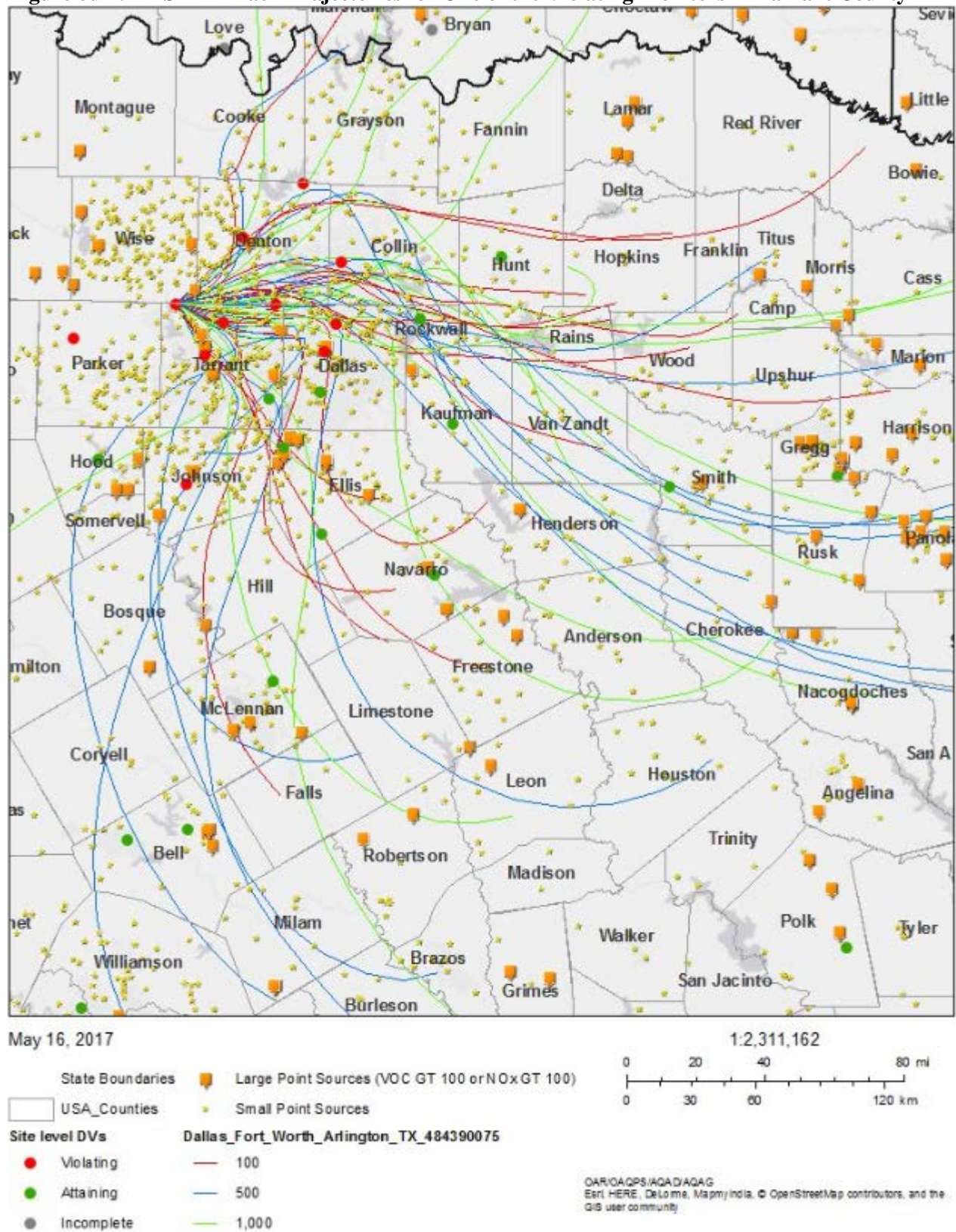
0 20 40 80 mi  
0 30 60 120 km

OAR/OAQPS/AQA/DQAQ  
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the  
GIS user community  
Map Service: USEPA Office of Environmental Information (OEI). Data: U.S.  
EPA Office of Air and Radiation (OAR) - Office of Air Quality

<sup>22</sup> This monitor at Grapevine Fairway has the highest ozone design value of the 4 violating monitors in Tarrant County.



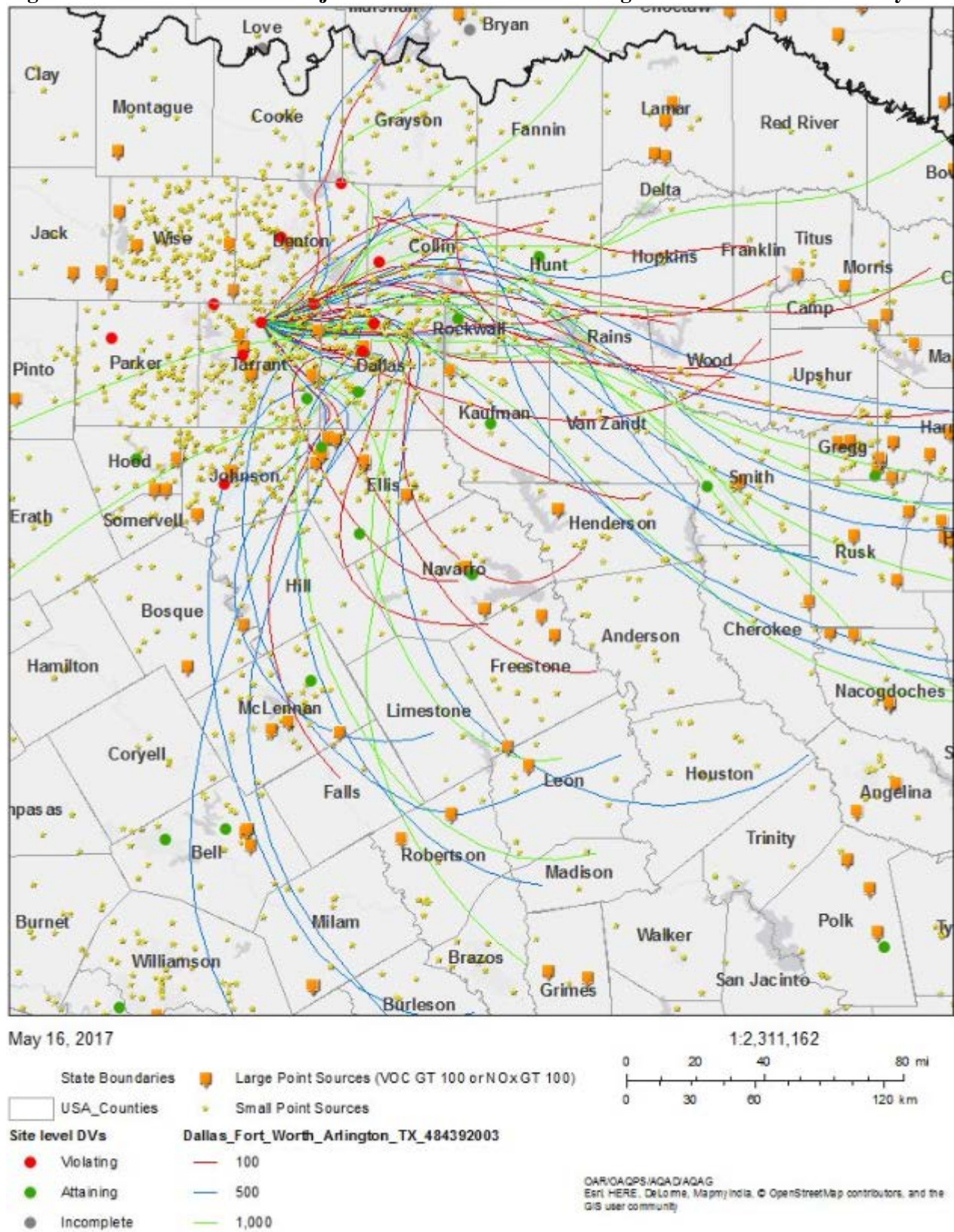
Figure 6d-2. HYSPLIT Back Trajectories for One of the Violating Monitors in Tarrant County<sup>23</sup>



<sup>23</sup> This is the second of four violating monitors in Tarrant County and is known as the Eagle Mountain Lake monitor.



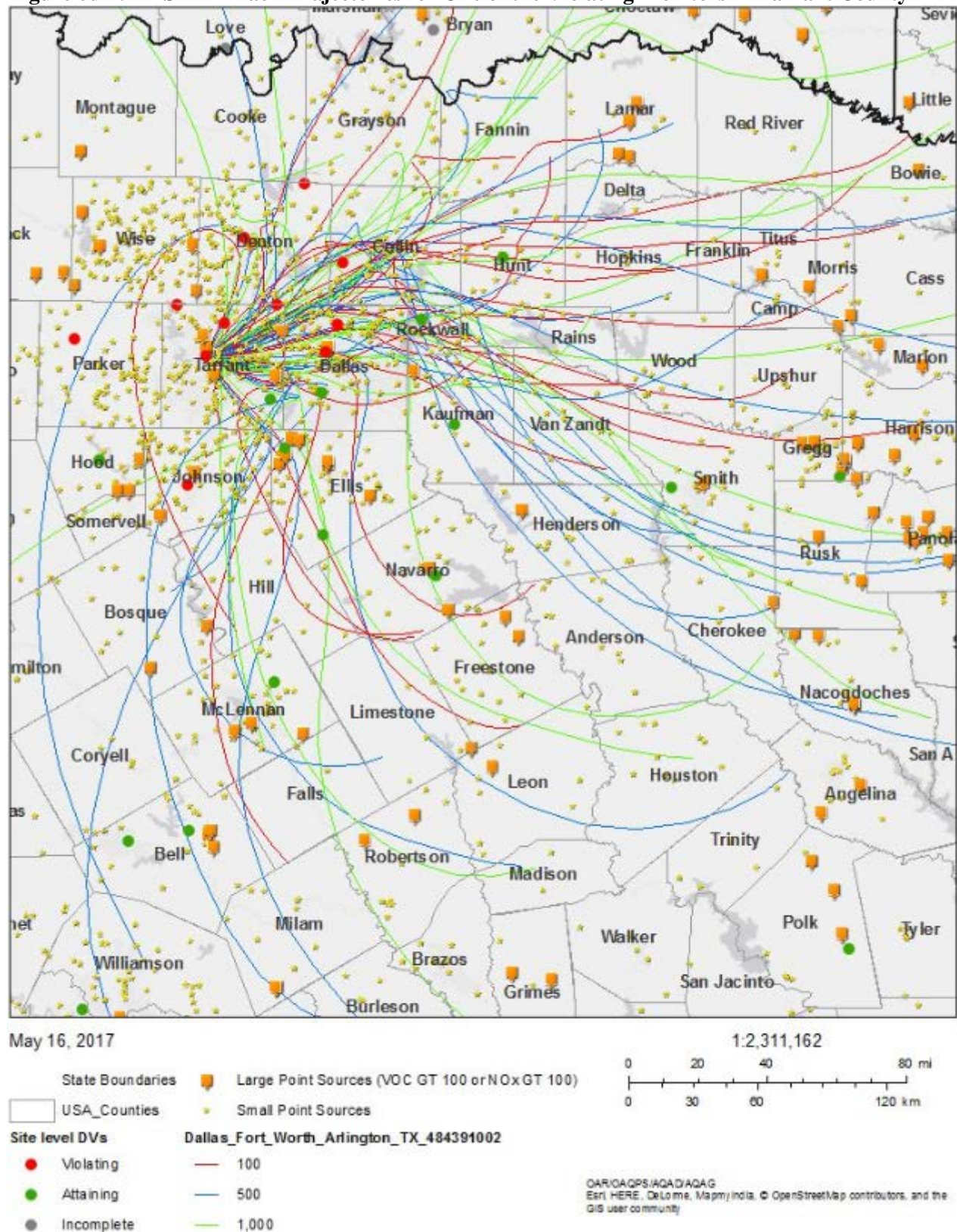
Figure 6d-3. HYSPLIT Back Trajectories for One of the Violating Monitors in Tarrant County<sup>24</sup>



<sup>24</sup> This is the third of four violating monitors in Tarrant County and is known as the Keller monitor.



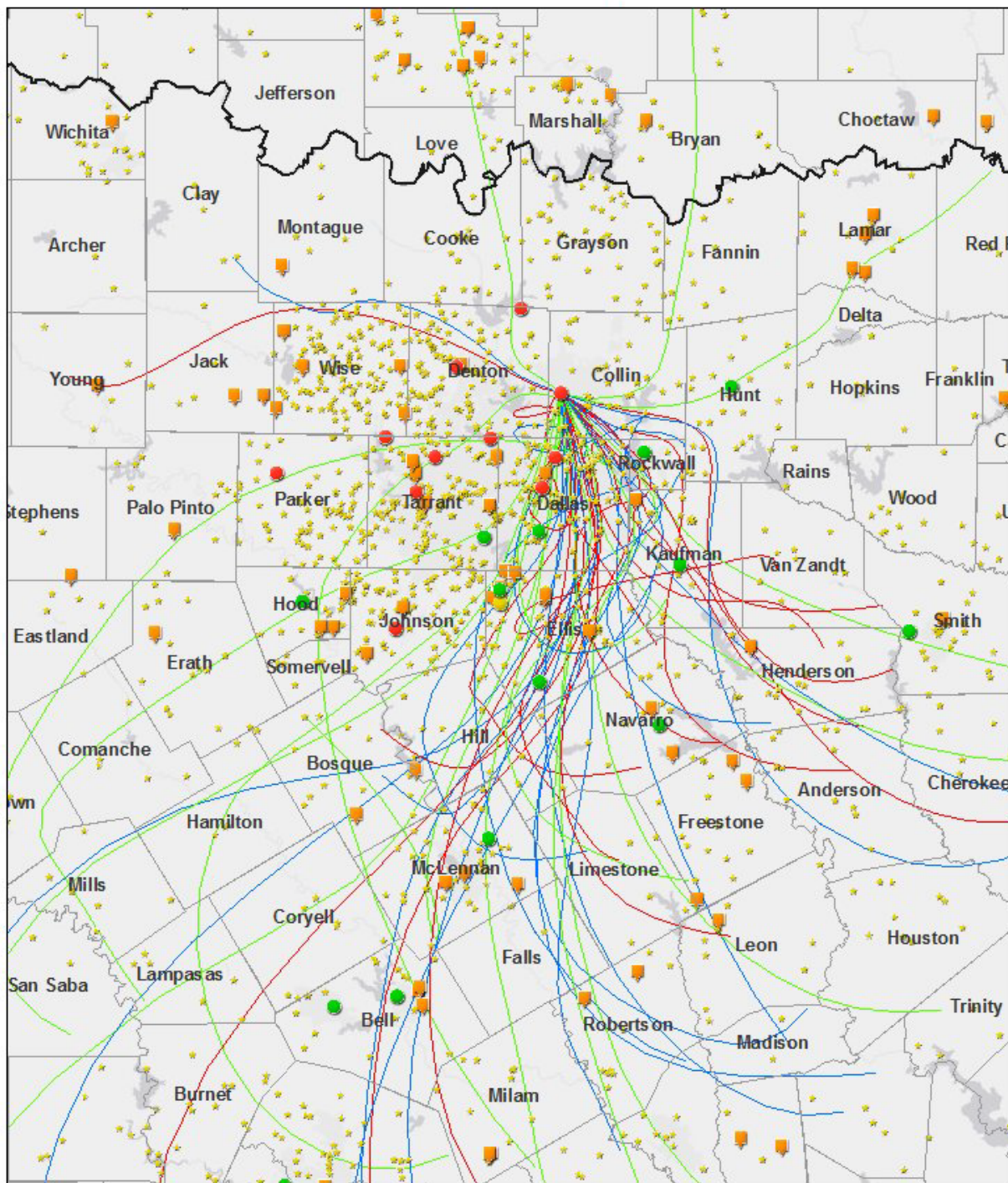
Figure 6d-4. HYSPLIT Back Trajectories for One of the Violating Monitors in Tarrant County<sup>25</sup>



<sup>25</sup> This is the fourth of four violating monitors in Tarrant County and is known as the Fort Worth Northwest monitor.



Figure 6e. HYSPLIT Back Trajectories for the Violating Monitor in Collin County



12/17/2017, 8:44:07 AM

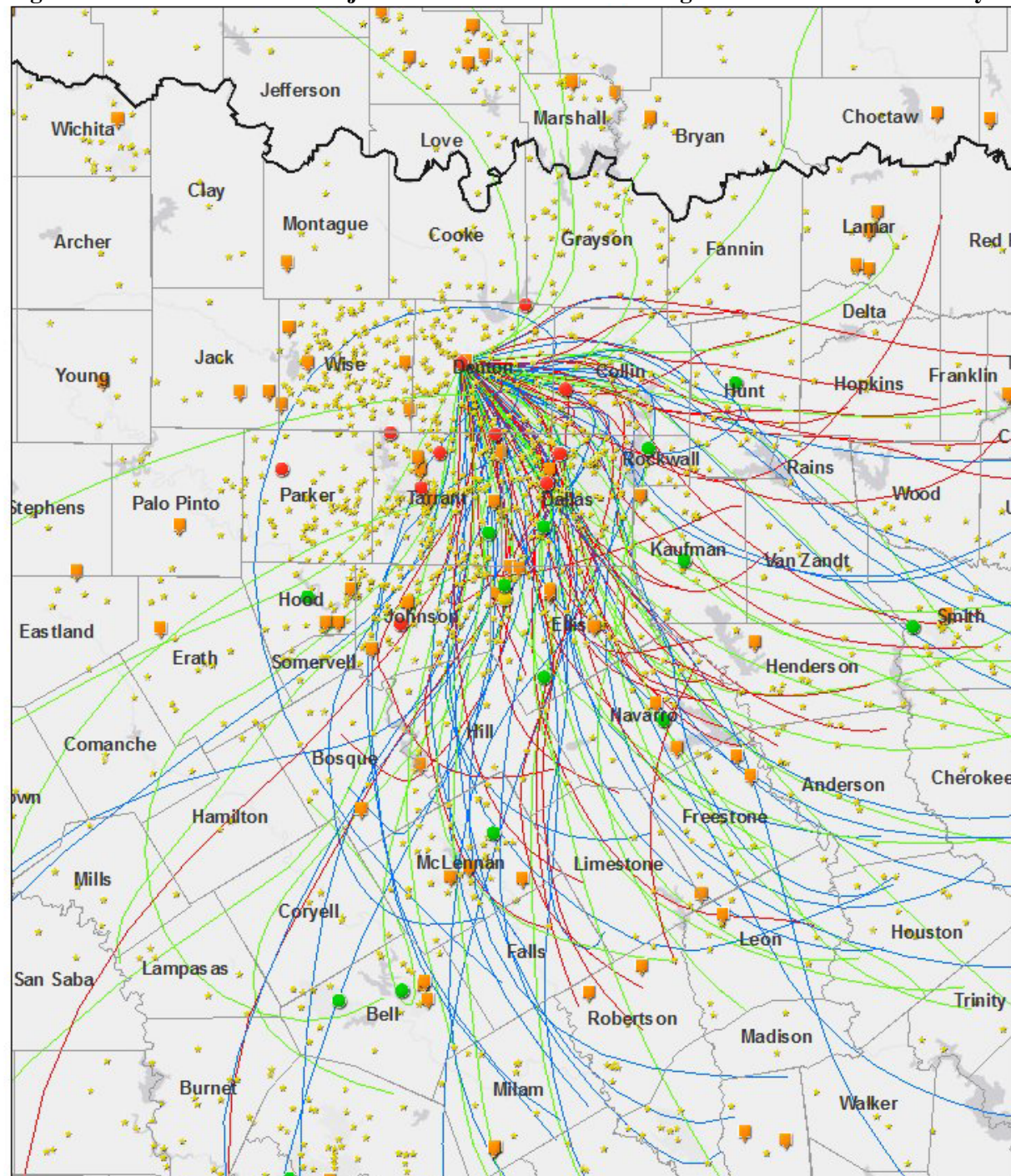
1:2,311,162  
0 20 40 80 mi  
0 30 60 120 km

State Boundaries  
USA\_Counties  
Large Point Sources (VOC GT 100 or NOx GT 100)  
Small Point Sources  
Ozone 2016 Site Level DVs Dallas\_Fort\_Worth\_Arlington\_TX\_480850005  
No valid value  
0 - 0.070  
0.071 and above  
100  
500  
1,000

OAR/OAQPS/AQAD/AQAG  
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the  
GIS user community  
Map Service: USEPA Office of Environmental Information (OEI). Data: U.S.  
EPA Office of Air and Radiation (OAR) - Office of Air Quality



Figure 6f-1. HYSPLIT Back Trajectories for One of the Violating Monitors in Denton County<sup>26</sup>



12/17/2017, 8:47:06 AM

State Boundaries  
 USA\_Counties  
 Large Point Sources (VOC GT 100 or NOx GT 100)  
 Small Point Sources  
 Ozone 2016 Site Level DVs Dallas\_Fort\_Worth\_Arlington\_TX\_481210034  
 No valid value  
 0 - 0.070  
 0.071 and above  
 100  
 500  
 1,000

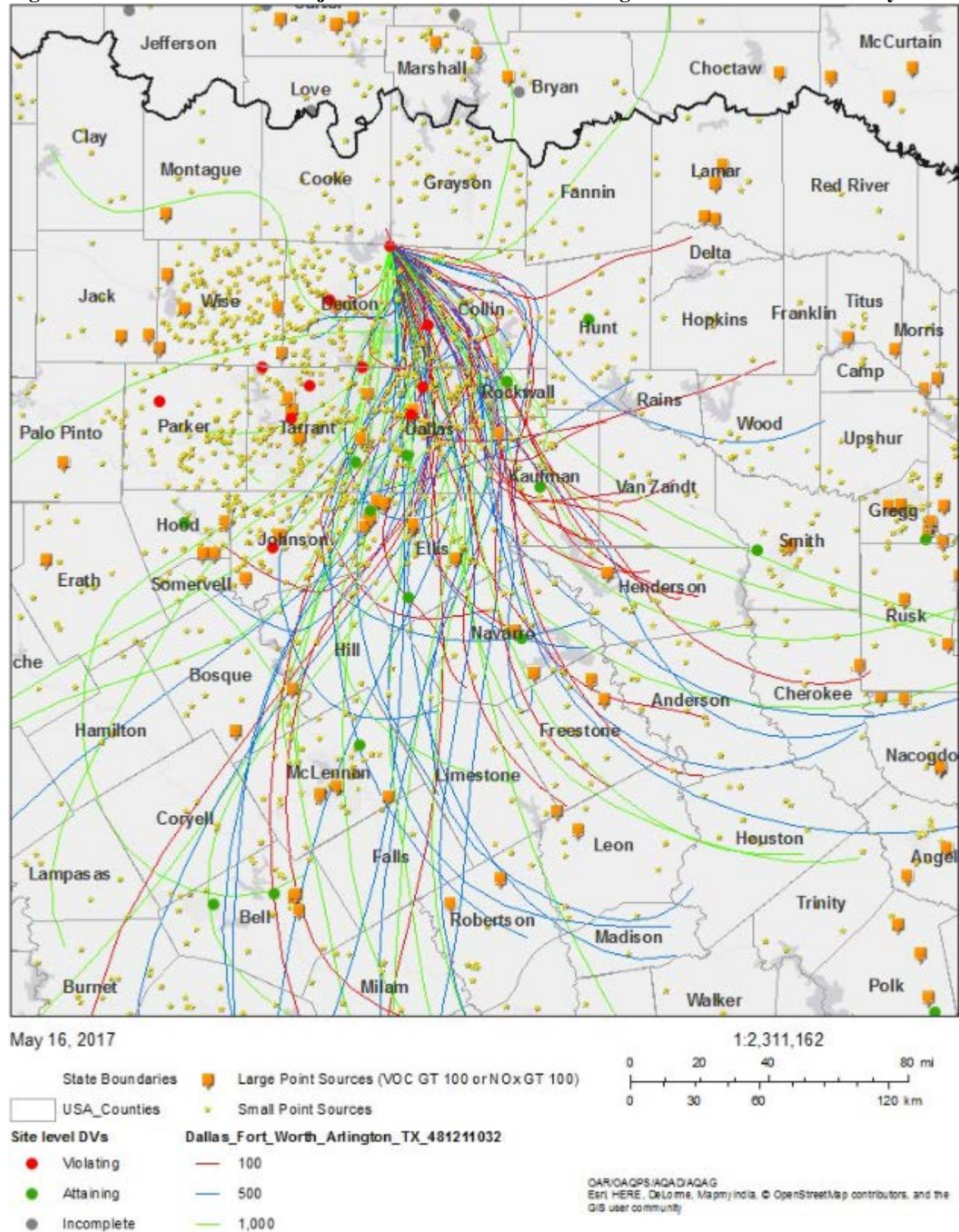
1:2,311,162  
 0 20 40 80 mi  
 0 30 60 120 km

OAR/OAQPS/AQA/DQAQ  
 Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the  
 GIS user community  
 Map Service: USEPA Office of Environmental Information (OEI). Data: U.S.  
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<sup>26</sup> This is the Denton Airport South monitor – it has the higher ozone DV of the 2 violating monitors in Denton County.



Figure 6f-2. HYSPLIT Back Trajectories for One of the Violating Monitors in Denton County<sup>27</sup>



<sup>27</sup> This is the second of two violating monitors in Denton County and is known as the Pilot Point monitor.

The HYSPLITs show air movement predominantly from the east, southeast, and south, with several exceptions in Parker, Tarrant, and Johnson Counties. The violating monitors are primarily impacted by transport from each other: Collin County impacts the Dallas, Denton, and Tarrant County monitors; Dallas County impacts the Collin, Denton, Johnson, and Tarrant County monitors; Denton County impacts the Collin, Dallas, and Tarrant County monitors; Ellis County impacts the Dallas, Johnson, and Tarrant County monitors; Johnson County impacts the Parker County monitor; Kaufman County impacts the Dallas County monitors; Tarrant County impacts the Denton, Johnson, and Parker County monitors; and Wise County impacts the Parker County monitor.

#### **Factor 4: Geography/topography**

Consideration of geography or topography can provide additional information relevant to defining nonattainment area boundaries. Analyses should examine the physical features of the land that might define the airshed. Mountains or other physical features may influence the fate and transport of emissions as well as the formation and distribution of ozone concentrations. The absence of any such geographic or topographic features may also be a relevant consideration in selecting boundaries for a given area.

The EPA analyzed geography/topography to evaluate the physical features of the land that might affect the airshed and, therefore, the distribution of ozone over the area.

The DFW TX-OK CSA and surrounding counties do not have any geographical or topographical features significantly limiting air pollution transport within its air shed. Therefore, this factor did not play a role in this evaluation.

#### **Factor 5: Jurisdictional boundaries**

Once the geographic extent of the violating area and the nearby area contributing to violations is determined, the EPA considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary to carry out the air quality planning and enforcement functions for nonattainment areas. In defining the boundaries of the DFW nonattainment area, EPA considered existing jurisdictional boundaries, which can provide easily identifiable and recognized boundaries for purposes of implementing the NAAQS. Examples of jurisdictional boundaries include, but are not limited to: counties, air districts, areas of Indian country, metropolitan planning organizations (MPOs), and existing nonattainment areas. If an existing jurisdictional boundary is used to help define the nonattainment area, it must fully encompass the area that has been identified as meeting the nonattainment definition. Where existing jurisdictional boundaries are not adequate or appropriate to describe the nonattainment area, the EPA considered other clearly defined and permanent landmarks or geographic coordinates for purposes of identifying the boundaries of the designated areas.

The DFW area has previously established nonattainment boundaries associated with the 1997 and 2008 ozone NAAQS, consisting of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties; Wise County was added to the nonattainment boundary under the 2008 ozone NAAQS.

### **Conclusion for the Dallas/Fort Worth Area**

Based on the assessment of factors described above, EPA is not modifying the State's recommendation that the following counties be included as part of the Dallas/Fort Worth nonattainment area: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Tarrant, and Wise Counties, and that Rockwall no longer be included. The counties of Collin, Dallas, Denton, Johnson, Parker, and Tarrant are included based on monitors within these counties with 2014-2016 ozone design values violating the 2015 ozone NAAQS. Ellis, Kaufman, and Wise Counties are nearby counties that do not have violating monitors, but the five-factor analysis indicates that these



areas contribute to the ozone concentrations in violation of the 2015 ozone NAAQS. Specifically, Ellis and Wise have among the highest emissions of NO<sub>x</sub> in the area. Ellis, Kaufman and Wise Counties all have relatively high levels of VMT and nearly 50 percent or more of workers living in these counties commute to the counties with the violating monitors. The HYSPLIT trajectories for the Dallas, Johnson, Parker, and Tarrant County violating monitors also indicate that emissions from Ellis, Kaufman and Wise Counties have the potential to impact the monitors on high ozone days. All nine counties recommended to be included in the nonattainment area by the state are in the same MPO and are also included in the DFW nonattainment area for the 2008 ozone NAAQS.

EPA is not designating Bryan, Cooke, Grayson, Henderson, Hood, Hopkins, Hunt, Navarro, Palo Pinto, Rockwall, and Somervell Counties as part of the DFW nonattainment area. The State recommended and in the December 2017 120-day letter EPA indicated that we did not intend to modify the State's recommendation that Rockwall County be included in the nonattainment area. However, the State has now requested that Rockwall County not be included as part of the nonattainment area and submitted a demonstration in support of that request. In light of the State's new request and demonstration, EPA re-evaluated whether to include Rockwall County as part of the nonattainment area. Rockwall County has the second and third lowest emissions of NO<sub>x</sub> and VOC, respectively, and has no large point sources. Rockwall County ranks near the middle of the 20 counties in the DFW TX-OK CSA in population and VMT, with a population of less than 91,000 and VMT less than 850 million. The HYSPLIT trajectories traveling through Rockwall County also pass through Collin, Dallas, Denton, Ellis, Tarrant, and Wise Counties, which have significantly greater emissions than Rockwall County.

While Navarro, Cooke and Grayson Counties rank near the middle for many of the emissions factors, the HYSPLIT trajectories indicate that they likely are not influencing air quality at the violating monitors. After passing through Navarro, the various trajectories pass through Ellis, Dallas Collin, Tarrant and Johnson Counties which have significantly greater emissions than Navarro County. As compared with other counties with significantly greater emissions, there are few trajectories passing through Cooke and Grayson Counties which lie north of the violating monitors.

The remaining counties rank among the lowest for all of the emission factors and as compared with the counties with significantly greater emissions have few trajectories passing through the counties.

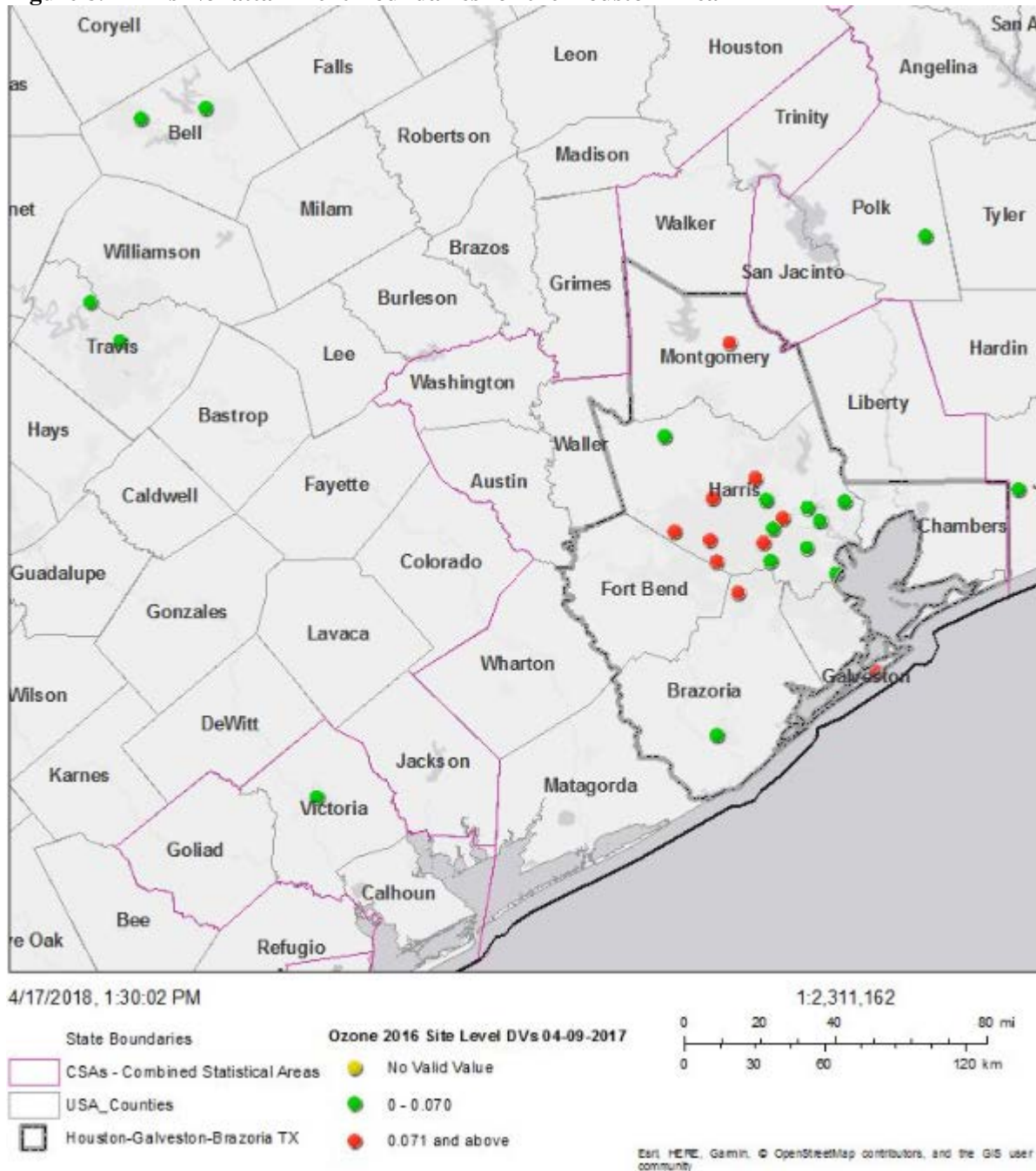
Within the area of analysis, the 10-county nonattainment area under the 2008 ozone standard includes approximately 97 percent of the commuters, 93 percent of the population, 90 percent of the VMT, 83 percent of the NO<sub>x</sub>, and 81 percent of the VOC. In comparison, excluding Rockwall County from the nonattainment area under the 2015 ozone standard leaves such nonattainment area with approximately 97 percent of the commuters, 91 percent of the population, 89 percent of the VMT, 82 percent of the NO<sub>x</sub> emissions, and 80 percent of the VOC emissions in the area of analysis.

### 3.2 Technical Analysis for the Houston-Galveston-Brazoria Area

The area of analysis for the Houston area is the CSA known as Houston-The Woodlands and includes the following 14 counties: Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Trinity, Walker, Waller, Washington, and Wharton. Figure 8 below is a map of the EPA's nonattainment boundary for the Houston area. The map shows the location of the ambient air quality monitors, county, CSA and other jurisdictional boundaries.

For purposes of the 1997 ozone NAAQS, this area was designated nonattainment. The nonattainment area for the 1997 ozone NAAQS included the entire counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller. For purposes of the 2008 ozone NAAQS, the same counties in this area were designated nonattainment.

**Figure 8. EPA's Nonattainment Boundaries for the Houston Area**



The EPA must designate as nonattainment any area that violates the NAAQS and any nearby areas that contribute to the violation in the violating area. Brazoria, Galveston, Harris and Montgomery Counties have monitors in violation of the 2015 ozone NAAQS, therefore these counties are included in the final non-attainment area. Based on the analysis below, the EPA has determined that Chambers and Fort Bend Counties contribute to the violating area. The following sections describe the weight-of-evidence five-factor analysis. While the factors are presented individually, they are not independent. The five-factor analysis process carefully considers the interconnections among the different factors and the dependence of each factor on one or more of the others, such as the interaction between emissions and meteorology for the area being evaluated.

## **Factor Assessment**

### **Factor 1: Air Quality Data**

The EPA considered 8-hour ozone design values (DVs) in ppm for air quality monitors in the Houston-Galveston-Brazoria area based on data for the 2014-2016 period (i.e., the 2016 DV). This is the most recent three-year period with fully-certified air quality data. The DV is the 3-year average of the annual 4<sup>th</sup> highest daily maximum 8-hour average ozone concentration.<sup>28</sup> The 2015 NAAQS are met when the DV is 0.070 ppm or less. Only ozone measurement data collected in accordance with the quality assurance (QA) requirements using approved (FRM/FEM) monitors are used for NAAQS compliance determinations.<sup>29</sup> The EPA uses FRM/FEM measurement data residing in the EPA's Air Quality System (AQS) database to calculate the ozone DVs. Individual violations of the 2015 ozone NAAQS that the EPA determines have been caused by an exceptional event that meets the administrative and technical criteria in the Exceptional Events Rule<sup>30</sup> are not included in these calculations. Whenever several monitors are located in a county (or designated nonattainment area), the DV for the county or area is determined by the monitor with the highest valid DV. The presence of one or more violating monitors (i.e. monitors with DVs greater than 0.070 ppm) in a county or other geographic area forms the basis for designating that county or area as nonattainment. The remaining four factors are then used as the technical basis for determining the spatial extent of the designated nonattainment area surrounding the violating monitor(s) based on a consideration of what nearby areas are contributing to a violation of the NAAQS.

The EPA identified monitors where the most recent DVs violate the 2015 ozone NAAQS, and examined historical ozone air quality measurement data (including previous DVs) to understand the nature of ozone ambient air quality in the area. Eligible monitors for providing DV data generally include State and Local Air Monitoring Stations that are operated in accordance with 40 CFR part 58, appendix A, C, D and E and operating with an FRM or FEM monitor. These requirements must be met in order to be acceptable for comparison to the 2015 ozone NAAQS for designation purposes. All data from Special Purpose Monitors (SPMs) using an FRM or FEM are eligible for comparison to the NAAQS, subject to the requirements given in the March 28, 2016 Revision to Ambient Monitoring Quality Assurance and Other Requirements Rule (81 FR 17248).

The 2014-2016 DVs for counties in the area of analysis are shown in Table 6 below.

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<sup>28</sup> The specific methodology for calculating the ozone design values, including computational formulas and data completeness requirements, is described in 40 CFR part 50, appendix U.

<sup>29</sup> The QA requirements for ozone monitoring data are specified in 40 CFR part 58, appendix A. The performance test requirements for candidate FEMs are provided in 40 CFR part 53, subpart B.

<sup>30</sup> The EPA finalized the rule on the Treatment of Data Influenced by Exceptional Events (81 FR 68513) and the guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events in September of 2016. For more information, see <https://www.epa.gov/air-quality-analysis/exceptional-events-rule-and-guidance>.

**Table 6. Air Quality Data (all values in ppm)<sup>a</sup>**

County	State Recommended Nonattainment?	AQS Site ID	2014-2016 DV	2014 4 <sup>th</sup> highest daily max value	2015 4 <sup>th</sup> highest daily max value	2016 4 <sup>th</sup> highest daily max value
Austin	No	No monitor	N/A			
Brazoria	Yes	480391004	<b>0.075</b>	0.071	0.086	0.069
		480391016	0.064	0.061	0.065	0.066
Chambers	Yes	No monitor	N/A			
Fort Bend	Yes	No monitor	N/A			
Galveston	Yes	481671034	<b>0.076</b>	0.071	0.084	0.074
Harris	Yes	482010024	<b>0.079</b>	0.068	0.095	0.074
		482010026	0.068	0.064	0.081	0.061
		482010029	0.069	0.063	0.078	0.067
		482010046	0.067	0.062	0.078	0.062
		482010047	0.074	0.064	0.091	0.069
		482010051	0.071	0.067	0.079	0.067
		482010055	0.075	0.067	0.080	0.078
		482010062	0.065	0.065	0.073	0.057
		482010066	0.076	0.070	0.079	0.079
		482011017	0.069	0.067	0.077	0.065
		482010416	0.072	0.066	0.087	0.065
		482011015	0.065	0.059	0.079	0.059
		482011034	0.073	0.066	0.088	0.067
		482011035	0.069	0.058	0.084	0.065
		482011039	0.067	0.063	0.077	0.062
		482011050	0.070	0.065	0.083	0.064
Liberty	No <sup>31</sup>	No monitor	N/A			
Matagorda	No	No monitor	N/A			
Montgomery	Yes	483390078	<b>0.072</b>	0.072	0.073	0.071
Trinity	No	No monitor	N/A			
Walker	No	No monitor	N/A			
Waller	No <sup>31</sup>	No monitor	N/A			
Washington	No	No monitor	N/A			
Wharton	No	No monitor	N/A			

<sup>a</sup> The highest design value in each county with a violating monitor is indicated in bold type.

N/A – in this case, no data exists because there is no eligible (regulatory) monitor.

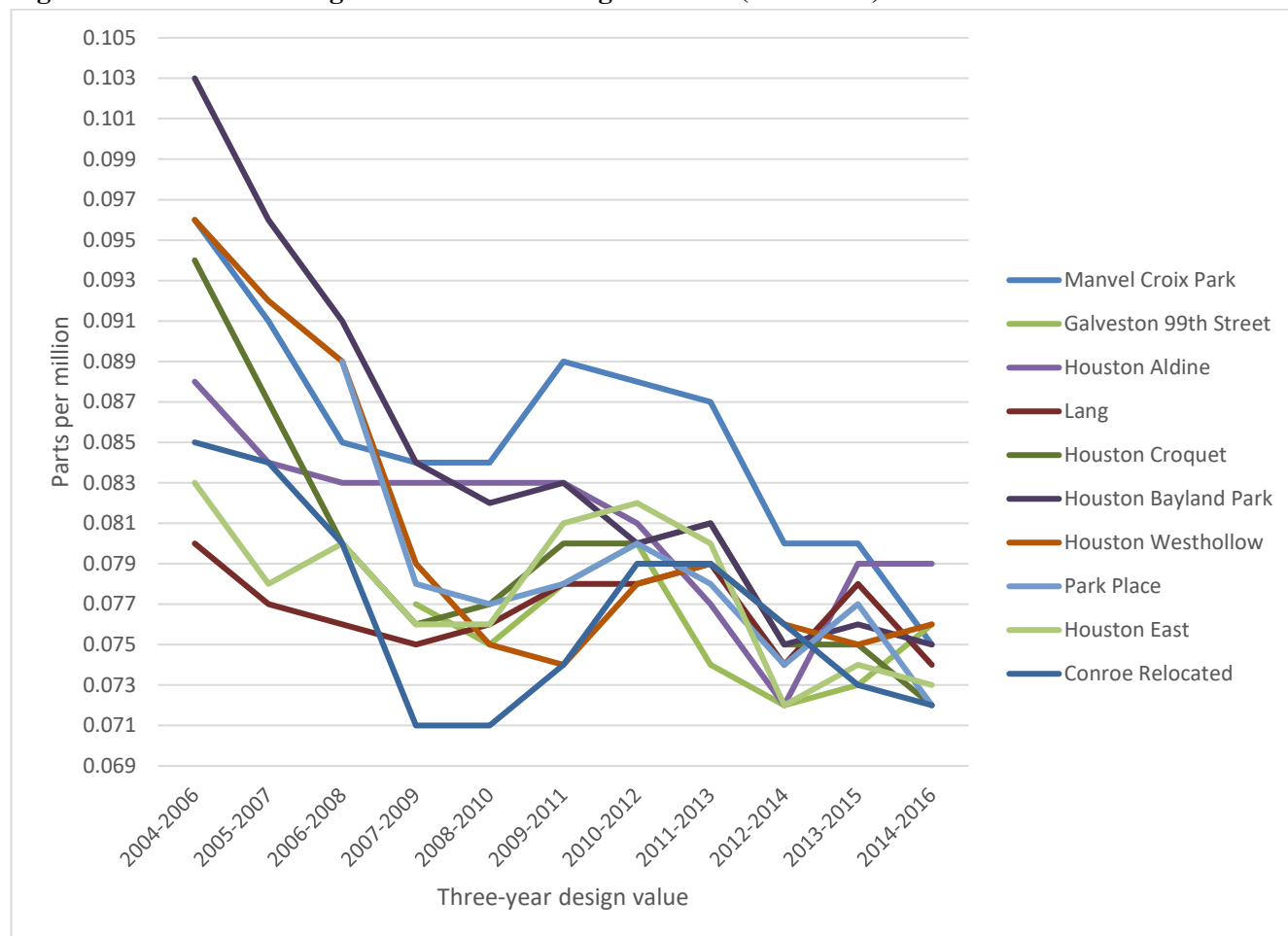
Brazoria, Harris, Galveston, and Montgomery Counties show a violation of the 2015 ozone NAAQS, therefore these counties are included in the final nonattainment area. A county must also be designated nonattainment if it contributes to a violation in a nearby area. Each county without a violating monitor that is located near a county with a violating monitor has been evaluated based on the weight-of-evidence of the five factors and other relevant information to determine whether it contributes to the nearby violation.

Figure 8, shown previously, identifies the Houston nonattainment area, the CSA boundary and the violating monitors. Table 6 above identifies the DVs for all monitors in the area of analysis and Figure 9 below shows the

<sup>31</sup> Texas originally recommended nonattainment for Liberty and Waller Counties and requested a revision to their recommendation during the 120-day process, due in part to the fact that there are no violating monitors in Liberty and Waller Counties.

historical trend of DVs for the violating monitors. As indicated on Figure 8, there are 10 violating monitors that are located in Conroe in central Montgomery County, Manvel in northern Brazoria County, Galveston Island in Galveston County, and the south-central and southwest portion of Harris County. There are also monitors in southern Brazoria County and the northwest and southeast portions of Harris County. As shown in Figure 9, while upticks are not uncommon, there has been a general downward trend in three-year design values.

**Figure 9. Three-Year Design Values for Violating Monitors (2006-2016).**



Four counties in the area of analysis have violating monitors with design values of 0.072, 0.075, 0.076, and 0.079 ppm. All other monitors in the CSA are between 0.064 and 0.070 ppm. Therefore, any nearby area determined to be contributing to the 10 violating monitors also needs to be designated as nonattainment.

## Factor 2: Emissions and Emissions-Related Data

The EPA evaluated ozone precursor emissions of NO<sub>x</sub> and VOC and other emissions-related data that provide information on areas contributing to violating monitors.

### Emissions Data

The EPA reviewed data from the 2014 NEI. For each county in the area of analysis, the EPA examined the magnitude of large sources (NO<sub>x</sub> or VOC emissions greater than 100 tons per year) and small point sources and the magnitude of county-level emissions reported in the NEI. These county-level emissions represent the sum of emissions from the following general source categories: point sources, non-point (i.e., area) sources, non-road mobile, on-road mobile, and fires. Emissions levels from sources in a nearby area indicate the potential for the area to contribute to monitored violations.

Table 7 below provides a county-level emissions summary of NO<sub>x</sub> and VOC (in tpy) for the area of analysis considered for inclusion in the Houston nonattainment area.

**Table 7. Total County-Level NO<sub>x</sub> and VOC Emissions**

County	State Recommended Nonattainment?	Total NO <sub>x</sub> (tpy)	Total VOC (tpy)
Harris	Yes	85,180	100,518
Galveston	Yes	14,939	12,028
Brazoria	Yes	12,811	15,542
Fort Bend	Yes	12,693	11,876
Montgomery	Yes	8,122	12,956
Chambers	Yes	5,267	26,892
Matagorda	No	3,647	7,167
Wharton	No	3,614	5,747
Liberty	No <sup>32</sup>	3,302	6,522
Austin	No	2,684	2,106
Walker	No	2,524	2,301
Waller	No <sup>32</sup>	1,946	1,815
Washington	No	1,838	2,233
Trinity	No	767	3,121
14-County CSA Total:		159,334	207,703
8-County Nonattainment Area (2008 Ozone NAAQS):		144,260	188,149
Percent of CSA Emissions in Nonattainment Area (2008 NAAQS):		91	91

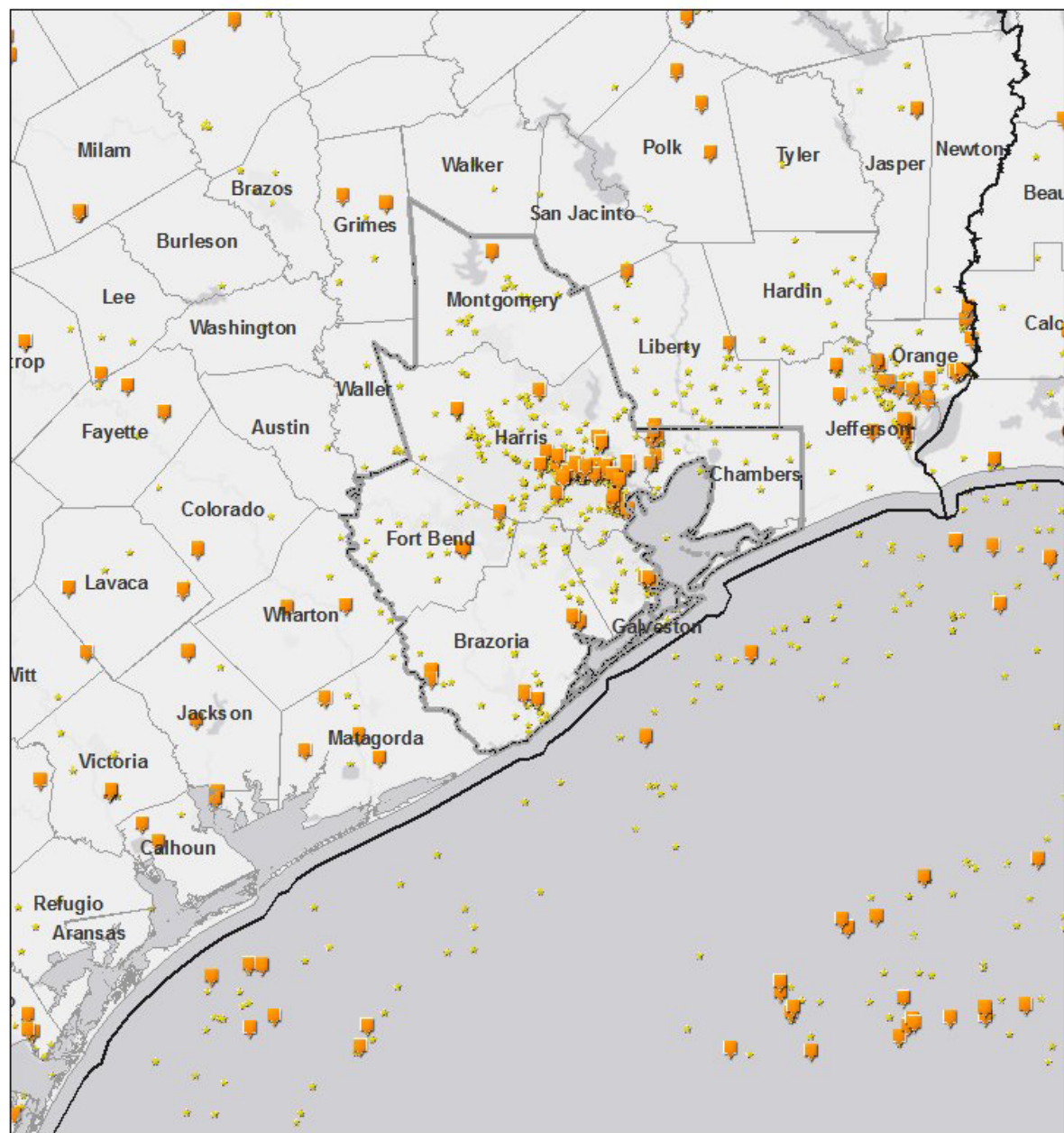
In addition to reviewing county-wide emissions of NO<sub>x</sub> and VOC in the area of analysis, the EPA also reviewed emissions from large point sources. The location of these sources, together with the other factors, can help inform nonattainment boundaries. The locations of the large and small point sources are shown in Figure 10 below.

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<sup>32</sup> Texas originally recommended nonattainment for Liberty and Waller Counties and requested a revision to their recommendation during the 120-day process, due in part to the fact that there are no violating monitors in Liberty and Waller Counties.



**Figure 10. Large and Small Point Sources in the Area of Analysis.**



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- State Boundaries
- USA\_Counties
- Houston-Galveston-Brazoria TX
- Large Point Sources (VOC GT 100 or NOx GT 100)
- Small Point Sources

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0 20 40 80 mi

0 30 60 120 km

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Web App Builder for ArcGIS  
© 2018 | OAR/OAQPS/AQAD/AQAG | Map Service: USEPA Office of Environmental Information (OEI). Data: USEPA Office of Environmental Information (OEI), US Census Bureau | Source: U.S. Census Bureau |

In summary, the EPA's analysis of relevant county-level emissions and the geographic locations of the relevant emissions showed that Harris County has higher NO<sub>x</sub> emissions than the other counties. The counties with the next highest level of NO<sub>x</sub> emissions, Galveston, Brazoria and Fort Bend Counties, have NO<sub>x</sub> emissions that are approximately 18, and 15 percent of the emissions in Harris County and greater NO<sub>x</sub> emissions than the other



counties in the CSA. The NO<sub>x</sub> emissions in the remaining counties are all less than 11 percent of the level in Harris County with the lowest emissions in Trinity, Washington, and Waller Counties.

Harris County also has the highest VOC emissions with Chambers County emitting approximately 27 percent of that amount and Brazoria approximately 15 percent. VOC emissions in Montgomery are approximately 13 percent the level in Harris County, and Galveston and Fort Bend approximately 12 percent. The remaining counties all have lower emissions with Waller ranking the lowest. The large and small point sources are concentrated in Harris County. Brazoria, Galveston, Chambers, Matagorda, Fort Bend, Liberty, Wharton, and Montgomery Counties have a total of 36 large point sources, with Brazoria, Galveston and Chambers having 10, 8 and 7 large point sources and the other five counties having 4 or fewer large point sources. The remaining counties in the CSA have no large point sources.

### **Population density and degree of urbanization**

In this part of the factor analysis, the EPA evaluated the population and vehicle use characteristics and trends of the area as indicators of the probable location and magnitude of non-point source emissions. These include emissions of NO<sub>x</sub> and VOC from on-road and non-road vehicles and engines, consumer products, residential fuel combustion, and consumer services. Areas of dense population or commercial development are an indicator of area source and mobile source NO<sub>x</sub> and VOC emissions that may contribute to violations of the NAAQS. Table 8 below shows the population, population density, and population growth information for each county in the CSA. Figure 11 contains a county-level density map of the area of analysis.

**Table 8. Population and Growth**

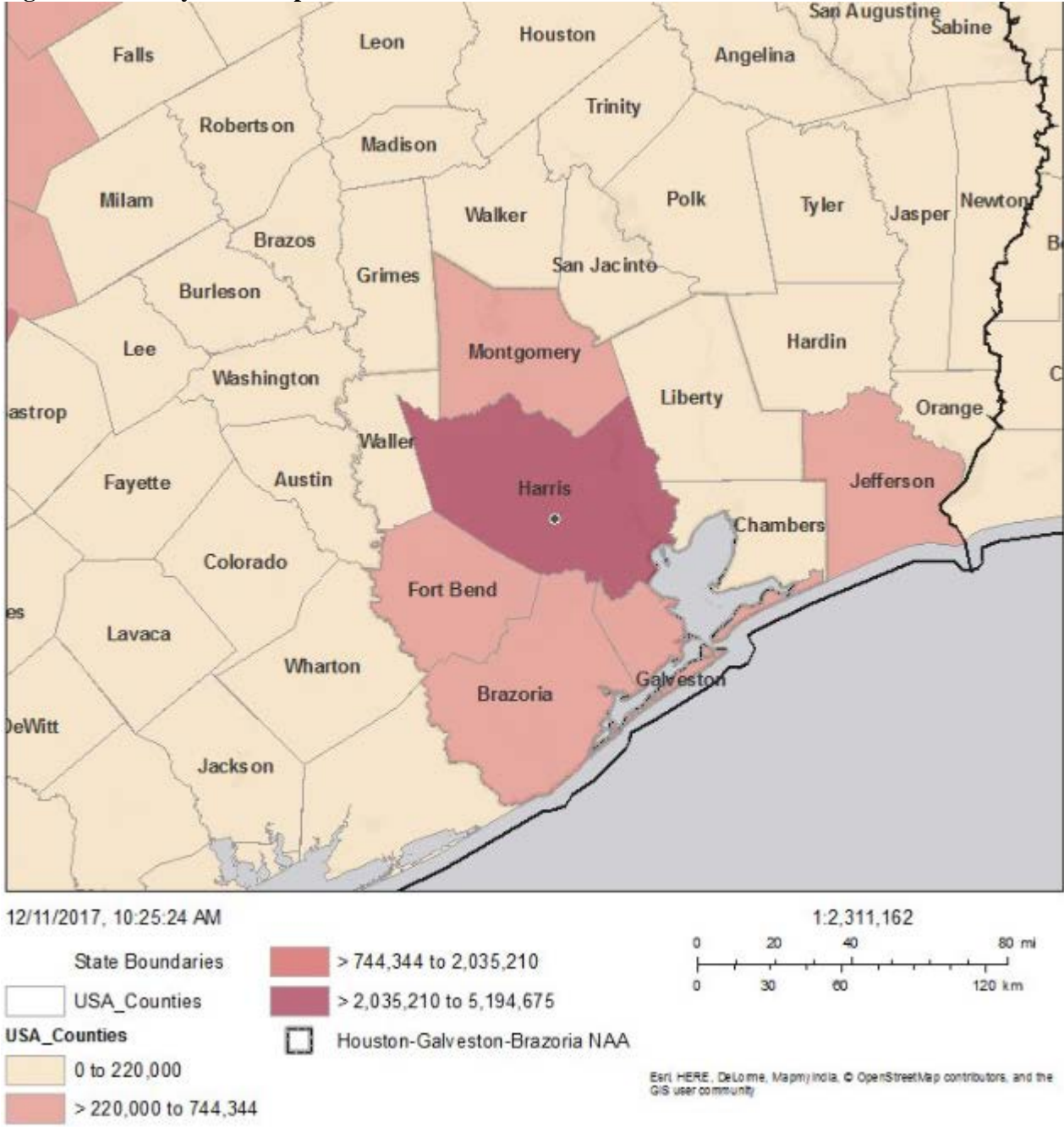
County	State Recommended Nonattainment?	2010 Population	2015 Population	2015 Population Density (per sq. mi.)	Absolute change in population (2010-2015)	Population % change (2010-2015)
Harris	Yes	4,092,459	4,538,028	2664	445,569	11
Fort Bend	Yes	585,375	716,087	831	130,712	22
Montgomery	Yes	455,746	537,559	516	81,813	18
Brazoria	Yes	313,166	346,312	255	33,146	11
Galveston	Yes	291,309	322,225	852	30,916	11
Liberty	No <sup>33</sup>	75,643	79,654	69	4,011	5
Walker	No	67,861	70,699	90	2,838	4
Waller	No <sup>33</sup>	43,205	48,656	95	5,451	13
Wharton	No	41,280	41,486	38	206	1
Chambers	Yes	35,096	38,863	65	3,767	11
Matagorda	No	36,702	36,770	33	68	0
Washington	No	33,718	34,765	58	1,047	3
Austin	No	28,417	29,563	46	1,146	4
Trinity	No	14,585	14,402	21	-183	-1
Area wide:		6,114,562	6,855,069	547	740,507	12

<sup>33</sup> Texas originally recommended nonattainment for Liberty and Waller Counties and requested a revision to their recommendation during the 120-day process, due in part to the fact that there are no violating monitors in Liberty and Waller Counties.

Source: U.S. Census Bureau population estimates for 2010 and 2015. See [www.census.gov/data.html](http://www.census.gov/data.html).

Harris County has the largest population, exceeding four million and a population density of 2664. While Fort Bend has a lower, but still high, population of approximately 716,000, its population density is about 31 percent of that in Harris County. The populations in Montgomery, Brazoria, and Galveston Counties each have less than 12 percent of Harris County’s population and the population densities vary from about 32 to 10 percent of that in Harris County. The remaining counties are significantly less populous (Figure 11 below) and less densely populated as well with Trinity County ranking the lowest on both metrics. Growth in population has varied - the highest growth was in Fort Bend and Montgomery at 22 and 18 percent, followed by Waller at 13 percent, and Harris, Brazoria, Galveston, and Chambers at 11 percent. Liberty, Walker, and Austin Counties followed at 5 and 4 percent, with Washington at 3 percent. Wharton’s population grew by one percent, Matagorda remained relatively stable, and Trinity County experienced a slight decline.

**Figure 11. County-Level Population**



## **Traffic and Vehicle Miles Travelled (VMT)**

The EPA evaluated the commuting patterns of residents, as well as the total vehicle miles traveled for each county in the area of analysis.<sup>34</sup> In combination with the population/population density data and the location of main transportation arteries, this information helps identify the probable location of non-point source emissions. A county with high VMT and/or a high number of commuters is generally an integral part of an urban area and high VMT and/or high number of commuters indicates the presence of motor vehicle emissions that may contribute to violations of the NAAQS. Rapid population or VMT growth in a county on the urban perimeter may signify increasing integration with the core urban area, and thus could indicate that the associated area source and mobile source emissions may be appropriate to include in the nonattainment area. In addition to VMT, the EPA evaluated worker data collected by the U.S. Census Bureau for the counties in the area of analysis.<sup>35</sup> Table 9 shows the traffic and commuting pattern data, including total VMT for each county in the area of analysis, number of residents who work in each county, number of those residents that commute to or within each county with a violating monitor, and the percent of residents commuting to or within counties with violating monitors. Unless otherwise noted, the information in Table 9 are 2014 data.

**Table 9. Traffic and Commuting Patterns**

County	State Recommended Nonattainment?	2008 Total VMT (Million Miles)	2014 Total VMT (Million Miles)	VMT Growth 2008 to 2014 (percent)	Number of County Residents Who Work	Number Commuting to or Within Counties with Violating Monitor(s)	Percentage Commuting to or Within Counties with Violating Monitor(s)
<b>Harris</b>	Yes	40,379	40,481	0.3%	1,874,608	1,597,010	85.2
<b>Montgomery</b>	Yes	3,982	4,517	13.4%	218,136	179,612	82.3
Fort Bend	Yes	3,339	3,652	9.4%	308,462	205,064	66.5
<b>Brazoria</b>	Yes	2,263	2,281	0.8%	149,107	126,362	84.7
<b>Galveston</b>	Yes	2,210	2,127	-3.8%	138,998	121,866	87.7
Chambers	Yes	935	969	3.6%	20,624	13,419	65.1
Walker	No	944	881	-6.7%	21,308	5,883	27.6
Liberty	No <sup>36</sup>	865	812	-6.1%	35,507	21,005	59.2
Waller	No <sup>36</sup>	759	760	0.2%	17,991	10,099	56.1
Wharton	No	690	657	-4.7%	22,012	7,120	32.3
Austin	No	542	520	-4%	15,420	5,457	35.4
Washington	No	515	454	-11.8%	16,692	3,382	20.3
Matagorda	No	343	316	-7.9%	18,892	7,660	40.5
Trinity	No	137	133	-2.9%	5,402	1,249	23.1
14-County CSA Total:		57,902	58,559	1.1%	2,863,159	2,305,188	

<sup>34</sup> The VMT data are available from the NEI (see <https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei>). See also <https://www.epa.gov/ozone-designations/ozone-designations-guidance-and-data>.

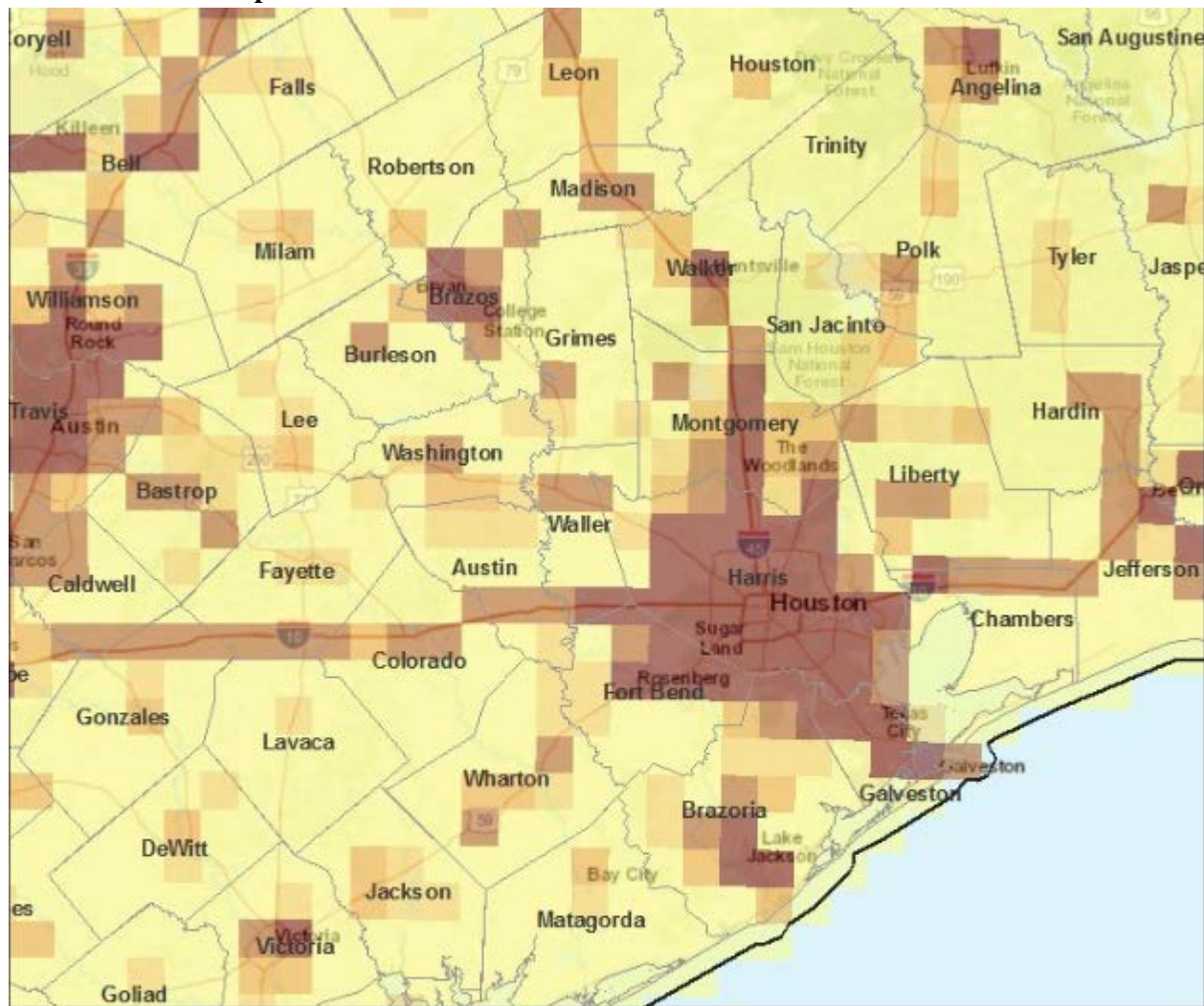
<sup>35</sup> The worker data can be accessed at: <http://onthemap.ces.census.gov/>.

<sup>36</sup> Texas originally recommended nonattainment for Liberty and Waller Counties and requested a revision to their recommendation during the 120-day process, due in part to the fact that there are no violating monitors in Liberty and Waller Counties.

8-County Nonattainment Area (2008 Ozone NAAQS) Total:		55,598 (95%)		2,763,433 (97%)	2,274,437 (99%)	
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Counties with a monitor(s) violating the NAAQS are indicated in bold.

To show traffic and commuting patterns, Figure 12 (below) overlays twelve-kilometer gridded VMT from the 2014 NEI with a map of the transportation arteries. **Figure 12. Twelve Kilometer Gridded VMT (Miles) Overlaid with Transportation Arteries**



June 8, 2017



Counties are listed in Table 9 in order of VMT from largest to smallest. The four counties with violating monitors have the first, second, forth and fifth largest VMT of the 14 counties in the area of analysis. The four counties with the violating monitors have the highest percentages of commuters traveling to or within a county with a violating monitor, each at about 82 percent or greater. Fort Bend has the third highest VMT, and it and Chambers County each have about 65 percent of their commuters traveling to the counties with violating monitors. Liberty and Waller Counties contribute about 59 and 56 percent of their commuters to the counties

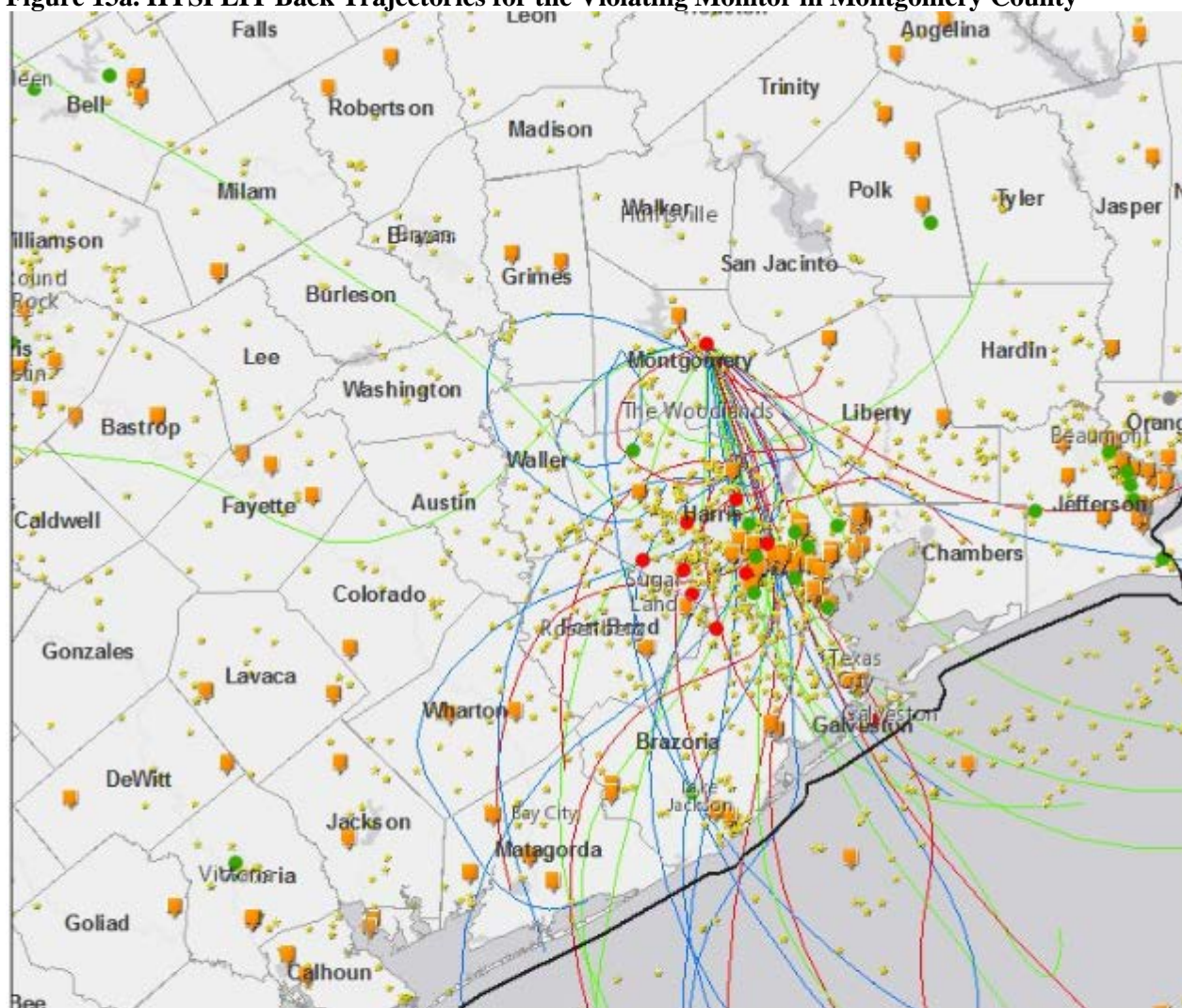
with violating monitors. Within the area of analysis, the six counties that EPA is designating as nonattainment (Harris, Brazoria, Chambers, Fort Bend, Galveston, and Montgomery) account for 92 percent of the VMT and 97 percent of the number commuting to or within the counties with the violating monitors.

### **Factor 3: Meteorology**

Evaluation of meteorological data helps to assess the fate and transport of emissions contributing to ozone concentrations and to identify areas potentially contributing to the monitored violations. Results of meteorological data analysis may inform the determination of nonattainment area boundaries. In order to determine how meteorological conditions, including, but not limited to, weather, transport patterns, and stagnation conditions, could affect the fate and transport of ozone and precursor emissions from sources in the area, EPA conducted analyses to better understand the area's meteorological transport conditions using the National Oceanic and Atmospheric Administration Hybrid Single Particle Lagrangian Integrated Trajectory Model (NOAA HYSPLIT or HYSPLIT). The HYSPLIT model yields an estimate of the path an air mass has traveled before reaching a monitor at a specific location and time. Specifically, the model provides the centerline of the probable path. By evaluating these estimates of where an air mass has traveled before reaching a monitor where an exceedance has occurred, one can consider what potential areas and emission sources could have contributed to the exceedance. The EPA evaluated 2014-2016 HYSPLIT trajectories at 100, 500, and 1000 meters AGL that illustrate the three-dimensional paths traveled by air parcels to a violating monitor. Figures 13a – 13j show the 24-hour HYSPLIT back trajectories for each exceedance day (i.e., daily maximum 8-hour values that exceed the 2015 ozone NAAQS) for the violating monitors.



Figure 13a. HYSPLIT Back Trajectories for the Violating Monitor in Montgomery County



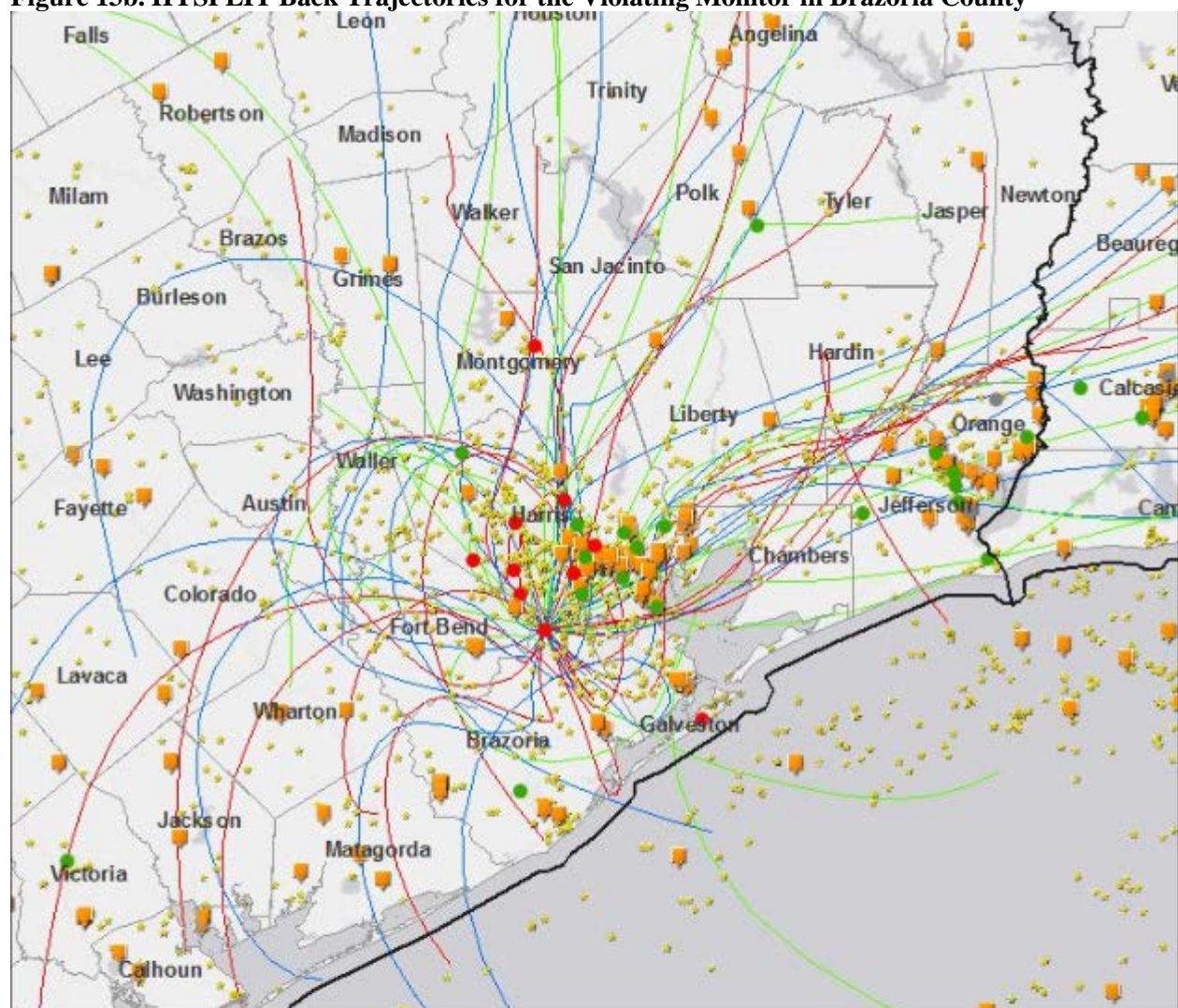
June 9, 2017

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State Boundaries  
 USA\_Counties  
 Site level DVs  
 Violating  
 Attaining  
 Incomplete  
 Large Point Sources (VOC GT 100 or NOx GT 100)  
 Small Point Sources  
 Houston\_The\_Woodlands\_Sugar\_Land\_TX\_483390078  
 100  
 500  
 1,000

QAR/OAQPS/AQA/AQAG  
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Figure 13b. HYSPLIT Back Trajectories for the Violating Monitor in Brazoria County



June 20, 2017

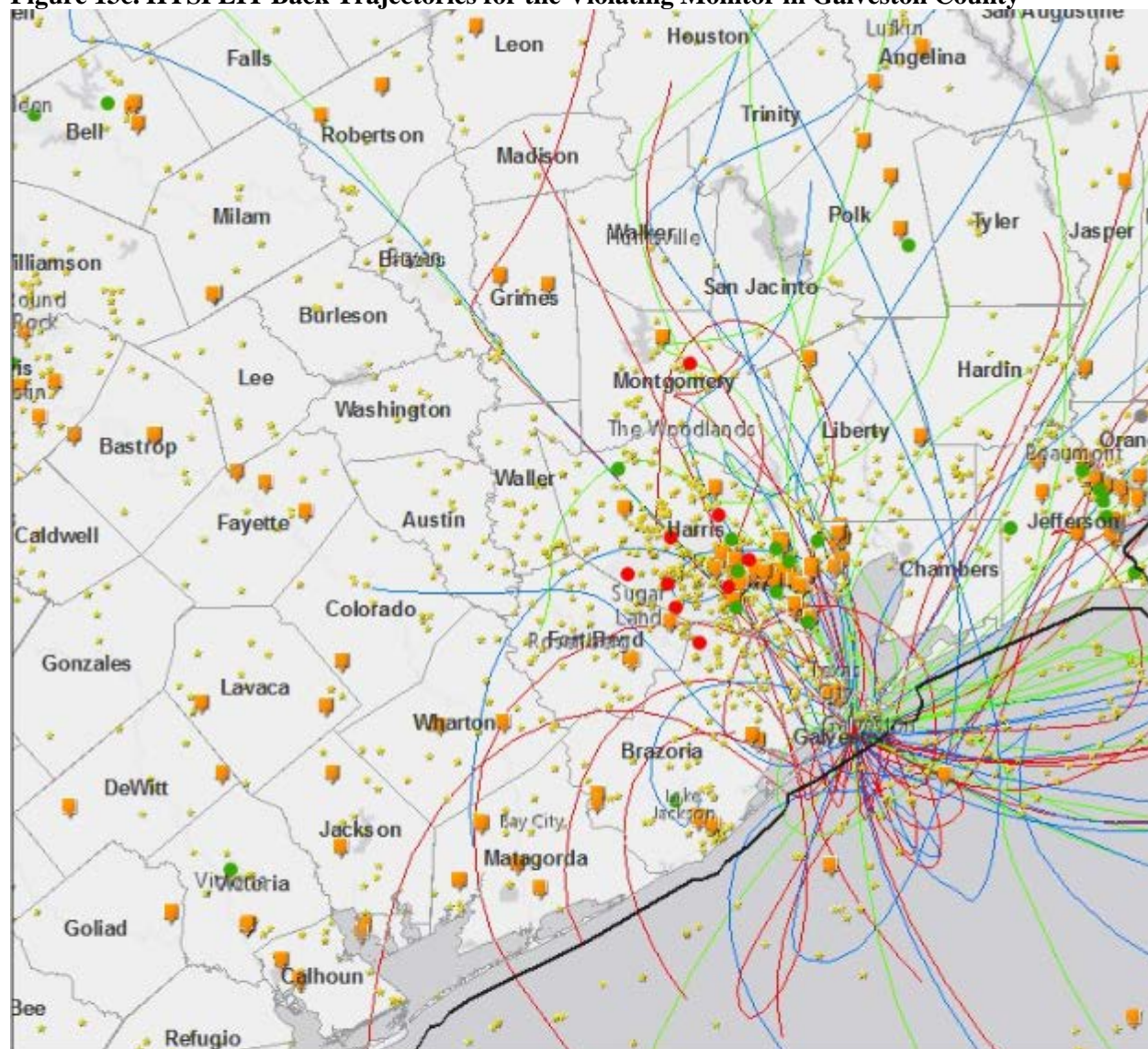
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- State Boundaries    Large Point Sources (VOC GT 100 or NOx GT 100)
- USA\_Counties    Small Point Sources
- Site level DVs    Houston\_The\_Woodlands\_Sugar\_Land\_TX\_480391004
- Violating
  - Attaining
  - Incomplete
- 100
- 500
- 1,000

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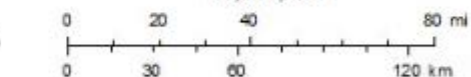


Figure 13c. HYSPLIT Back Trajectories for the Violating Monitor in Galveston County



June 9, 2017

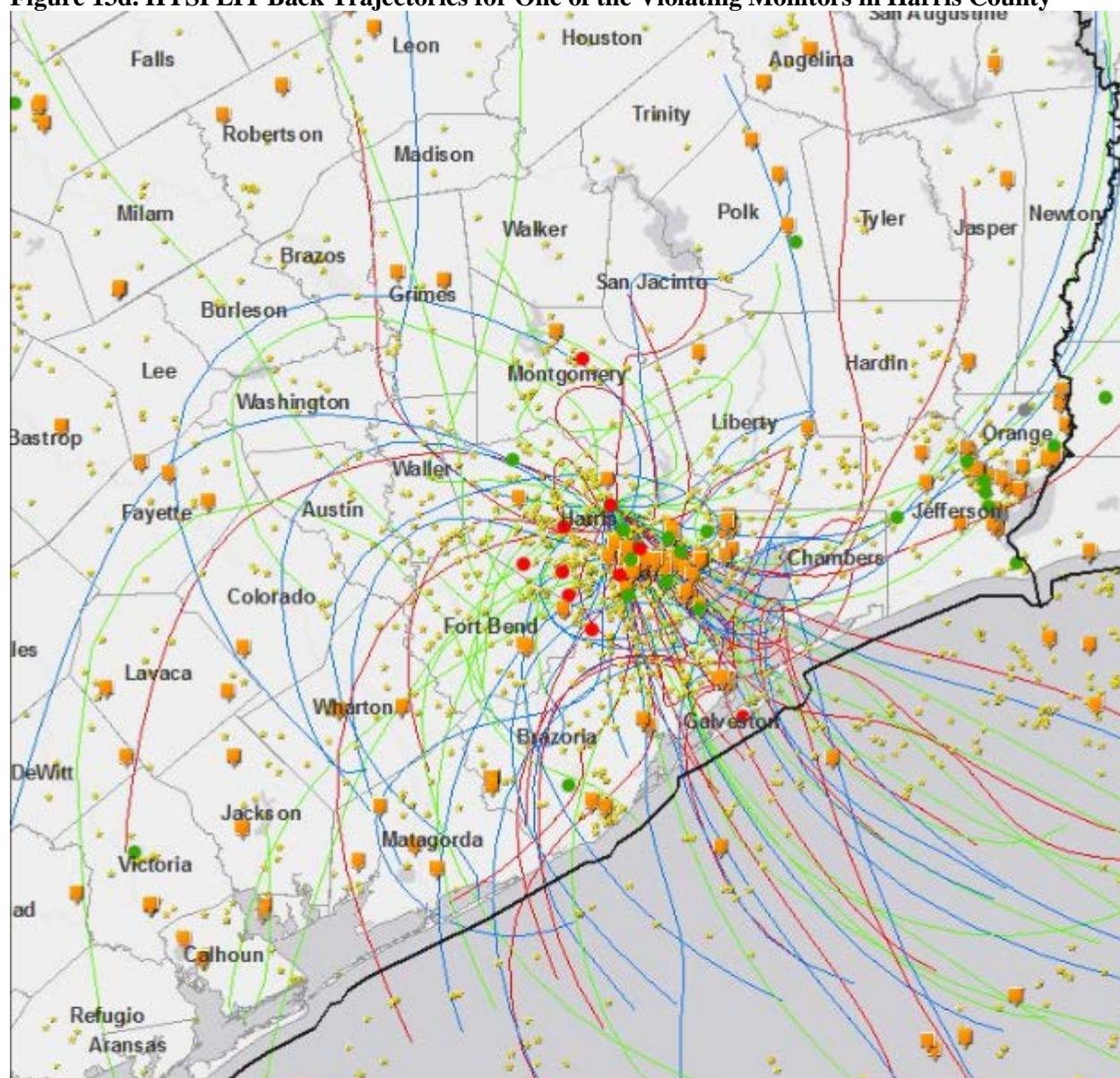
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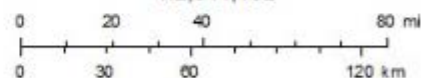


Figure 13d. HYSPLIT Back Trajectories for One of the Violating Monitors in Harris County<sup>37</sup>



June 20, 2017

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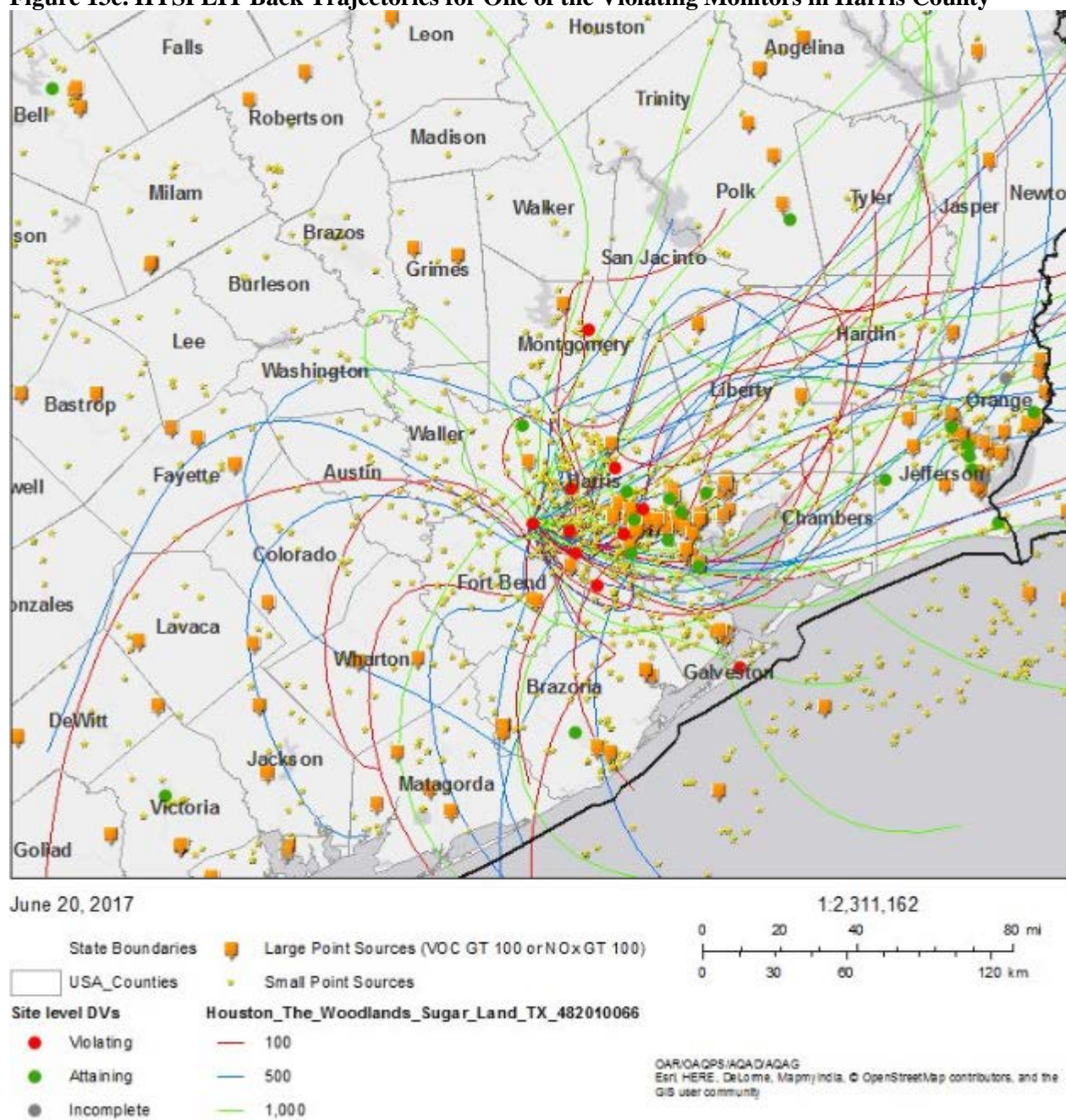


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<sup>37</sup> This is the Houston Aldine monitor, which has the highest design value of the seven violating monitors in Harris County.

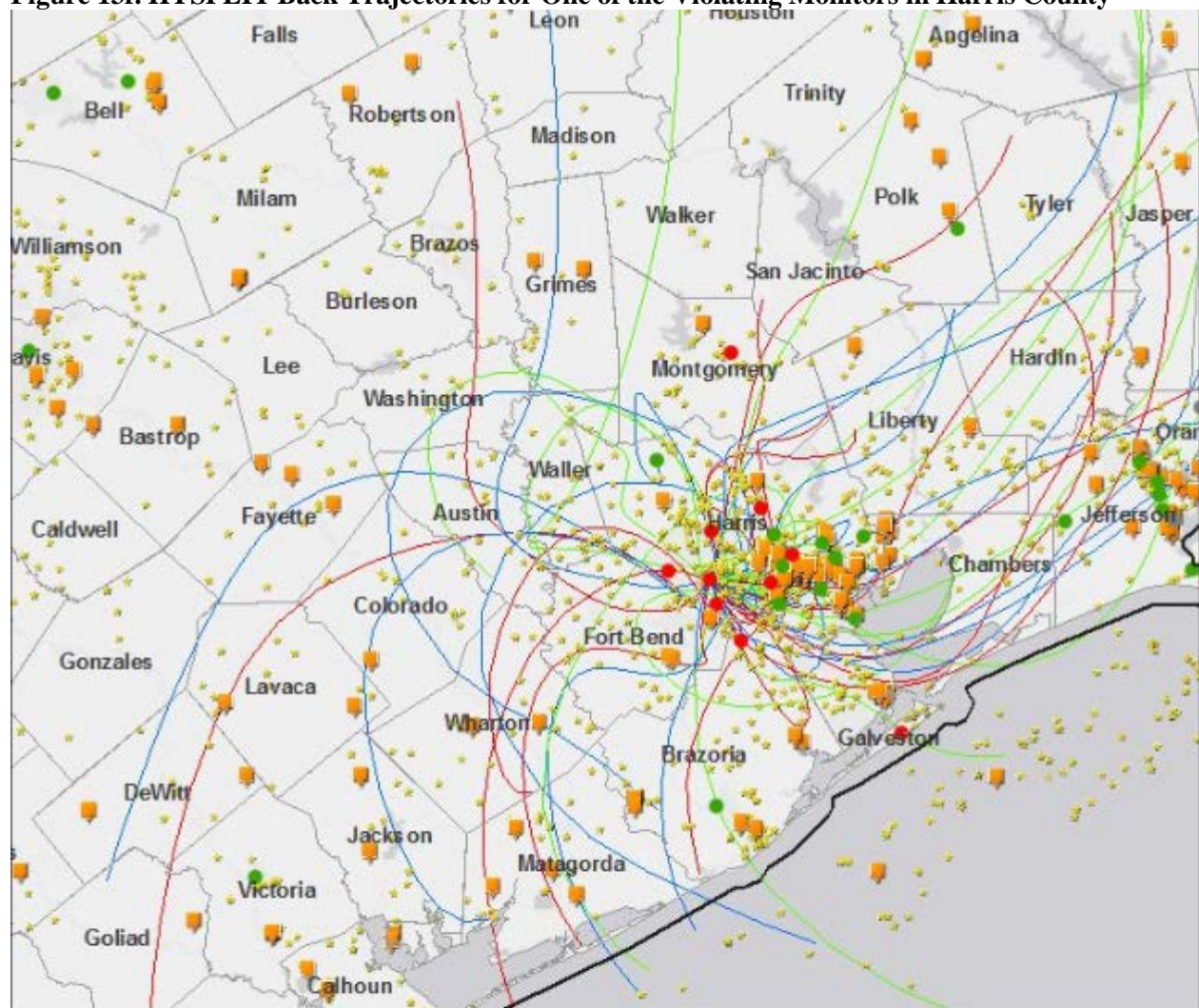


Figure 13e. HYSPLIT Back Trajectories for One of the Violating Monitors in Harris County<sup>38</sup>



<sup>38</sup> This is the Westhollow monitor, which has the second highest design value of the seven violating monitors in Harris County.

Figure 13f. HYSPLIT Back Trajectories for One of the Violating Monitors in Harris County<sup>39</sup>



June 20, 2017

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- State Boundaries    Large Point Sources (VOC GT 100 or NOx GT 100)
- USA\_Counties    Small Point Sources
- Site level DVs    Houston\_The\_Woodlands\_Sugar\_Land\_TX\_482010055
- Violating
  - Attaining
  - Incomplete
- 100
- 500
- 1,000

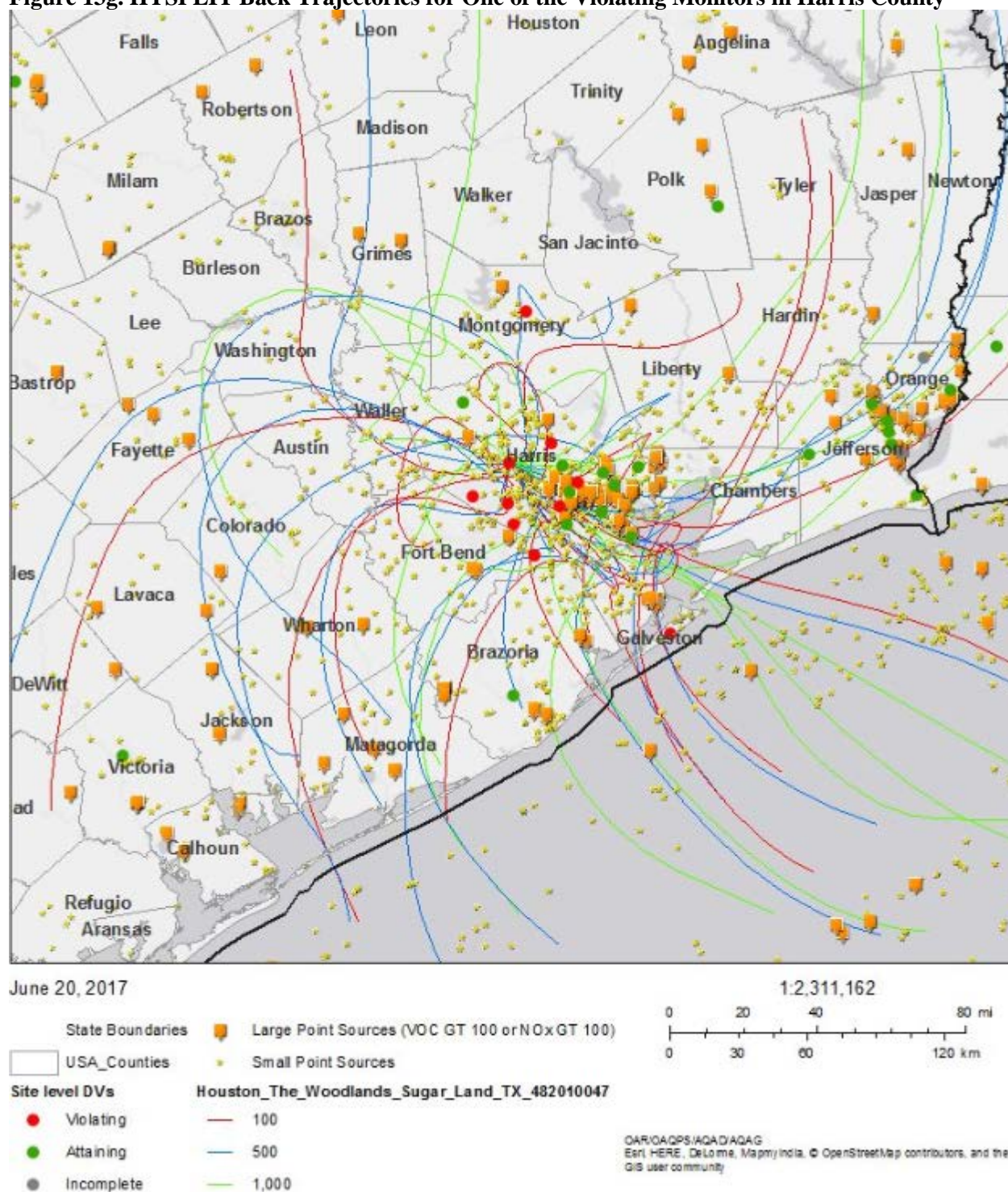
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0 30 60 120 km

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<sup>39</sup> This is the Bayland Park monitor, which has the third highest design value of the seven violating monitors in Harris County.

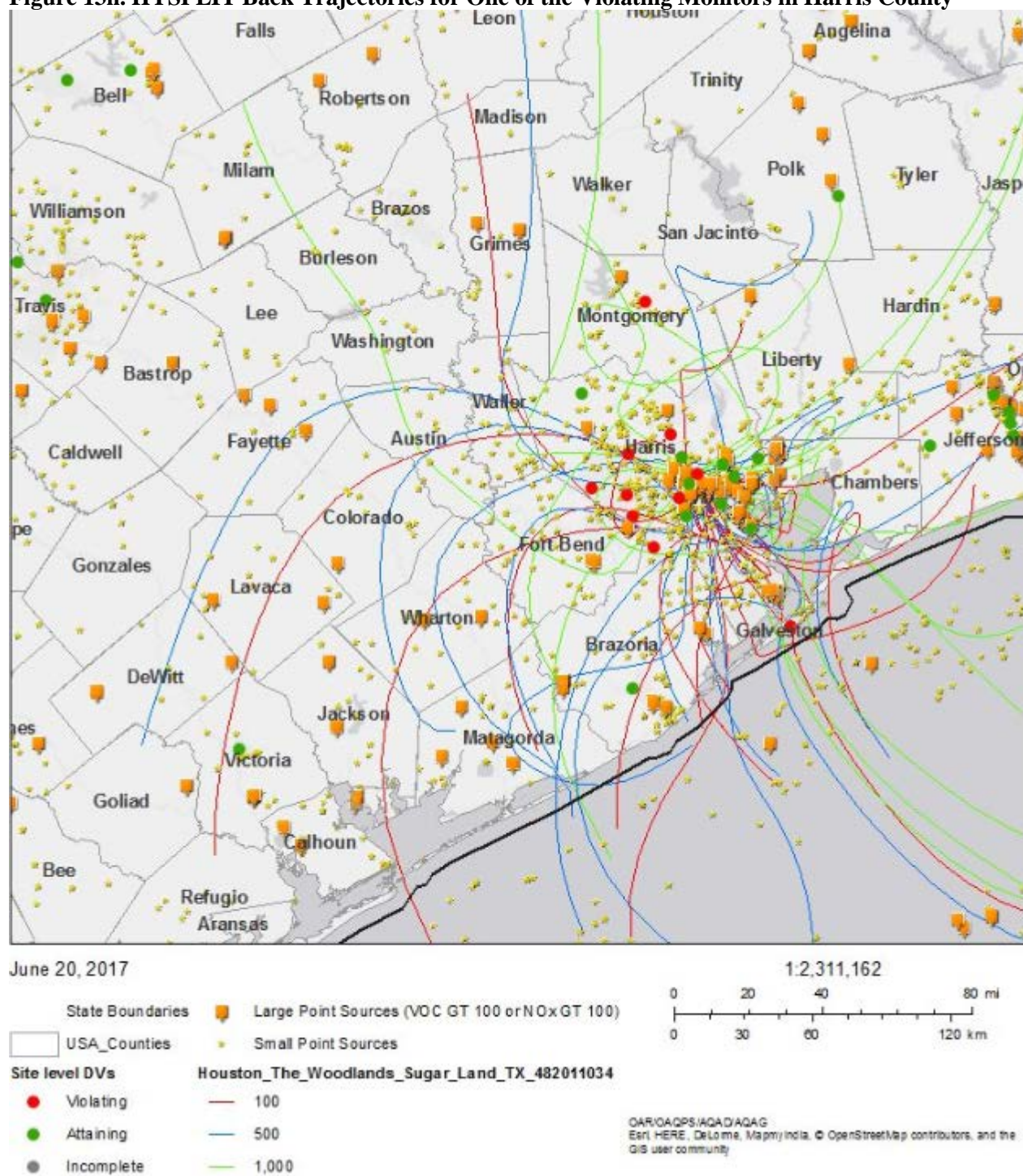


Figure 13g. HYSPLIT Back Trajectories for One of the Violating Monitors in Harris County<sup>40</sup>



<sup>40</sup> This is the Lang monitor, which has the fourth highest design value of the seven violating monitors in Harris County.

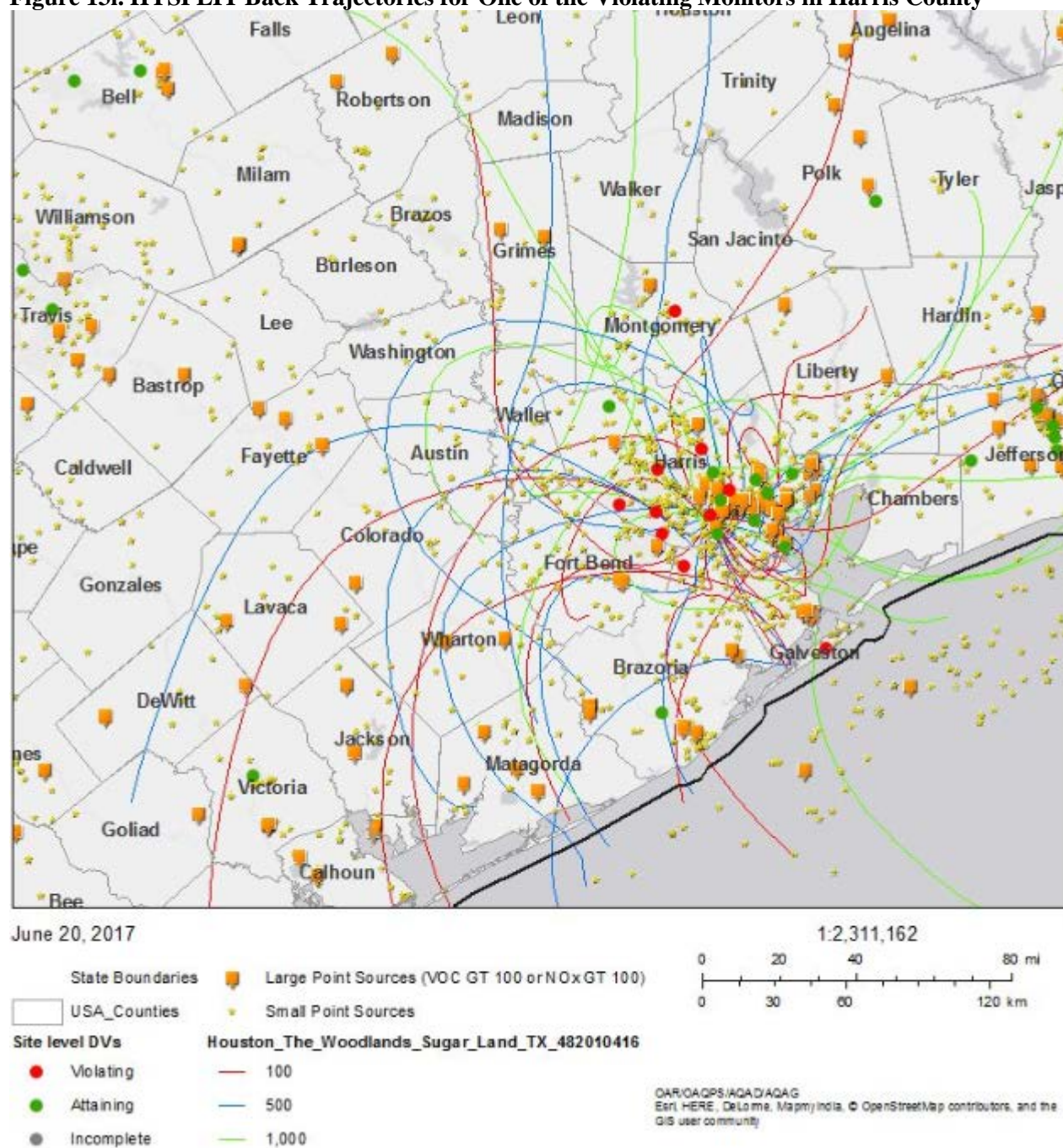
Figure 13h. HYSPLIT Back Trajectories for One of the Violating Monitors in Harris County<sup>41</sup>



<sup>41</sup> This is the Houston East monitor, which has the fifth highest design value of the seven violating monitors in Harris County.



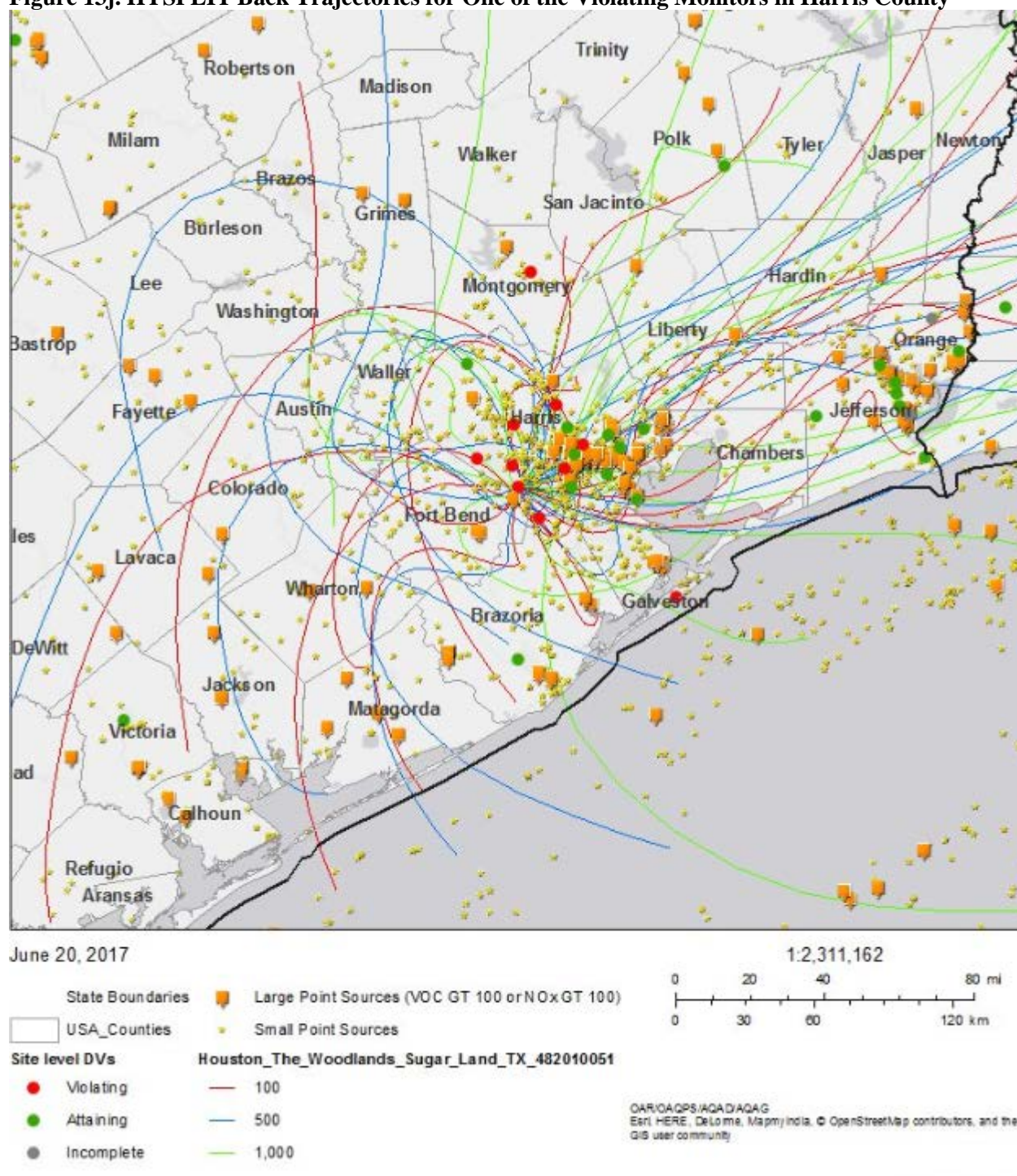
Figure 13i. HYSPLIT Back Trajectories for One of the Violating Monitors in Harris County<sup>42</sup>



<sup>42</sup> This is the Park Place monitor, which has the sixth highest design value of the seven violating monitors in Harris County.



Figure 13j. HYSPLIT Back Trajectories for One of the Violating Monitors in Harris County<sup>43</sup>



The HYSPLIT results show that many of the back trajectories come from nearly every direction and change direction (denoted by the curving and looping trajectories) before reaching the violating monitors. The violating monitor in Montgomery County is primarily impacted by transport from Harris, Brazoria, and Fort Bend Counties. The violating monitor in Brazoria County is primarily impacted by transport from Harris, Galveston, and Fort Bend Counties, as well as sources in Brazoria County. The violating monitors in Harris County are primarily impacted by transport from Brazoria, Chambers, Galveston, and Fort Bend Counties, as well as sources in Harris County.

<sup>43</sup> This is the Houston Croquet monitor, which has the lowest design value of the seven violating monitors in Harris County.

#### **Factor 4: Geography/topography**

Consideration of geography or topography can provide additional information relevant to defining nonattainment area boundaries. Analyses should examine the physical features of the land that might define the airshed. Mountains or other physical features may influence the fate and transport of emissions as well as the formation and distribution of ozone concentrations. The absence of any such geographic or topographic features may also be a relevant consideration in selecting boundaries for a given area.

The EPA used geography/topography analysis to evaluate the physical features of the land that might affect the airshed and, therefore, the distribution of ozone over the area

The Houston area does not have any geographical or topographical features significantly limiting air pollution transport within its air shed. Therefore, this factor did not play a role in this evaluation.

#### **Factor 5: Jurisdictional boundaries**

Once the geographic extent of the violating area and the nearby area contributing to violations is determined, the EPA considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary to carry out the air quality planning and enforcement functions for nonattainment areas. In defining the boundaries of the Houston nonattainment area, the EPA considered existing jurisdictional boundaries, which can provide easily identifiable and recognized boundaries for purposes of implementing the NAAQS. Examples of jurisdictional boundaries include, but are not limited to: counties, air districts, areas of Indian country, metropolitan planning organizations, and existing nonattainment areas. If an existing jurisdictional boundary is used to help define the nonattainment area, it must encompass all of the area that has been identified as meeting the nonattainment definition. Where existing jurisdictional boundaries are not adequate or appropriate to describe the nonattainment area, the EPA considered other clearly defined and permanent landmarks or geographic coordinates for purposes of identifying the boundaries of the designated areas.

The Houston area has previously established nonattainment boundaries associated with the 1997 and 2008 8-hour ozone NAAQS, consisting of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties.

### **Conclusion for the Houston-Galveston-Brazoria Area**

Based on the assessment of factors described above, the EPA is not modifying the State's recommendation to include the following counties in the Houston-Galveston-Brazoria ozone nonattainment area: Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties. The counties of Brazoria, Galveston, Harris, and Montgomery Counties are included based on monitors within these counties with 2016 ozone design values violating the 2015 ozone NAAQS. Fort Bend and Chambers Counties are nearby counties that do not have violating monitors, but the five-factor analysis indicates that these areas contribute to the ozone concentrations in violation of the 2015 ozone NAAQS. Specifically, Fort Bend County is among the highest regarding NO<sub>x</sub> (4<sup>th</sup>) and VOC (6<sup>th</sup>) emissions, population statistics (2<sup>nd</sup>), and VMT (3<sup>rd</sup>) in the area; and Chambers County is among the highest regarding VOC (2<sup>nd</sup>) and NO<sub>x</sub> (6<sup>th</sup>) emissions in the area. The HYSPLIT trajectories for the Brazoria, Harris, and Montgomery County violating monitors also indicate that emissions from Fort Bend and Chambers Counties have the potential to impact the monitors on high ozone days. Finally, all six counties recommended to be included in the nonattainment area by the State are also included in the Houston nonattainment area for the 1997 and 2008 ozone NAAQS. The designated nonattainment

area captures approximately 97 percent of the commuters, 95 percent of the population, 92 percent of the VMT, 84 percent of the NOx emissions, and 87 percent of the VOC emissions in the area of analysis.

The EPA is not designating Austin, Matagorda, Trinity, Walker, Washington and Wharton Counties as part of the Houston nonattainment area. Austin, Trinity, and Washington Counties rank low for most of the factors, and Trinity and Washington contribute the lowest percentage of commuters to the counties with violating monitors; Trinity County ranks the lowest for every emission source except VOC, where it is the 5<sup>th</sup> lowest out of the 14 counties; Washington and Austin are among the lowest in NOx (2<sup>nd</sup> and 5<sup>th</sup> lowest) and VOC (2<sup>nd</sup> and 3<sup>rd</sup> lowest) emissions, population (3<sup>rd</sup> and 2<sup>nd</sup> lowest), and VMT (3<sup>rd</sup> and 4<sup>th</sup> lowest), respectively; emissions from these counties are not influencing nonattainment monitors based upon HYSPLIT outputs. Matagorda and Wharton Counties have the 8<sup>th</sup> and 6<sup>th</sup> lowest VOC emissions of the 14 counties, the 4<sup>th</sup> and 6<sup>th</sup> lowest populations, and the 2<sup>nd</sup> and 5<sup>th</sup> lowest VMT; and have the 6<sup>th</sup> and 4<sup>th</sup> lowest percentage of commuters to the counties with violating monitors; emissions from these counties are not influencing nonattainment monitors based upon HYSPLIT outputs. Walker County is among the lowest in NOx and VOC emissions (4<sup>th</sup> lowest) and contributes the 3<sup>rd</sup> lowest percentage of commuters to the counties with violating monitors; these emissions are not influencing nonattainment monitors based upon HYSPLIT outputs.

The State recommended and in the December 2017 120-day letter EPA indicated that we did not intend to modify the State's recommendation that Liberty and Waller Counties be included in the nonattainment area. However, the State has now requested that Liberty and Waller Counties not be included as part of the nonattainment area and submitted a demonstration in support of that request. In light of the State's new request and demonstration, EPA re-evaluated whether to include Liberty and Waller Counties as part of the nonattainment area. Liberty County VOC emissions rank in the middle of the 14 counties (8<sup>th</sup>), which accounts for about 3 percent of the VOC emitted in the area of analysis; and is not densely populated, with about 69 people per square mile; VMT ranks 7<sup>th</sup> and commuting patterns show 59% of workers in Liberty County commute to a county with a violating monitor – this represents approximately 21,000 commuters, which accounts for less than one percent of the commuters in the area of analysis; examination of the HYSPLIT data show back trajectories through Liberty County to the violating monitors in nearby Montgomery and Harris Counties, though many of the trajectories from Liberty into Harris County flow along the ship channel before reaching the violating monitor, which is densely populated with large point sources and greatly outweighs Liberty County in terms of all emissions. Waller County has no large point sources, the lowest emissions of VOC in the 14 counties, and the 3<sup>rd</sup> lowest emissions of NOx; Waller County VMT ranks in the middle (8<sup>th</sup>) and commuting patterns show 56% of workers in Waller County commute to a county with a violating monitor – this represents approximately 10,100 commuters, which accounts for less than half of one percent of the commuters in the area of analysis; examination of the HYSPLIT data show back trajectories through Waller County to the violating monitors in nearby Montgomery and Harris Counties, though many of the trajectories from Waller flow through Harris and Fort Bend Counties before reaching the violating monitors – Harris and Fort Bend Counties greatly outweigh Waller County in terms of all emission sources.