Appendix K

Key Water Quality Parameters

Appendix K - Key Water Quality Parameters

Section Outline

Section K.1 – Key Water Quality Parameter Selection

Section K.2 – Baseline Water Quality Conditions

Section K.3 – Water Quality Data Summary

Related Chapters

Chapter 6 – Impacts of Regional Water Plan and Consistency with Protection of Water Resources, Agricultural Resources, and Natural Resources

Key Water Quality Parameters Selected for 2021 Region C Plan

- Surface Water:
  - Ammonia-nitrogen
  - Nitrate-nitrogen
  - Total phosphorous
  - Chlorophyll-a
  - Total dissolved solids (TDS)
  - Chloride **NEW**
  - Sulfate **NEW**
- Groundwater
  - TDS
  - Chloride **NEW**
  - Sulfate **NEW**

K.1 Key Water Quality Parameters Selection

Regional Water Planning Groups are charged with selecting key water quality parameters that are important to water uses in the region and assessing impacts of water management strategies on these parameters. This appendix provides the parameter selection process and establishes baseline water quality conditions for the selected parameters.

In order to provide some basis for selection of parameters and for quantitative comparisons between different water bodies within the region, regulatory standards and screening levels are referenced throughout this memorandum. However, it is not the intent of this memorandum to evaluate regulatory compliance of any water body within the region. These regulatory standards are only used as "yardsticks" for relative comparisons of water quality within the region.

K.1.1 Process of Selecting Key Water Quality Parameters

Selection of key water quality parameters for surface water and groundwater involved a two-stage process. The first stage included a compilation of potential water quality parameters from various sources. These sources are described below:

- Parameters regulated by the Texas Commission on Environmental Quality (TCEQ) in the Texas Surface Water Quality Standards (TSWQS);
- Parameters considered for the TCEQ Water Quality Inventory in evaluation of whether water body uses are supported, not supported, or have water quality concerns. The designated water body uses included in the Water Quality Inventory are:
    - Aquatic life use
    - Contact recreation use
    - General use
    - Fish consumption use
    - Public water supply use;
- Parameters that may impact suitability of water for irrigation; and
- Parameters that may impact treatability of water for municipal or industrial supply.

Categories a and b above were selected to represent environmental water quality parameters, and Categories c and d were selected to be representative of water quality as related to irrigation uses and treatability for municipal or industrial supplies.

For the second stage of the process, key water quality parameters were selected from this compiled list of potential parameters based on general guidelines which were established in Appendix P of the 2006 Region C Plan. The general guidelines used to further develop a manageable and meaningful list of key water quality parameters are described below.

- Selected parameters should be representative of water quality conditions that may be impacted on a regional scale and that are likely to be impacted by multiple water management strategies within the region. Water quality issues associated with localized conditions (such as elevated levels of a toxic material within one water body) will be addressed as necessary within

the environmental impact evaluations of the individual water management strategies for each water user group. In addition, water quality parameters that could impact specific advanced treatment processes (e.g., membranes or ozone) will be addressed as necessary during pilot testing and/or preliminary design.

- Sufficient data must be available for a parameter in order to include it as a key water quality parameter. If meaningful statistical summaries cannot be carried out on the parameter, it should not be designated as a key water quality parameter.

K.1.2 Selection of Parameters for the 2021 Plan

Potential key water quality parameters were assessed for the Region C planning area according to the process described above. Little has changed since 2011 in terms of parameters that may impact suitability for irrigation, municipal, or industrial purposes. Since development of the 2011 Plan, the TCEQ has added Surface Water Quality Standards for the following parameters:

- Toxics:
  - Nonylphenol and diazinon standards for all segments.
  - Site-specific copper and aluminum standards for various segments.
- Site-specific dissolved oxygen standards for various classified and unclassified segments.
- Site-specific chlorophyll-a standards for various reservoirs.
- Site-specific E. coli standards for various unclassified segments.

Any entity that proposes to discharge treated wastewater must show that the discharge will not cause a violation of the Surface Water Quality Standards to obtain a discharge permit. In addition, most of the new standards only apply to a few segments/locations in Region C. Therefore, with the exception of chlorophyll-a, it has been assumed that the newly regulated parameters will be addressed as necessary for each water user group within the environmental impact evaluations of the individual water management strategies or during preliminary wastewater treatment design.

Therefore, the first stage in the process of selecting key water quality parameters yielded the same candidate parameters as those in the 2006, 2011 and 2016 Region C Water Plans. In addition, baseline conditions are not anticipated to have changed significantly in the years since the 2006 Plan development and were not re-assessed in this round of planning. While total dissolved solids were evaluated in previous plans, chloride and sulfate were not. Since data for these two parameters are readily available and they both have Federal secondary standards, these two parameters were added into the evaluation for this plan, though they were not included in previous plans. Further information on specific candidate parameters and basis for selection, is available in Appendix P of the 2006 Plan.

Similarly, key water quality parameters were identified for groundwater based on an evaluation of the parameters regulated by drinking water standards and those known to be potential problems for groundwater in Region C.

The following key water quality parameters were selected to assess impacts from water management strategies:

- Surface Water:
  - Ammonia-nitrogen
  - Nitrate-nitrogen
  - Total phosphorous
  - Chlorophyll-a
  - Total dissolved solids (TDS)
  - Chloride
  - Sulfate
- Groundwater
  - TDS
  - Chloride
  - Sulfate

K.2 Baseline Water Quality Conditions

Baseline water quality conditions were evaluated using data obtained from the Texas Surface Water Quality Monitoring Database. Water quality data for reservoirs and streams located within Region C were evaluated, as well as sources located outside of Region C that are currently being considered for use or are in use as raw water sources for the region. Statistical analyses were conducted to determine the number of data points (count), mean, median, 75th percentile, maximum, and minimum for each water body assessed. Data from 1998 through 2018 for surface water and 1993 to 2019 for groundwater were assessed for each parameter. Statistical summaries for each surface water parameter are presented in **Section K.3**.

To further demonstrate baseline water quality conditions in Region C, each water body was placed in categories based on parameter concentration. The lowest bin (Bin 1) constitutes levels that are less than regulatory or literature levels of concern. The second bin (Bin 2) represents parameter levels that are approaching regulatory standards or levels of concern (nominally 80 percent of regulated standard). The highest bin (Bin 3) represents parameter levels that exceed the stated regulatory standards, levels of concern, or screening criteria. Screening levels for nutrient parameters were based on the TCEQ *2014 Guidance for Assessing and Reporting Surface Water Quality in Texas*. For surface water assessment of TDS, chloride, and sulfate, screening levels were based on National Secondary Drinking Water Standards. For the groundwater TDS, chloride and sulfate assessment, screening limits were based on the State of Texas Secondary Drinking Water Standard.

It is important to note that placement in Bins 2 or 3 does not necessarily indicate a violation of a water quality standard or the need for additional treatment levels. As mentioned earlier, the data presented here are summarized over the entire surface water segment (at all depths and all stations located in the main water body) or the entire aquifer/county area. In many cases, regulatory application of the standard or level of concern is performed on a different group of data than are summarized here (e.g., for lake mixed layer samples only). The bin designations, while derived from regulatory standards, are only provided as a "yardstick" for assessing water quality conditions and as a basis for comparisons between water bodies. The bin designations are not to be used to evaluate whether conditions within a given water body are in compliance with regulatory standards. **Table K.1** and **Table K.2** demonstrate baseline surface water and groundwater quality bins by parameter.

For TDS, chloride and sulfate, the median value is used for comparison with the numerical regulatory standard or level of concern, but for nutrients and chlorophyll-a (parameters subject to the TCEQ secondary screening levels), the 75th percentile is used. This value was used for comparison because the TCEQ secondary screening levels are applied such that a source water is "of concern" when more than 25 percent of the samples taken exceed the numerical screening limit.

K.2.1 Surface Water Baseline Conditions

The following sections summarize the baseline water quality conditions for each key surface water quality parameter. As discussed earlier, this review of baseline conditions is not intended to provide an evaluation of compliance with regulatory standards. When referenced, regulatory standards are only used as a means of making relative comparisons between water bodies.

With respect to nutrients, it should be noted that the impact of nutrients on chlorophyll-a concentrations is site-specific and can vary significantly between water bodies. Therefore, high levels of nutrients are not necessarily indicative of poor water quality in any given water body.

Ammonia Nitrogen

Ammonia Nitrogen levels were measured from 26 reservoirs between 1998 and 2018. Of the 26 reservoirs sampled, fifteen demonstrated 75th percentile ammonia nitrogen concentrations ranging between 0.088 and 0.11 mg/L and fell into Bin 2. Lakes with screening levels exceeding 0.11 mg/L fell into Bin 3 and included Lake O' the Pines (Segment 403), Toledo Bend Reservoir (Segment 504), Lake Tawakoni (Segment 507), and Wright-Patman Lake (Segment 302). Seven other reservoirs fell into Bin 1 with screening levels less than 0.088 mg/L

Of the twenty streams sampled for ammonia nitrogen, all but one stream fell below screening levels and were categorized as Bin 1. One stream demonstrated 75th percentile ammonia nitrogen concentrations ranging between 0.26 and 0.33 mg/L and fell into Bin 2and was Sulphur/South Sulphur River (Segment 303). This contrasts with the 2016 Plan, where an analysis of samples collected between 1993 and 2009 yielded one stream that exceeded the 0.33 mg/L screening level and fell into Bin 3.

Nitrate Nitrogen

Twenty-four reservoirs were sampled for nitrate nitrogen concentrations in the Region C planning area. Eight of the 24 reservoirs demonstrated 75th percentile concentrations exceeding the Bin 3 screening criteria of 0.37 mg/L. Five reservoirs were categorized as Bin 2 with 75th percentile concentrations between 0.3 mg/L and 0.37 mg/L. Eleven other reservoirs fell into Bin 1 with screening levels less than 0.3 mg/L.

Of the 16 streams sampled for nitrate nitrogen concentrations, eleven fell below screening criteria and were classified into Bin 1 (< 1.56 mg/L). Five streams exceeded the screening criteria of 1.95 mg/L and were placed in Bin 3. Streams categorized as Bin 3 included Elm Fork Trinity River above Ray Roberts Lake (Segment 824), Upper Trinity River (Segment 805), Lower West Fork Trinity River (Segment 841), Trinity River Above Lake Livingston (Segment 804) and East Fork Trinity River (Segment 819). There were no streams that fell within Bin 2 with concentrations ranging between 1.56 and 1.95 mg/L.

Table K.1 Definition of Baseline Surface Water Quality Bins by Parameter

Parameter	Statistic Used for Comparison	Lower Bound of Bin 3	Basis of Lower Bound, Bin 3	Lower Bound of Bin 2	Basis of Lower Bound, Bin 2
Total Dissolved Solids	Median	500 mg/L	National Secondary Drinking Water Standard	400 mg/L	80 percent of secondary standard
Chloride	Median	250 mg/L	National Secondary Drinking Water Standard	200 mg/L	80 percent of secondary standard
Sulfate	Median	250 mg/L	National Secondary Drinking Water Standard	200 mg/L	80 percent of secondary standard
Ammonia-Nitrogen (as N)	75th percentile	0.11 mg/L (reservoir) 0.33 mg/L (stream)	TCEQ 2014 Guidance for Assessing and Recording Surface Water Quality in Texas	0.088 mg/L (reservoir) 0.26 mg/L (stream)	80 percent of screening level
Nitrate-Nitrogen (as N)	75th percentile	0.37 mg/L (reservoir) 1.95 mg/L (stream)	TCEQ 2014 Guidance for Assessing and Recording Surface Water Quality in Texas	0.30 mg/L (reservoir) 1.56 mg/L (stream)	80 percent of screening level
Total Phosphorus (as P)	75th percentile	0.20 mg/L (reservoir) 0.69 mg/L (stream)	TCEQ 2014 Guidance for Assessing and Recording Surface Water Quality in Texas	0.16 mg/L (reservoir) 0.55 mg/L (stream)	80 percent of screening level
Chlorophyll-a	75th percentile	26.7 µg/L (reservoir) 14.1 µg/L (stream)	TCEQ 2014 Guidance for Assessing and Recording Surface Water Quality in Texas	21.4 µg/L (reservoir) 11.3 µg/L (stream)	80 percent of screening level

Table K.2 Definition of Baseline Groundwater Quality Bins by Parameter

Parameter	Statistic Used for Comparison	Lower Bound of Bin 3	Basis of Lower Bound, Bin 3	Lower Bound of Bin 2	Basis of Lower Bound, Bin 2
Total Dissolved Solids	Median	1000 mg/L	State of Texas Secondary Drinking Water Standard	500 mg/L	National Secondary Drinking Water Standard
Chloride	Median	300 mg/L	State of Texas Secondary Drinking Water Standard	250 mg/L	National Secondary Drinking Water Standard
Sulfate	Median	300 mg/L	State of Texas Secondary Drinking Water Standard	250 mg/L	National Secondary Drinking Water Standard

Total Phosphorous

None of the 26 reservoirs sampled for total phosphorous in Region C exhibited 75th percentile concentrations that exceed the TCEQ screening level of 0.20 mg/L to be placed into Bin 3. One reservoir was found to approach screening levels and was placed into Bin 2 (0.16 to 0.20 mg/L). Wright-Patman Lake (Segment 302) demonstrated a 75th percentile concentration of 0.16 mg/L.

Of the 20 streams sampled for total phosphorous concentrations, five streams demonstrated 75th percentile concentrations exceeding the Bin 3 screening criteria of 0.69 mg/L and included East Fork Trinity River (Segment 819), Lower West Fork Trinity River (Segment 841), Upper Trinity River (Segment 805) Clear Fork Trinity River Below Lake Weatherford (Segment 831) and Trinity River Above Lake Livingston (Segment 804). Fourteen out of twenty streams sampled for total phosphorous were below the screening criteria and fell in Bin 1. One stream, West Fork Trinity River Above Bridgeport Reservoir (Segment 812) fell within Bin 2 with a 75th percentile concentration of 0.55 mg/L.

Chlorophyll-a

Of the 25 reservoirs sampled for chlorophyll-a, 17 fell into Bins 2 or 3, demonstrating 75th percentile concentrations approaching or exceeding screening levels. Six reservoirs fell into Bin 2 with concentrations ranging from 21.4 to 26.7 µg/L, and eleven exceeded 26.7 µg/L and fell into Bin 3. Bin 2 reservoirs included Lake Fork (Segment 512), Grapevine Lake (Segment 826), Lewisville Lake (Segment 823), Lake Waxahachie (Segment 816), Richland-Chambers Reservoir (Segment 836), and Chapman Lake (Segment 307).

Ten out of nineteen streams that were sampled for chlorophyll-a exceeded the screening criteria of 14.1 µg/L and fell into Bin 3. One stream was categorized in Bin 2 (West Fork Trinity River above Bridgeport Reservoir, Segment 812) with a concentration ranging from 11.3 to 14.1 µg/L

Total Dissolved Solids

In general, concentrations of TDS in surface water for sampled water bodies were relatively low. Eight of 46 reservoirs and streams in the area approached or exceeded screening levels for TDS. Three water bodies were categorized into Bin 2 with median concentrations ranging from 400-500 mg/L. Bin 2 water bodies included the Upper Trinity River (Segment 805), Clear Fork Trinity River below Lake Weatherford (Segment 831), and the Lower West Fork Trinity River (Segment 841). Five water bodies demonstrated median concentrations above 500 mg/L and included East Fork Trinity River (Segment 819), Clear Fork Trinity River above Lake Weatherford (Segment 833), Red River above and below Lake Texoma (Segments 202 and 204), and Lake Texoma (Segment 203).

Sulfate

In general, concentrations of sulfate in surface water for sampled water bodies were relatively low. Only two of 44 reservoirs and streams in the area exceeded and approached screening levels for sulfate. Lake Texoma (Segment 203) was categorized into Bin 2 with a median concentration ranging from 200-250 mg/L. Red River Above Lake Texoma (Segment

204) fell into Bin 3 with a median concentration of 565 mg/L.

Chloride

In general, concentrations of chloride in surface water for sampled water bodies were relatively low. Three of 46 reservoirs and streams in the area approached or exceeded screening levels for chloride. One water body was categorized in Bin 2 with median concentrations ranging from 200-250 mg/L (Red River Below Lake Texoma, Segment 202). Two water bodies demonstrated median concentrations above 250 mg/L and included Lake Texoma (Segment 203) and Red River above Lake Texoma (Segment 204).

K.2.2 Groundwater Baseline Conditions

In previous plans, the sole key water quality parameter selected for groundwater in Region C was TDS. However, since chloride and sulfate are also regulated by secondary drinking water standards and data were available, they have been added in the 2021 Plan. Baseline conditions for TDS, chloride and sulfate were summarized using data from 1993-2019. The groundwater quality data summaries are presented in **Table K.10**, **Table K.11**, and **Table K.12**.

Total Dissolved Solids

With the exception of the Carrizo-Wilcox and Queen City aquifers, most groundwater sources in Region C report median TDS concentrations greater than 500 mg/L, the National secondary drinking water standard. The Trinity aquifer beneath these counties generally reports median concentrations between 500 mg/L and 1,000 mg/L. TDS concentrations in the Woodbine aquifer are even greater, with the highest median concentrations occurring in the most urban counties and those counties immediately down-gradient (Dallas, Tarrant, Ellis, and Navarro). Although limited, data for the Nacatoch aquifer indicate that TDS levels are greater than 500 mg/L in Kaufman County and slightly below 500 mg/L in Navarro County.

Sulfate

Median sulfate concentrations are generally below the National secondary drinking water standard of 250 mg/L in all aquifers except the Woodbine. The highest median sulfate concentrations (greater than 300 mg/L) were found in Dallas, Ellis and Navarro Counties within the Woodbine aquifer.

Chloride

Median chloride concentrations in all aquifers are well below the National secondary drinking water standard of 250 mg/L. Therefore, all aquifers were classified as Bin 1 for chloride.

K.3 Water Quality Data Summary

K.3.1 Surface Water Quality Data Summary

Table K.3 through **Table K.9** summarize surface water quality data by segment and parameter. This data was collected between January 1, 1998 and December 31, 2018. The source of this data is TCEQ's Water Quality Monitoring Database.

K.3.2 Groundwater Quality Data Summary

Table K.10 through **Table K.12** summarize groundwater water quality data by aquifer and county.

Table K.3 Ammonia Nitrogen in Surface Water

Segment Number	Segment Description	Water Body Type	Total Nitrogen (mg/L as N)						
			Count	Median	Mean	75th Percentile	Max	Min	Bin
203	Lake Texoma	Lake	81	0.05	0.06	0.07	0.20	0.02	1
302	Wright-Patman Lake	Lake	9	0.05	0.09	0.16	0.24	0.02	3
307	Chapman/Cooper Lake	Lake	244	0.05	0.10	0.11	1.52	0.02	2
403	Lake O' the Pines	Lake	228	0.09	0.09	0.12	0.40	0.02	3
504	Toledo Bend Reservoir	Lake	156	0.06	0.18	0.11	6.74	0.02	3
507	Lake Tawakoni	Lake	404	0.08	0.13	0.14	1.95	0.02	3
512	Lake Fork	Lake	51	0.09	0.15	0.11	1.53	0.05	2
605	Lake Palestine	Lake	51	0.1	0.10	0.10	0.23	0.05	2
807	Lake Worth	Lake	533	0.06	0.07	0.10	0.44	0.02	2
809	Eagle Mountain Reservoir	Lake	59	0.05	0.06	0.06	0.23	0.02	1
811	Bridgeport Reservoir	Lake	347	0.1	0.08	0.10	0.46	0.02	2
815	Bardwell Reservoir	Lake	1244	0.1	0.12	0.10	3.76	0.02	2
816	Lake Waxahachie	Lake	261	0.1	0.08	0.10	0.31	0.02	2
817	Navarro Mills Lake	Lake	239	0.03	0.04	0.05	0.21	0.02	1
818	Cedar Creek Reservoir	Lake	426	0.05	0.11	0.10	6.00	0.01	2
820	Lake Ray Hubbard	Lake	107	0.05	0.06	0.06	0.80	0.00	1
821	Lake Lavon	Lake	715	0.03	0.06	0.10	2.03	0.02	2
823	Lewisville Lake	Lake	158	0.05	0.08	0.05	2.36	0.00	1
826	Grapevine Lake	Lake	624	0.1	0.11	0.11	2.60	0.02	2
827	White Rock Lake	Lake	155	0.05	0.08	0.10	0.30	0.02	2
828	Lake Arlington	Lake	134	0.05	0.06	0.05	1.00	0.00	1
830	Benbrook Lake	Lake	37	0.05	0.08	0.07	0.46	0.02	1
832	Lake Weatherford	Lake	120	0.1	0.12	0.11	1.30	0.02	2
836	Richland-Chambers Reservoir	Lake	392	0.1	0.09	0.10	0.50	0.01	2
838	Joe Pool Lake	Lake	542	0.05	0.07	0.09	0.41	0.02	2
840	Ray Roberts Lake	Lake	1159	0.07	0.08	0.10	0.92	0.02	2
202	Red River Below Lake Texoma	Stream	93	0.09	0.09	0.10	0.27	0.02	1
204	Red River Above Lake Texoma	Stream	296	0.05	0.08	0.10	0.67	0.02	1
303	Sulphur/South Sulphur River	Stream	187	0.1	0.26	0.27	2.59	0.02	2
804	Trinity River Above Lake Livingston	Stream	266	0.05	0.06	0.06	0.43	0.02	1
805	Upper Trinity River	Stream	75	0.05	0.07	0.06	0.43	0.02	1
806	West Fork Trinity River Below Lake Worth	Stream	124	0.04	0.14	0.10	2.92	0.01	1
810	West Fork Trinity River Below Bridgeport Reservoir	Stream	1331	0.09	0.10	0.10	2.30	0.02	1
812	West Fork Trinity River Above Bridgeport Reservoir	Stream	315	0.07	0.12	0.14	1.42	0.02	1
814	Chambers Creek Above Richland-Chambers Reservoir	Stream	65	0.05	0.07	0.07	0.48	0.02	1

Segment Number	Segment Description	Water Body Type	Total Nitrogen (mg/L as N)						
			Count	Median	Mean	75th Percentile	Max	Min	Bin
819	East Fork Trinity River	Stream	68	0.05	0.06	0.06	0.20	0.02	1
822	Elm Form Trinity River Below Lewisville Lake	Stream	48	0.03	0.07	0.10	0.31	0.02	1
824	Elm Fork Trinity River Above Ray Roberts Lake	Stream	638	0.1	0.12	0.10	1.50	0.03	1
825	Denton Creek	Stream	251	0.05	0.07	0.06	0.49	0.02	1
829	Clear Fork Trinity River Below Benbrook Lake	Stream	440	0.05	0.08	0.05	1.13	0.01	1
831	Clear Fork Trinity River Below Lake Weatherford	Stream	151	0.1	0.16	0.12	3.13	0.02	1
833	Clear Fork Trinity River Above Lake Weatherford	Stream	15	0.05	0.08	0.14	0.17	0.02	1
835	Chambers Creek Below Richland–Chambers Reservoir	Stream	4	0.05	0.07	0.07	0.14	0.05	1
837	Richland Creek Above Richland–Chambers Reservoir	Stream	42	0.05	0.07	0.06	0.28	0.02	1
839	Elm Fork Trinity River Below Ray Roberts Lake	Stream	461	0.1	0.08	0.10	1.10	0.02	1
841	Lower West Fork Trinity River	Stream	260	0.05	0.11	0.06	1.62	0.02	1

Bin 1: Less than regulatory or literature levels of concern
Bin 2: Approaching regulatory standards or levels of concern
Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.4 Nitrate Nitrogen in Surface Water

Segment Number	Segment Description	Water Body Type	Count	Nitrate Nitrogen, Total (mg/L as N)					
				Median	Mean	75th Percentile	Max	Min	Bin
203	Lake Texoma	Lake	136	0.0795	0.13	0.19	0.45	0.02	1
302	Wright-Patman Lake	Lake	165	0.05	0.08	0.05	1.64	0.01	1
307	Chapman/Cooper Lake	Lake	146	0.055	0.15	0.24	0.54	0.02	1
403	Lake O' the Pines	Lake	36	0.05	0.09	0.05	0.56	0.01	1
504	Toledo Bend Reservoir	Lake	1547	0.05	0.08	0.08	3.12	0.02	1
507	Lake Tawakoni	Lake	570	0.08	0.14	0.21	1.99	0.00	1
512	Lake Fork	Lake	562	0.05	0.11	0.14	1.28	0.01	1
605	Lake Palestine	Lake	26	0.085	0.98	1.64	6.99	0.05	3
809	Eagle Mountain Reservoir	Lake	131	0.19	0.24	0.34	0.93	0.01	2
811	Bridgeport Reservoir	Lake	24	0.19	0.24	0.29	0.50	0.14	1
815	Bardwell Reservoir	Lake	25	0.25	0.35	0.63	0.88	0.05	3
816	Lake Waxahachie	Lake	25	0.13	0.29	0.39	1.15	0.01	3
817	Navarro Mills Lake	Lake	6	0.075	1.00	1.92	3.23	0.05	3
818	Cedar Creek Reservoir	Lake	54	0.245	0.29	0.37	0.82	0.01	2
820	Lake Ray Hubbard	Lake	170	0.125	0.20	0.27	0.96	0.00	1
821	Lake Lavon	Lake	555	0.33	0.82	0.86	15.50	0.02	3
823	Lewisville Lake	Lake	113	0.1	0.33	0.35	7.13	0.00	2
826	Grapevine Lake	Lake	73	0.17	0.26	0.40	1.15	0.00	3
828	Lake Arlington	Lake	19	0.3	0.28	0.38	0.78	0.05	3
830	Benbrook Lake	Lake	18	0.24	0.24	0.25	0.32	0.18	1
832	Lake Weatherford	Lake	6	0.05	0.06	0.05	0.09	0.05	1
836	Richland-Chambers Reservoir	Lake	48	0.245	0.28	0.34	0.79	0.01	2
838	Joe Pool Lake	Lake	5	0.25	1.35	0.36	5.72	0.20	2
840	Ray Roberts Lake	Lake	164	0.175	0.47	0.52	5.36	0.00	3
202	Red River Below Lake Texoma	Stream	67	0.06	0.18	0.22	1.06	0.04	1
204	Red River Above Lake Texoma	Stream	22	0.04	0.57	0.84	4.98	0.02	1
303	Sulphur/South Sulphur River	Stream	27	0.08	0.22	0.29	1.44	0.05	1
804	Trinity River Above Lake Livingston	Stream	195	2.55	3.51	5.22	13.65	0.02	3
805	Upper Trinity River	Stream	92	4.83	5.68	9.49	16.14	0.07	3
806	West Fork Trinity River Below Lake Worth	Stream	13	0.23	0.50	0.83	1.40	0.02	1
810	West Fork Trinity River Below Bridgeport Reservoir	Stream	8	0.51	0.54	0.75	1.09	0.05	1
812	West Fork Trinity River Above Bridgeport Reservoir	Stream	6	0.05	0.05	0.05	0.05	0.05	1
814	Chambers Creek Above Richland-Chambers Reservoir	Stream	5	0.8	0.87	1.24	2.10	0.05	1
819	East Fork Trinity River	Stream	16	9.97	10.19	13.25	17.80	4.90	3
822	Elm Form Trinity River Below Lewisville Lake	Stream	93	0.5	0.57	0.73	1.73	0.00	1

Segment Number	Segment Description	Water Body Type	Count	Nitrate Nitrogen, Total (mg/L as N)					
				Median	Mean	75th Percentile	Max	Min	Bin
824	Elm Fork Trinity River Above Ray Roberts Lake	Stream	36	4.26	4.54	7.35	12.82	0.18	3
825	Denton Creek	Stream	9	0.58	0.70	0.96	1.25	0.30	1
829	Clear Fork Trinity River Below Benbrook Lake	Stream	8	0.27	0.30	0.34	0.54	0.17	1
839	Elm Fork Trinity River Below Ray Roberts Lake	Stream	7	0.55	0.67	0.83	1.32	0.17	1
841	Lower West Fork Trinity River	Stream	58	9.04	7.74	11.35	15.21	0.36	3

☐ Bin 1: Less than regulatory or literature levels of concern
☐ Bin 2: Approaching regulatory standards or levels of concern
☐ Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.5 Phosphorous Total, Wet Method, in Surface Water

Segment Number	Segment Description	Water Body Type	Count	Phosphorous Total, Wet Method (mg/L as P)					
				Median	Mean	75th Percentile	Max	Min	Bin
203	Lake Texoma	Lake	387	0.06	0.06	0.07	0.46	0.02	1
302	Wright-Patman Lake	Lake	545	0.11	0.13	0.16	1.65	0.01	2
307	Chapman/Cooper Lake	Lake	262	0.09	0.10	0.13	0.38	0.02	1
403	Lake O' the Pines	Lake	435	0.06	0.13	0.10	8.34	0.01	1
504	Toledo Bend Reservoir	Lake	1045	0.06	0.07	0.06	0.35	0.06	1
507	Lake Tawakoni	Lake	405	0.06	0.08	0.08	0.28	0.01	1
512	Lake Fork	Lake	470	0.06	0.08	0.07	0.54	0.02	1
605	Lake Palestine	Lake	391	0.06	0.10	0.09	1.97	0.01	1
807	Lake Worth	Lake	365	0.07	0.08	0.09	0.94	0.01	1
809	Eagle Mountain Reservoir	Lake	1186	0.07	0.08	0.10	0.64	0.01	1
811	Bridgeport Reservoir	Lake	746	0.05	0.06	0.06	0.66	0.01	1
815	Bardwell Reservoir	Lake	81	0.05	0.05	0.06	0.25	0.01	1
816	Lake Waxahachie	Lake	65	0.05	0.05	0.06	0.25	0.02	1
817	Navarro Mills Lake	Lake	70	0.06	0.06	0.08	0.25	0.02	1
818	Cedar Creek Reservoir	Lake	1399	0.08	0.11	0.12	1.33	0.01	1
820	Lake Ray Hubbard	Lake	240	0.05	0.06	0.06	1.50	0.01	1
821	Lake Lavon	Lake	638	0.10	0.18	0.15	5.30	0.02	1
823	Lewisville Lake	Lake	123	0.05	0.13	0.08	2.50	0.01	1
826	Grapevine Lake	Lake	228	0.04	0.05	0.06	0.58	0.01	1
827	White Rock Lake	Lake	35	0.07	0.08	0.10	0.13	0.02	1
828	Lake Arlington	Lake	498	0.06	0.07	0.08	1.29	0.01	1
830	Benbrook Lake	Lake	647	0.06	0.07	0.08	0.63	0.01	1
832	Lake Weatherford	Lake	58	0.05	0.06	0.06	0.13	0.02	1
836	Richland-Chambers Reservoir	Lake	1268	0.05	0.09	0.10	1.26	0.01	1
838	Joe Pool Lake	Lake	116	0.04	0.06	0.06	0.40	0.01	1
840	Ray Roberts Lake	Lake	244	0.03	0.06	0.06	0.50	0.01	1
202	Red River Below Lake Texoma	Stream	282	0.11	0.14	0.16	1.04	0.02	1
204	Red River Above Lake Texoma	Stream	189	0.20	0.30	0.35	1.47	0.05	1
303	Sulphur/South Sulphur River	Stream	258	0.14	0.15	0.20	0.75	0.01	1
804	Trinity River Above Lake Livingston	Stream	498	0.77	0.89	1.16	3.30	0.05	3
805	Upper Trinity River	Stream	571	1.08	1.15	1.68	4.17	0.03	3
806	West Fork Trinity River Below Lake Worth	Stream	253	0.08	0.09	0.10	0.70	0.02	1
810	West Fork Trinity River Below Bridgeport Reservoir	Stream	124	0.16	0.26	0.29	1.80	0.01	1
812	West Fork Trinity River Above Bridgeport Reservoir	Stream	53	0.28	0.41	0.55	1.70	0.02	2

Segment Number	Segment Description	Water Body Type	Count	Phosphorous Total, Wet Method (mg/L as P)					
				Median	Mean	75th Percentile	Max	Min	Bin
814	Chambers Creek Above Richland-Chambers Reservoir	Stream	200	0.14	0.35	0.51	2.40	0.01	1
819	East Fork Trinity River	Stream	165	1.72	1.81	2.57	6.20	0.03	3
822	Elm Form Trinity River Below Lewisville Lake	Stream	289	0.11	0.14	0.15	2.87	0.01	1
824	Elm Fork Trinity River Above Ray Roberts Lake	Stream	145	0.16	0.62	0.42	4.12	0.02	1
825	Denton Creek	Stream	48	0.19	0.24	0.30	0.94	0.04	1
829	Clear Fork Trinity River Below Benbrook Lake	Stream	81	0.06	0.07	0.07	0.59	0.02	1
831	Clear Fork Trinity River Below Lake Weatherford	Stream	202	0.44	0.52	0.78	2.36	0.01	3
833	Clear Fork Trinity River Above Lake Weatherford	Stream	27	0.08	0.10	0.13	0.23	0.01	1
835	Chambers Creek Below Richland–Chambers Reservoir	Stream	4	0.11	0.13	0.18	0.24	0.05	1
837	Richland Creek Above Richland–Chambers Reservoir	Stream	39	0.12	0.16	0.22	0.45	0.02	1
839	Elm Fork Trinity River Below Ray Roberts Lake	Stream	6	0.04	0.04	0.04	0.06	0.01	1
841	Lower West Fork Trinity River	Stream	235	0.91	0.97	1.35	2.66	0.06	3

☐ Bin 1: Less than regulatory or literature levels of concern
☐ Bin 2: Approaching regulatory standards or levels of concern
☐ Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.6 Chlorophyll-a, Spectrophotometric Acid Method, in Surface Water

Segment Number	Segment Description	Water Body Type	Count	Chlorophyll-a, (µg/L)					
				Median	Mean	75th Percentile	Max	Min	Bin
203	Lake Texoma	Lake	267	10.10	13.28	17.65	155.00	2.88	1
302	Wright-Patman Lake	Lake	231	18.00	26.25	35.20	150.00	1.00	3
307	Chapman/Cooper Lake	Lake	158	13.90	17.61	22.85	130.00	3.00	2
403	Lake O' the Pines	Lake	265	10.00	9.82	11.80	63.40	0.01	1
504	Toledo Bend Reservoir	Lake	494	10.00	14.30	18.00	204.00	1.00	1
507	Lake Tawakoni	Lake	402	34.00	36.18	49.00	124.00	1.00	3
512	Lake Fork	Lake	513	15.50	17.18	22.00	108.00	1.00	2
605	Lake Palestine	Lake	128	14.60	26.90	32.93	237.00	1.00	3
807	Lake Worth	Lake	365	16.90	21.94	31.20	159.30	0.50	3
809	Eagle Mountain Reservoir	Lake	1188	19.40	21.27	28.50	124.60	0.50	3
811	Bridgeport Reservoir	Lake	759	5.30	6.13	7.30	51.60	0.50	1
815	Bardwell Reservoir	Lake	63	15.00	18.73	28.00	58.70	1.00	3
816	Lake Waxahachie	Lake	49	11.00	15.51	23.00	41.40	1.00	2
817	Navarro Mills Lake	Lake	33	10.00	8.79	10.70	22.40	0.00	1
818	Cedar Creek Reservoir	Lake	1385	19.60	24.00	32.70	112.30	0.50	3
820	Lake Ray Hubbard	Lake	123	22.00	22.32	32.00	53.00	1.00	3
821	Lake Lavon	Lake	584	24.70	32.96	47.60	202.00	3.00	3
823	Lewisville Lake	Lake	85	17.00	20.90	25.00	150.10	3.00	2
826	Grapevine Lake	Lake	149	17.00	17.55	23.60	58.40	3.00	2
828	Lake Arlington	Lake	499	20.00	24.01	34.95	95.40	0.90	3
830	Benbrook Lake	Lake	671	17.80	20.57	30.70	65.40	0.50	3
832	Lake Weatherford	Lake	17	10.00	14.72	19.80	35.20	1.00	1
836	Richland-Chambers Reservoir	Lake	1237	11.80	15.59	21.80	94.70	0.50	2
838	Joe Pool Lake	Lake	57	8.00	16.45	17.80	170.00	0.00	1
840	Ray Roberts Lake	Lake	85	6.50	7.73	9.00	37.40	3.00	1
202	Red River Below Lake Texoma	Stream	141	10.00	13.75	18.20	73.40	1.00	3
204	Red River Above Lake Texoma	Stream	26	16.15	26.34	42.65	93.30	1.00	3
303	Sulphur/South Sulphur River	Stream	93	10.00	10.73	10.40	45.40	1.00	1
804	Trinity River Above Lake Livingston	Stream	471	10.60	17.56	19.16	191.00	0.01	3
805	Upper Trinity River	Stream	410	10.55	12.56	15.60	80.00	0.20	3
806	West Fork Trinity River Below Lake Worth	Stream	250	18.00	21.70	29.55	94.00	0.90	3
810	West Fork Trinity River Below Bridgeport Reservoir	Stream	31	10.00	10.74	10.70	41.60	1.00	1
812	West Fork Trinity River Above Bridgeport Reservoir	Stream	11	10.00	12.77	12.50	32.00	3.20	2
814	Chambers Creek Above Richland-Chambers Reservoir	Stream	13	10.00	9.55	10.70	19.60	1.33	1

Segment Number	Segment Description	Water Body Type	Count	Chlorophyll-a, (µg/L)					
				Median	Mean	75th Percentile	Max	Min	Bin
819	East Fork Trinity River	Stream	88	10.00	12.81	15.30	45.60	3.00	3
822	Elm Form Trinity River Below Lewisville Lake	Stream	239	12.00	17.53	18.95	100.00	0.20	3
824	Elm Fork Trinity River Above Ray Roberts Lake	Stream	73	10.70	20.30	21.40	163.00	1.00	3
825	Denton Creek	Stream	30	10.00	7.20	10.00	13.90	1.00	1
829	Clear Fork Trinity River Below Benbrook Lake	Stream	33	10.00	9.64	10.00	30.00	1.00	1
831	Clear Fork Trinity River Below Lake Weatherford	Stream	83	4.00	5.97	9.90	38.40	0.20	1
833	Clear Fork Trinity River Above Lake Weatherford	Stream	23	6.90	7.05	10.00	18.10	0.82	1
835	Chambers Creek Below Richland–Chambers Reservoir	Stream	4	10.00	25.83	25.83	73.30	10.00	3
837	Richland Creek Above Richland–Chambers Reservoir	Stream	7	1.25	3.24	2.81	12.80	1.00	1
841	Lower West Fork Trinity River	Stream	229	10.40	12.03	15.10	58.00	0.90	3

Bin 1: Less than regulatory or literature levels of concern
Bin 2: Approaching regulatory standards or levels of concern
Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.7 Total Dissolved Solids in Surface Water

Segment Number	Segment Description	Water Body Type	Total Dissolved Solids (mg/L) as Residue, Total Filtrable (dried at 180°)						
			Count	Median	Mean	75th Percentile	Max	Min	Bin
203	Lake Texoma	Lake	394	1020.00	993.55	1120.00	1640.00	286.00	3
302	Wright-Patman Lake	Lake	380	136.50	141.78	158.25	536.00	21.00	1
307	Chapman/Cooper Lake	Lake	208	125.50	132.94	138.25	420.00	88.00	1
403	Lake O' the Pines	Lake	202	106.00	117.44	123.00	376.00	54.00	1
504	Toledo Bend Reservoir	Lake	3	77.00	77.67	81.00	85.00	71.00	1
507	Lake Tawakoni	Lake	116	107.50	108.84	118.00	150.00	78.00	1
512	Lake Fork	Lake	60	103.00	128.68	117.00	1300.00	75.00	1
605	Lake Palestine	Lake	245	130.00	144.47	164.00	416.00	74.00	1
807	Lake Worth	Lake	369	213.00	214.67	231.00	306.00	147.00	1
809	Eagle Mountain Reservoir	Lake	1164	215.00	214.96	234.00	551.00	52.20	1
811	Bridgeport Reservoir	Lake	731	179.00	183.67	199.00	329.00	78.00	1
815	Bardwell Reservoir	Lake	64	236.50	233.70	257.25	342.00	75.00	1
816	Lake Waxahachie	Lake	61	186.00	192.85	214.00	291.00	64.00	1
817	Navarro Mills Lake	Lake	29	201.00	205.79	226.00	256.00	154.00	1
818	Cedar Creek Reservoir	Lake	1358	122.00	127.01	136.00	804.00	33.00	1
820	Lake Ray Hubbard	Lake	170	194.00	199.59	213.00	835.00	118.00	1
821	Lake Lavon	Lake	639	222.00	247.39	273.00	744.00	131.00	1
823	Lewisville Lake	Lake	127	207.00	252.46	240.00	730.00	67.00	1
826	Grapevine Lake	Lake	159	212.00	202.86	224.00	258.00	92.00	1
827	White Rock Lake	Lake	7	270.00	247.57	281.00	288.00	184.00	1
828	Lake Arlington	Lake	500	182.50	204.54	201.00	1573.00	78.00	1
830	Benbrook Lake	Lake	657	197.00	198.16	212.00	287.00	119.00	1
832	Lake Weatherford	Lake	32	243.50	240.34	258.25	302.00	166.00	1
836	Richland-Chambers Reservoir	Lake	1241	163.00	167.53	179.00	498.00	59.10	1
838	Joe Pool Lake	Lake	63	340.00	402.32	379.00	2260.00	175.00	1
840	Ray Roberts Lake	Lake	184	179.00	183.15	193.25	344.00	38.00	1
819	East Fork Trinity River	Stream	114	527.50	536.67	635.50	1300.00	214.00	3
841	Lower West Fork Trinity River	Stream	147	435.00	421.52	484.00	662.00	215.00	2
805	Upper Trinity River	Stream	199	420.00	393.61	474.00	1080.00	73.00	2
824	Elm Fork Trinity River Above Ray Roberts Lake	Stream	120	387.00	417.63	485.00	1310.00	144.00	1
814	Chambers Creek Above Richland-Chambers Reservoir	Stream	93	348.00	389.02	463.00	964.00	162.00	1
825	Denton Creek	Stream	57	230.00	244.12	264.00	354.00	185.00	1
806	West Fork Trinity River Below Lake Worth	Stream	26	253.00	249.35	273.50	326.00	153.00	1
839	Elm Fork Trinity River Below Ray Roberts Lake	Stream	23	195.00	196.00	204.50	241.00	169.00	1
810	West Fork Trinity River Below Bridgeport Reservoir	Stream	50	323.00	363.66	427.25	788.00	170.00	1

Segment Number	Segment Description	Water Body Type	Total Dissolved Solids (mg/L) as Residue, Total Filtrable (dried at 180°)						
			Count	Median	Mean	75th Percentile	Max	Min	Bin
822	Elm Form Trinity River Below Lewisville Lake	Stream	217	250.00	256.63	285.00	708.00	69.00	1
829	Clear Fork Trinity River Below Benbrook Lake	Stream	52	279.00	279.79	312.50	690.00	28.00	1
303	Sulphur/South Sulphur River	Stream	164	201.00	222.24	284.50	620.00	76.00	1
202	Red River Below Lake Texoma	Stream	300	774	795.94	985	9380	45	3
812	West Fork Trinity River Above Bridgeport Reservoir	Stream	20	283.00	559.40	604.00	3450.00	109.00	1
804	Trinity River Above Lake Livingston	Stream	383	332.00	334.59	418.00	566.00	71.00	1
204	Red River Above Lake Texoma	Stream	125	2900.00	2999.39	3960.00	5590.00	666.00	3
831	Clear Fork Trinity River Below Lake Weatherford	Stream	63	422.00	430.89	467.00	922.00	258.00	2
833	Clear Fork Trinity River Above Lake Weatherford	Stream	15	544.00	528.00	566.00	610.00	422.00	3
835	Chambers Creek Below Richland–Chambers Reservoir	Stream	4	232.00	224.25	243.00	270.00	163.00	1
837	Richland Creek Above Richland–Chambers Reservoir	Stream	30	229.00	350.15	412.00	1010.00	160.00	1

Bin 1: Less than regulatory or literature levels of concern
Bin 2: Approaching regulatory standards or levels of concern
Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.8 Sulfate in Surface Water

Segment Number	Segment Description	Water Body Type	Count	Sulfate (mg/L as SO4)					
				Median	Mean	75th Percentile	Max	Min	Bin
203	Lake Texoma	Lake	408	242.50	231.70	266.25	920.00	28.00	2
302	Wright-Patman Lake	Lake	636	16.00	17.78	22.00	89.10	5.00	1
307	Chapman/Cooper Lake	Lake	344	8.55	9.59	11.00	119.00	1.00	1
403	Lake O' the Pines	Lake	437	22.30	24.57	28.00	121.00	1.65	1
504	Toledo Bend Reservoir	Lake	2257	16.40	18.08	20.00	112.00	1.06	1
507	Lake Tawakoni	Lake	710	10.00	10.06	11.00	37.94	1.47	1
512	Lake Fork	Lake	821	18.80	18.59	22.10	38.00	3.22	1
605	Lake Palestine	Lake	451	24.00	25.37	30.50	80.00	7.00	1
807	Lake Worth	Lake	186	24.19	24.14	28.50	37.00	5.00	1
809	Eagle Mountain Reservoir	Lake	258	25.85	27.10	30.38	64.20	5.00	1
811	Bridgeport Reservoir	Lake	247	15.00	17.37	20.15	50.00	2.80	1
815	Bardwell Reservoir	Lake	148	43.30	44.04	46.80	76.50	11.70	1
816	Lake Waxahachie	Lake	66	22.50	27.40	35.00	58.40	12.00	1
817	Navarro Mills Lake	Lake	178	24.90	26.45	29.58	60.60	9.59	1
818	Cedar Creek Reservoir	Lake	413	20.70	21.09	25.00	73.60	5.00	1
820	Lake Ray Hubbard	Lake	79	40.00	41.19	49.00	60.00	5.00	1
821	Lake Lavon	Lake	658	32.85	37.11	46.58	140.00	1.00	1
826	Grapevine Lake	Lake	140	32.65	32.51	35.50	48.00	15.90	1
827	White Rock Lake	Lake	37	35.60	37.48	45.00	63.00	18.00	1
828	Lake Arlington	Lake	331	28.73	29.49	32.65	54.00	0.32	1
830	Benbrook Lake	Lake	180	27.34	28.50	30.80	55.70	5.00	1
832	Lake Weatherford	Lake	61	32.00	30.65	35.00	39.00	15.00	1
836	Richland-Chambers Reservoir	Lake	413	28.04	29.00	32.50	94.70	8.56	1
838	Joe Pool Lake	Lake	255	104.00	101.85	112.00	423.00	17.53	1
840	Ray Roberts Lake	Lake	113	15.15	14.07	17.00	19.34	8.72	1
202	Red River Below Lake Texoma	Stream	326	182.50	178.56	231.00	434.00	10.00	1
204	Red River Above Lake Texoma	Stream	153	565.00	579.32	778.00	1200.00	24.00	3
303	Sulphur/South Sulphur River	Stream	295	22.00	35.21	49.50	251.00	1.00	1
804	Trinity River Above Lake Livingston	Stream	469	66.00	64.73	80.60	431.00	5.00	1
805	Upper Trinity River	Stream	415	78.29	74.01	89.60	223.90	13.20	1
806	West Fork Trinity River Below Lake Worth	Stream	181	33.00	35.39	40.40	128.00	6.00	1
810	West Fork Trinity River Below Bridgeport Reservoir	Stream	54	37.50	42.64	50.50	110.00	11.00	1
812	West Fork Trinity River Above Bridgeport Reservoir	Stream	20	11.50	57.70	36.75	506.00	2.00	1
814	Chambers Creek Above Richland-Chambers Reservoir	Stream	193	70.01	85.23	107.00	312.00	2.54	1

Segment Number	Segment Description	Water Body Type	Count	Sulfate (mg/L as SO4)					
				Median	Mean	75th Percentile	Max	Min	Bin
819	East Fork Trinity River	Stream	195	99.00	103.52	125.50	365.00	19.80	1
822	Elm Form Trinity River Below Lewisville Lake	Stream	48	56.75	55.78	66.03	114.40	20.20	1
824	Elm Fork Trinity River Above Ray Roberts Lake	Stream	114	40.50	40.96	50.00	96.00	7.00	1
825	Denton Creek	Stream	74	40.50	69.28	60.50	463.00	18.00	1
829	Clear Fork Trinity River Below Benbrook Lake	Stream	84	36.35	38.71	45.00	68.00	9.00	1
831	Clear Fork Trinity River Below Lake Weatherford	Stream	79	48.00	47.66	56.50	95.00	14.00	1
833	Clear Fork Trinity River Above Lake Weatherford	Stream	15	68.00	62.89	71.90	78.00	34.00	1
835	Chambers Creek Below Richland–Chambers Reservoir	Stream	4	34.00	36.00	47.25	54.00	22.00	1
837	Richland Creek Above Richland–Chambers Reservoir	Stream	61	28.04	57.59	69.00	279.00	7.00	1
841	Lower West Fork Trinity River	Stream	204	59.80	59.33	68.05	107.00	13.50	1

☐ Bin 1: Less than regulatory or literature levels of concern
☐ Bin 2: Approaching regulatory standards or levels of concern
☐ Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.9 Chloride in Surface Water

Segment Number	Segment Description	Water Body Type	Count	Chloride (mg/L as Cl)					
				Median	Mean	75th Percentile	Max	Min	Bin
203	Lake Texoma	Lake	407	333.00	326.36	394.00	603.00	33.50	3
302	Wright-Patman Lake	Lake	638	10.00	10.95	13.10	36.30	1.00	1
307	Chapman/Cooper Lake	Lake	342	3.97	4.94	5.00	172.00	1.00	1
403	Lake O' the Pines	Lake	437	13.10	14.63	17.00	57.00	3.00	1
504	Toledo Bend Reservoir	Lake	2264	15.70	17.77	19.00	161.00	2.20	1
507	Lake Tawakoni	Lake	806	6.00	6.87	10.00	16.00	1.82	1
512	Lake Fork	Lake	827	14.80	14.47	17.00	48.00	4.33	1
605	Lake Palestine	Lake	445	23.00	24.51	28.00	84.00	5.00	1
807	Lake Worth	Lake	341	28.90	28.06	33.20	52.00	11.05	1
809	Eagle Mountain Reservoir	Lake	1093	31.05	30.74	35.10	64.76	9.10	1
811	Bridgeport Reservoir	Lake	644	18.45	20.60	23.43	174.20	9.80	1
815	Bardwell Reservoir	Lake	148	16.55	17.20	19.00	36.20	10.00	1
816	Lake Waxahachie	Lake	66	11.95	13.39	15.98	28.50	7.00	1
817	Navarro Mills Lake	Lake	177	9.00	9.35	10.60	44.00	1.73	1
818	Cedar Creek Reservoir	Lake	1209	13.50	13.76	15.31	99.70	2.20	1
820	Lake Ray Hubbard	Lake	234	22.50	24.17	26.00	80.00	5.00	1
821	Lake Lavon	Lake	667	19.24	23.47	30.10	130.00	1.00	1
823	Lewisville Lake	Lake	126	19.65	29.62	28.38	190.00	4.50	1
826	Grapevine Lake	Lake	225	26.00	27.14	29.10	54.00	11.00	1
827	White Rock Lake	Lake	37	25.00	24.45	29.00	37.00	8.00	1
828	Lake Arlington	Lake	569	16.10	17.00	18.80	62.03	6.00	1
830	Benbrook Lake	Lake	544	21.86	22.26	24.40	44.71	10.90	1
832	Lake Weatherford	Lake	61	31.00	30.36	34.00	44.00	15.50	1
836	Richland-Chambers Reservoir	Lake	1066	9.90	10.52	11.40	72.30	2.50	1
838	Joe Pool Lake	Lake	214	18.60	19.75	21.87	69.00	6.09	1
840	Ray Roberts Lake	Lake	294	16.50	16.13	19.38	48.50	2.50	1
202	Red River Below Lake Texoma	Stream	326	219.00	223.91	307.75	600.00	10.00	2
204	Red River Above Lake Texoma	Stream	152	1150.00	1126.65	1465.00	2190.00	18.00	3
303	Sulphur/South Sulphur River	Stream	298	12.00	17.61	23.00	128.00	1.00	1
804	Trinity River Above Lake Livingston	Stream	440	45.05	47.61	67.20	112.10	5.10	1
805	Upper Trinity River	Stream	347	52.30	55.85	74.90	397.00	9.35	1
806	West Fork Trinity River Below Lake Worth	Stream	147	22.50	24.61	29.79	180.00	5.00	1

Segment Number	Segment Description	Water Body Type	Count	Chloride (mg/L as Cl)					
				Median	Mean	75th Percentile	Max	Min	Bin
810	West Fork Trinity River Below Bridgeport Reservoir	Stream	119	44.00	57.84	77.85	261.00	3.30	1
812	West Fork Trinity River Above Bridgeport Reservoir	Stream	51	21.70	74.45	90.15	474.00	2.70	1
814	Chambers Creek Above Richland-Chambers Reservoir	Stream	218	20.45	40.55	49.38	325.00	4.40	1
819	East Fork Trinity River	Stream	193	74.00	80.52	101.00	340.00	10.23	1
822	Elm Form Trinity River Below Lewisville Lake	Stream	122	27.00	29.70	34.38	98.00	10.80	1
824	Elm Fork Trinity River Above Ray Roberts Lake	Stream	136	30.00	35.61	47.00	155.00	7.00	1
825	Denton Creek	Stream	73	26.00	27.59	33.00	51.00	9.36	1
829	Clear Fork Trinity River Below Benbrook Lake	Stream	83	23.00	23.19	27.00	52.30	9.53	1
831	Clear Fork Trinity River Below Lake Weatherford	Stream	152	48.00	52.64	67.85	158.00	6.00	1
833	Clear Fork Trinity River Above Lake Weatherford	Stream	15	69.00	68.32	75.90	95.00	40.00	1
835	Chambers Creek Below Richland–Chambers Reservoir	Stream	4	39.50	36.00	51.25	58.00	7.00	1
837	Richland Creek Above Richland–Chambers Reservoir	Stream	61	11.30	36.76	51.00	213.00	2.80	1
839	Elm Fork Trinity River Below Ray Roberts Lake	Stream	23	19.50	19.93	21.00	28.00	16.00	1
841	Lower West Fork Trinity River	Stream	179	72.20	68.34	84.50	167.00	12.00	1

Bin 1: Less than regulatory or literature levels of concern
Bin 2: Approaching regulatory standards or levels of concern
Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.10 Total Dissolved Solids in Groundwater

Aquifer	County	Count	Total Dissolved Solids (mg/L)					
			Mean	Median	75th Percentile	Max	Min	Bin
Carrizo-Wilcox	Anderson	101	354	293	390	1,869	123	1
Carrizo-Wilcox	Freestone	61	301	280	331	632	99	1
Carrizo-Wilcox	Henderson	59	258	269	304	638	32	1
Carrizo-Wilcox	Navarro	3	406	326	462	598	295	1
Carrizo-Wilcox	Smith	127	300	235	335	972	99	1
Carrizo-Wilcox	Upshur	27	437	380	496	1,130	148	1
Carrizo-Wilcox	Wood	41	258	244	285	926	124	1
Nacatoch	Kaufman	6	877	865	993	1,041	730	2
Nacatoch	Navarro	7	475	453	552	642	316	1
Queen City	Freestone	3	173	108	207	306	106	1
Queen City	Henderson	14	179	151	168	418	92	1
Trinity	Collin	42	820	746	904	1,688	394	2
Trinity	Cooke	46	508	457	550	843	399	1
Trinity	Dallas	62	957	822	961	4,606	255	2
Trinity	Denton	99	631	610	712	1,291	408	2
Trinity	Ellis	59	897	734	1,099	1,432	634	2
Trinity	Fannin	18	888	892	904	932	804	2
Trinity	Grayson	120	673	605	812	1,492	268	2
Trinity	Jack	3	1,073	1,094	1,269	1,443	681	3
Trinity	Kaufman	4	1,074	1,070	1,085	1,106	1,048	3
Trinity	Parker	80	502	443	649	1,086	97	1
Trinity	Tarrant	128	715	643	844	3,302	274	2
Trinity	Wise	63	674	534	762	2,186	304	2
Woodbine	Collin	26	649	579	727	1,388	318	2
Woodbine	Cooke	6	596	410	624	1,505	184	1
Woodbine	Dallas	22	1,150	1,226	1,460	1,700	436	3
Woodbine	Denton	18	710	683	770	1,841	291	2
Woodbine	Ellis	32	1,363	1,391	1,608	2,144	785	3
Woodbine	Fannin	40	804	825	886	1,201	408	2
Woodbine	Grayson	66	601	587	742	1,105	186	2
Woodbine	Navarro	4	1,589	1,586	1,620	1,634	1,549	3
Woodbine	Tarrant	55	1,399	828	1,352	8,150	163	2

Bin 1: Less than regulatory or literature levels of concern
Bin 2: Approaching regulatory standards or levels of concern
Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.11 Sulfate in Groundwater

Aquifer	County	Count	Sulfate (mg/L as SO4)					
			Mean	Median	75th Percentile	Max	Min	Bin
Carrizo-Wilcox	Anderson	90	19.89	17.45	26.75	52	1	1
Carrizo-Wilcox	Freestone	36	24.09	19.6	35.95	63.2	4.19	1
Carrizo-Wilcox	Henderson	44	23.27	22.5	33.78	80	1	1
Carrizo-Wilcox	Navarro	1	72.5	72.5	72.50	72.5	72.5	1
Carrizo-Wilcox	Smith	106	20.60	14.6	22.18	132	1	1
Carrizo-Wilcox	Upshur	24	18.73	8.89	30.50	62	1	1
Carrizo-Wilcox	Wood	30	19.48	16.25	27.28	53	1	1
Nacatoch	Kaufman	6	228.7	224	309.3	320	139	1
Nacatoch	Navarro	6	37.35	36.65	50.68	81	1	1
Queen City	Freestone	2	14	14	17.5	21	7	1
Queen City	Henderson	15	20.47	15.3	18.5	73	4	1
Trinity	Collin	37	139.9	90	128	590	47.7	1
Trinity	Cooke	42	38.82	32.5	35.98	129	24.5	1
Trinity	Dallas	59	249.1	178	207.5	2920	77	1
Trinity	Denton	86	73.69	64	91.08	326	26.3	1
Trinity	Ellis	53	113.6	102	139	262	65	1
Trinity	Fannin	18	128.4	128.5	133.8	144	116	1
Trinity	Grayson	105	79.05	77	99.7	155	15.2	1
Trinity	Jack	2	163.1	163.05	202.5	242	84.1	1
Trinity	Parker	61	53.97	43	73.3	202	12	1
Trinity	Tarrant	113	117.3	92	154	1430	0.89	1
Trinity	Wise	40	67.79	50.75	71.25	207	25.2	1
Woodbine	Collin	20	121	96.5	135.3	394	19	1
Woodbine	Cooke	6	123.5	49.2	69.3	522	17.7	1
Woodbine	Dallas	21	332.2	348	428	507	36.6	3
Woodbine	Denton	16	125	97.95	137.5	347	43	1
Woodbine	Ellis	32	383.3	383.5	490.8	729	137	3
Woodbine	Fannin	33	185.1	202	214	260	67	1
Woodbine	Grayson	62	99.07	88.05	150	330	17	1
Woodbine	Navarro	4	434	438	440	440	420	3
Woodbine	Tarrant	18	437.7	109.5	255	3300	5.42	1

☐ Bin 1: Less than regulatory or literature levels of concern
☐ Bin 2: Approaching regulatory standards or levels of concern
☐ Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria

Table K.12 Chloride in Groundwater

Aquifer	County	Count	Chloride (mg/L as Cl)					
			Mean	Median	75th Percentile	Max	Min	Bin
Carrizo-Wilcox	Anderson	90	19.59	10	20.13	196	2.86	1
Carrizo-Wilcox	Freestone	36	24.51	23.35	38.28	46.4	8.86	1
Carrizo-Wilcox	Henderson	44	28.24	15.95	42.23	164	2	1
Carrizo-Wilcox	Navarro	1	46.9	46.9	46.9	46.9	46.9	1
Carrizo-Wilcox	Smith	106	26.98	10.3	24.53	178	1.92	1
Carrizo-Wilcox	Upshur	24	49.79	37.75	82.93	116	9	1
Carrizo-Wilcox	Wood	30	21.80	12.2	37.33	71.8	3.72	1
Nacatoch	Kaufman	6	95.77	93.5	107.5	119	80.1	1
Nacatoch	Navarro	6	28.35	28.25	35.2	57	8.62	1
Queen City	Freestone	2	8.71	8.71	9.065	9.42	8	1
Queen City	Henderson	15	29.28	14.9	18.2	127	4.48	1
Trinity	Collin	37	77.29	23	44	647	10.6	1
Trinity	Cooke	42	53.56	16	45.25	311	3	1
Trinity	Dallas	59	92.37	75	103.5	340	16.5	1
Trinity	Denton	86	89.27	20.35	153	532	2.74	1
Trinity	Ellis	53	162.3	74.3	213	427	63.6	1
Trinity	Fannin	18	34.49	35.3	38.33	44	4	1
Trinity	Grayson	105	70.12	32.5	56.5	571	6.79	1
Trinity	Jack	2	124.9	124.9	139	153	96.8	1
Trinity	Parker	61	40.9	24.4	50	297	4	1
Trinity	Tarrant	113	77.98	37.8	78	1822	5.64	1
Trinity	Wise	40	148.8	47.45	186	678	4.17	1
Woodbine	Collin	20	53.91	37.2	66.15	148	14	1
Woodbine	Cooke	6	126.2	39.2	201.5	369	24.6	1
Woodbine	Dallas	21	101.7	86.9	180	235	12	1
Woodbine	Denton	16	62.59	29.65	46.45	371	9	1
Woodbine	Ellis	32	109.3	76.55	145.3	364	31.5	1
Woodbine	Fannin	33	60.52	54	78	120	22	1
Woodbine	Grayson	62	33.43	26	39.95	180	6	1
Woodbine	Navarro	4	132	131.5	143.8	146	119	1
Woodbine	Tarrant	18	153.4	46.2	93.3	1700	10	1

☐ Bin 1: Less than regulatory or literature levels of concern
☐ Bin 2: Approaching regulatory standards or levels of concern
☐ Bin 3: Exceed the stated regulatory standards, levels of concern, or screening criteria