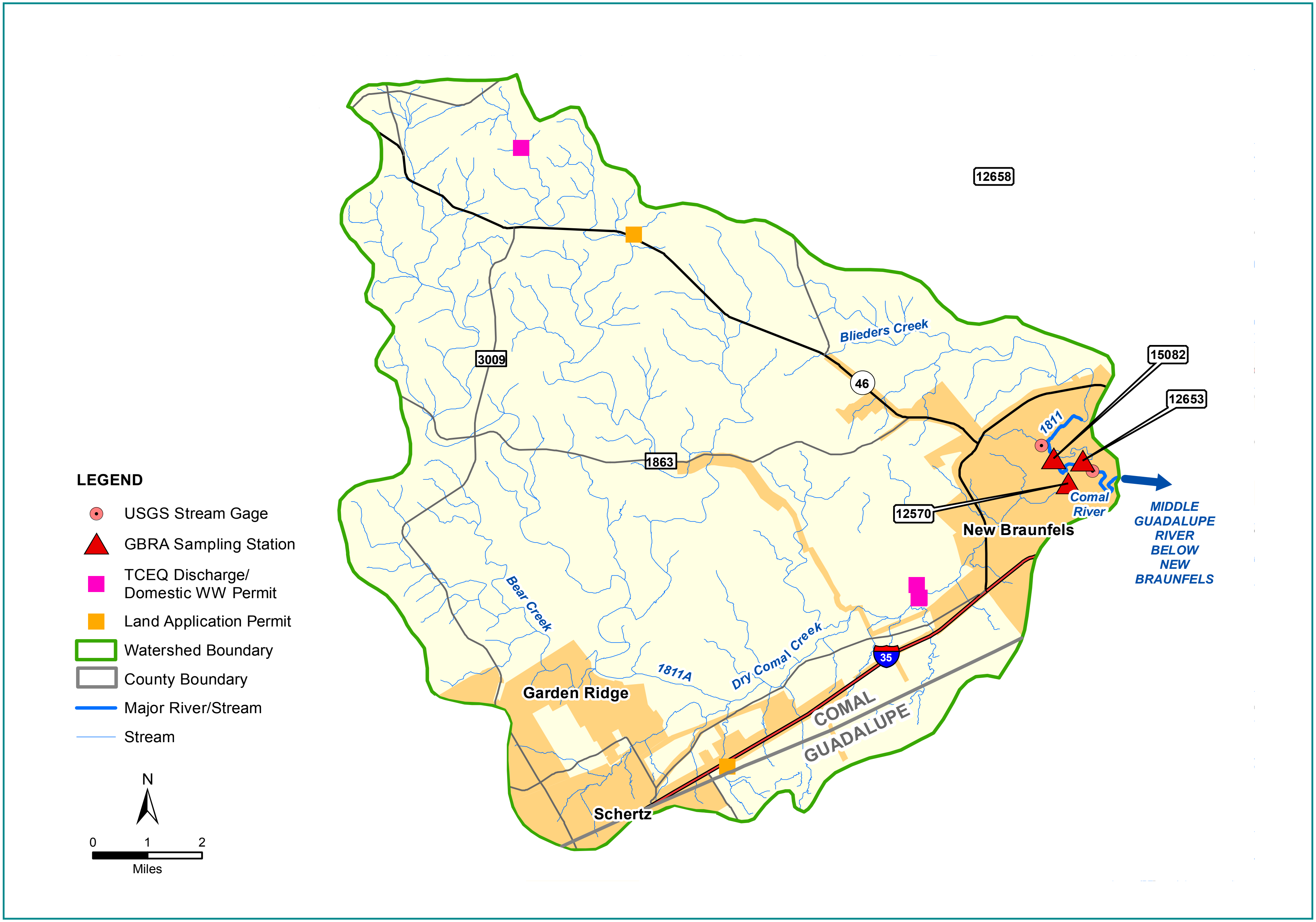
COMAL RIVER


12658
Blieders Creek
46
3009
1863
15082
12653
1811
12570
Comal River
New Braunfels
MIDDLE GUADALUPE RIVER BELOW NEW BRAUNFELS
Bear Creek
1811A
Dry Comal Creek
35
Garden Ridge
COMAL
GUADALUPE
Schertz
LEGEND
USGS Stream Gage
GBRA Sampling Station
TCEQ Discharge/ Domestic WW Permit
Land Application Permit
Watershed Boundary
County Boundary
Major River/Stream
Stream
N
0
1
2
Miles

COMAL RIVER

Segment 1811 represents the Comal River. This stream segment is fed by underground springs from the Edwards Aquifer. The Comal Springs discharge into Landa Lake and travel approximately 2.5 miles to the confluence with the Guadalupe River. Several smaller contributing springs occur in the approximately 1 mile long wetted portion of the segment upstream of Landa Lake. The stream segment has been divided by the TCEQ into two assessment units (AUs). AU 1811_01 is the portion of the river from the confluence with the Guadalupe River (Segment 1804) to just upstream of the confluence with the Dry Comal Creek tributary (Segment 1811A). AU 1811_02 is the portion of the stream upstream of the confluence with the Dry Comal Creek tributary to Klingemann Street in the City of New Braunfels, TX. The Dry Comal Creek has a much larger drainage area that is fed by several seeps in the lower portion of the watershed. The creek remains dry for most of the year in the portions of the watershed upstream of the City of New Braunfels.

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Comal River
Drainage Area: 130 square miles
Length: 2.5 miles
Tributaries of Comal River: Blieders Creek, Dry Comal Creek (1811A),
Aquifer: Edwards Trinity, Edwards Balcones Fault Zone
River Segments: 1811
Cities: New Braunfels
Counties: Comal
EcoRegion: Edwards Plateau, Blackland Prairie
Climate: Average annual rainfall 33.98 inches, Average annual temperature 19.58°C
Vegetation Cover: Evergreen Forest 37.72%, Deciduous Forest 9.25%, Shrubland 22.10%; Grassland 17.35%; Woody Wetlands: 0.86% Cultivated Crops 0.69% ; Pasture Hay 0.69%
Land Uses: urban, light industry, and recreational.
Development: Low Intensity 2.50% ; Medium Intensity 1.32%; High Intensity 0.75%; Open Space 4.90%
Water Body Uses: aquatic life, contract recreation, general use, fish consumption, and public water supply.
Soils: Dark and loamy over limestone to loam with clay subsoils
Permitted Wastewater Treatment Facilities: N/A

Dry Comal Creek
Drainage Area: 110.7 square miles
Length: 34.8 miles
Tributaries of the Dry Comal Creek: Bear Creek, West Fork of Dry Comal Creek
Aquifer: Edwards Trinity
River Segments: 1811
Cities and Communities: New Braunfels, Garden Ridge
Counties: Comal
EcoRegion: Edwards Plateau, Blackland Prairie
Climate: Average annual rainfall 33.98 inches, Average annual temperature 19.58°C
Vegetation Cover: Evergreen Forest 37.14%, Deciduous Forest 9.71%, Shrubland 22.73%; Grassland 18.73%; Woody Wetlands: 0.88% Cultivated Crops 0.82% ; Pasture Hay 0.76%
Land Uses: urban, suburban sprawl, cattle, goat and sheep production, light industry, and recreational.
Development: Low Intensity 1.94% ; Medium Intensity 0.77%; High Intensity 0.57%; Open Space 3.64%
Water Body Uses: aquatic life, contract recreation, general use, fish consumption
Soils: Dark and loamy over limestone to loam with clay subsoils
Permitted Wastewater Treatment Facilities: N/A

COMAL RIVER

The Comal River is the shortest river in the state of Texas and is located entirely within the City limits of the City of New Braunfels. The portion of the River above Clemens dam was split into two channels in the late 19th century in order to provide hydraulic energy to historical mills and power plants of the area. The old river channel that currently flows through the Landa Park golf course had a portion of the spring flows diverted into a new river channel that receives the discharge from the Dry Comal Creek. The Dry Comal Creek tributary is largely comprised of agricultural land use, but urban development continues to grow throughout the watershed. The underground springs that feed the Comal River create unique water quality conditions. The river maintains consistent water temperatures and high water clarity throughout the year. These conditions have made the Comal a perennial tourist destination for recreational swimming and tubing, while also providing suitable living conditions for several aquatic endangered species. The Comal River and springs are home to several federally endangered species, including the Fountain Darter (Etheostoma fonticola), Comal Springs Riffle Beetle (Heterelmis comalensis), Comal Springs Dryopid Beetle (Stygoparnus comalensis) and the Peck's Cave Amphipod (Stygobromus pecki). The U.S. Fish and Wildlife Service has (USFWS) identified diminished springflows and pollution of groundwater as the largest potential threats to these species.

In 2013, a large 2,430 acre property with drainage into the Blieders Creek arm of the Comal River was approved for development. The first phase of construction has begun on this Veramendi subdivision, which includes 1200 acres devoted to the construction of a new elementary school, roads and over 5,000 houses. An additional 380 acres of nonresidential hotels, town centers and schools and 480 acres of public parks are also planned for the future. To date, the new elementary school is the only impervious cover that has been developed. The development should significantly change the drainage into the Comal, with planned dam infrastructure in Bleiders Creek designed to reduce up to 1,000 cubic feet per second (cfs) of runoff into the Comal watershed.

The GBRA routinely samples one surface water quality monitoring station in each TCEQ assessment unit on a monthly basis. In 1968, a historical monitoring station 12653 on the Comal River at Hinman Island was established by the Texas Water Quality Board, which was a predecessor agency of the TCEQ in AU 1811_01. The station was monitored by subsequent iterations of the current TCEQ until 1998. The GBRA began sampling at this station in 1994 and has collected routine samples on a monthly basis since 1996, when it joined the Clean Rivers Program. The GBRA has also monitored one routine station 12570 monthly since 1996, on the Dry Comal Creek (Segment 1811A) near the confluence with the Comal River. In order to better measure the impacts of the bacterial impairment from the Dry Comal Creek tributary on the Comal River, the GBRA began monitoring at station 15082 on the new river channel below Landa Lake in 2014. This station was located upstream of any influence from the Dry Comal Creek.

The spring fed source of the river and distinct aquatic habitat have lead the TCEQ to assess the river with a unique temperature criterion of 25.6°C in AU 1811_02 upstream of the Dry Comal Creek. This temperature criterion excludes the Blieders Creek arm of Landa Lake, Spring Island on the Western Channel and Pecan Island on the Eastern Channel. The average temperature of the Comal River at station 12653 below the Dry Comal is 23.3°C for the 163 data points available for analysis between December of 2002 and November of 2016. The average temperature for the Dry Comal Creek at station 12570 averaged 21.5°C during the same time period. The much smaller data set available from station 15082 upstream of the Dry Comal Creek showed an average temperature very similar to the 23.4°C for the 30 data points available from June 2016 to November of 2016.

The water quality data from all active monitoring stations on the Comal River and the Dry Comal Creek were analyzed for trends and several significant changes were noted. Station 12653 is the only active monitoring station in AU 1811_01 below the confluence with the Dry Comal Creek confluence. This station also has the most available historical monitoring data. The monthly streamflow at station 12653 was found to be significantly decreasing over time for the 164 data points evaluated since 2002 (Figure 1). Stream flow is of particular importance in this watershed because of the unique recreational and aquatic life uses. Dissolved Oxygen and Nitrate Nitrogen at this station were both found to be significantly correlated to streamflow. The dissolved oxygen concentrations in this AU were found to be significantly decreasing over time and decreasing with streamflow (Figure 2 & 3). Nitrate nitrogen is the form of nitrogen most readily available for use by aquatic organisms. The nitrate nitrogen at station 12653 is significantly increasing over the 163 data points assessed and inversely correlated with streamflow (Figure 4 & 5). E. coli bacteria analyses are of particular importance in the watershed because it is assessed as an indicator of support for contact recreation standards, which are currently evaluated at a geometric mean of 126 MPN/100 mL. When the data set of 166 points was evaluated between December of 2002 and November of 2016 an E. coli geometric mean concentration of 114 MPN/100 mL was calculated, but no significant change was discovered over time (Figure 6). A closer examination of the data points beginning in August of 2014 showed a significant reduction of E. coli was occurring over time for the 31 data points available during this smaller window of time (Figure 7). These concentrations were most likely reduced as the result of a return to normal stream flow and precipitation conditions, as the area recovered from a historic drought.

The only active monitoring station in AU 1811_02 above the confluence with the Dry Comal Creek is station 15082. This station has a much more limited data set available for analysis, which began in June of 2014 through November of 2016. The streamflow at this station was found to be increasing with time (Figure 8), which was also significantly affecting several other water quality parameters. The chloride and sulfate levels at station 15082 are both decreasing over time (Figures 9 & 10) and are inversely correlated with streamflow (Figures 11 & 12). Chloride and sulfate are salt anions that are common constituents of total dissolved solids in the water column. The nitrate nitrogen at this station is significantly increasing over time (Figure 13) and appears to be following a similar pattern as the long term data set available from station 12653 in the watershed downstream. The E. coli bacteria concentrations at this station were higher than anticipated, with a geometric mean 141 MPN/100 mL, but they are also significantly decreasing over time for the 30 data points available (Figure 14). The E. coli concentrations at this station indicate that there may be a persistent source of bacteria in the Comal River upstream of the Dry Comal Creek and the majority of any influences from recreational activities.

The Dry Comal Creek is a 34.8 mile long tributary of the Comal River with a large 110.7 square mile drainage area that is heavily influenced by agricultural land use. The Dry Comal Creek was listed on the Texas 303(d) list of impaired water bodies, as required by Clean Water Act Sections 303(d) and 305(b) in 2010. The TCEQ found that the assessed geometric mean of 173.90 MPN/100 mL of E. coli bacteria in the lower 25 miles of the segment exceeded the station contact recreation standard of 126 MPN/100 mL. The creek was initially classified in category 5b, which indicated that the water quality standards for this segment were being reviewed to determine applicability. The segment was reclassified into category 5c in 2012 with 291.03 MPN/100 mL, which indicated that more information needed to be collected in order to develop a management strategy to address the impairment. The most recent Texas Integrated Report on Water Quality assessed a geometric mean of 301.89 MPN/100 mL in this segment. A trending analysis was performed on station 12570 on the Dry Comal Creek on AU1811A_01. This station is located near the confluence with the Comal River immediately downstream of the Mill Dam on the new river channel. The flows of the Dry Comal have less spring flow influence and experience greater changes from rainfall runoff than the Comal River due to a much larger drainage area. No significant changes were noted in streamflow over time at this location. The chloride and sulfate concentrations in the Dry Comal Creek are both significantly decreasing over time (Figure 15 & 16). The E. coli bacteria concentration is being closely tracked in this watershed due to the assessed geometric mean in the 2014 Texas Integrated report above the contact recreation standard of 126 MPN/100 mL. The geometric mean for the 169 data points available from December of 2002 to November of 2016 is 257 MPN/100 mL. There was not a significant trend in E. coli concentrations found in the data set for this monitoring station (Figure 17).

The City of New Braunfels secured

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COMAL RIVER

Clean Water Act Section 319 Non-Point Source Grant funding in 2015 to develop a watershed protection plan for the Dry Comal Creek and Comal River in order to address the contact recreation impairment for E. coli bacteria in the watershed. The first phase of the watershed protection plan began in 2015, when the City assembled a group of stakeholders; defined target bacteria load reduction goals, and characterized the watershed. The load duration curves created by the WPP identified a 50% reduction of bacteria was needed on the Comal River and a 34% load reduction was needed on the Dry Comal Creek in order to meet targeted bacterial reductions during normal flow conditions. A second phase of the WPP was implemented in 2016 in order identify best management practices to address bacteria concerns and meet the load reduction goals. In support of the WPP, the City of New Braunfels commissioned additional bacteria sampling by the GBRA at multiple locations throughout the watershed. Bacterial source tracking (BST) samples were also collected by the GBRA and analyzed by the Texas A&M Soil and Microbiology Laboratory (TAMU SAML) in order to assist with identifying the source of the bacteria. The results of the BST analysis indicated that the majority of the bacteria in both the Comal River and Dry Comal Creeks came from wildlife sources with additional contributions from livestock, humans and pets. A draft watershed protection plan was reviewed by stakeholders in June of 2017. The City of New Braunfels is currently addressing TCEQ comments to the WPP draft in preparation for submittal to the United States Environmental Protection Agency (US EPA).

The USFWS officially approved the Edwards Aquifer Habitat Conservation Plan (EAHCP) to provide protection for the endangered species in 2013. The EAHCP was developed through the consensus based Edwards Aquifer Recovery Implementation Program (EARIP), which included a diverse group of stakeholders, including municipalities, industries, agricultural users, river authorities, state agencies and environmental organizations. The EAHCP is designed to sustain spring flows from the Edwards Aquifer by restoring and improving the habitat available to endangered species, while minimizing the impact of development and recreational activities in the watershed. The EAHCP also issues incidental take permits for water withdrawals, recreational activities and other covered actions that may result in unintended mortalities of the endangered species. The flow of the Comal River splits into two parts as it leaves Landa Lake. The majority of the flow moves down a man-made mill race called the new river channel. Many of the EAHCP activities have focused on restoration of the Old River Channel of the Comal through restoration of eroding riparian zones and the removal of excess sediment and non-native plants. In 2014, the City of New Braunfels removed culverts that previously separated Landa Lake from the old river channel. The culverts were restored and flow-control gates installed in order to better control flows into the Old Channel to meet biological objectives, prevent channel and vegetation scouring during high-flow periods and to route more water to the Old Channel during periods of drought.. Many implementation activities have also focused on preserving springflows by reducing water pumped from the Edwards Aquifer. The Voluntary Irrigation Suspension Program Option, (VISPO) has been implemented by the Edwards Aquifer Authority (EAA) to compensate farmers for suspension of groundwater pumping during times of drought. If the J-17 index well on the Edwards Aquifer falls below 635 feet on October 1st of a given year, then participants in the program will suspend their pumping from the aquifer on January 1st of the following year. The goal of this program was to reduce 40,000 acre feet of pumping from the aquifer per year, which was met during the drought year of 2014. The San Antonio Water System (SAWS) has also developed an Aquifer Storage and Recovery program (ASR) to purchase water leases and store the water underground for use during times of drought. If all EAHCP recommended implementation and conservation practices are followed, the Comal springs are projected to remain at flow rates that are capable of sustaining the species of concern during periods of drought.

COMAL RIVER

Table 1

Station 12653 – Comal River at Hinman Island 12/2002 – 11/2016					
AU 1811_01 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	23.3	27.0	17.0	163	25.6
pH (S.U.)	7.6	8.2	7.0	163	6.5 – 9.0
Chloride (mg/L)	18.2	24.4	12.1	164	50.00
Sulfate (mg/L)	28.1	59.2	19.7	164	50.00
Total Dissolved Solids (mg/L)	378	445	333	163	400.00
NH3-N (mg/L)	<0.10	0.30	<0.02	83	0.33
Total Phosphorus (mg/L)	<0.04	0.17	<0.02	163	0.69
Chlorophyll-a (µg/L)	<1.0	<5.0	<1.0	163	14.10
Nitrate Nitrogen (mg/L)	1.64	2.28	<0.02	163	1.95
TKN (mg/L)	<0.20	1.84	0.11	66	N/A
AU 1811_01 Recreational Use					
E. coli (MPN/100 mL)	114 Geomean	2900	4	166	126 Geomean
AU 1811_01 Aquatic Life Use					
Dissolved Oxygen (mg/L)	7.6	13.2	7.4	162	≥4.0 Minimum & ≥6.0 Average

Table 2

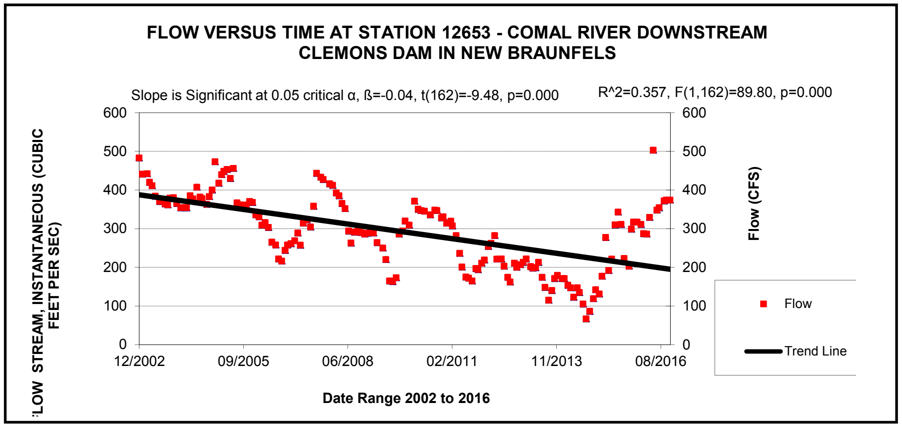
Station 15082 – Comal River at Landa Park Rest Area 16 06/2014 - 11/2017					
AU 1811_02 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	23.4	25.4	21.5	30	25.6
pH (S.U.)	7.2	7.5	7.0	30	6.5 – 9.0
Chloride (mg/L)	19.7	22.8	18.2	30	50.00
Sulfate (mg/L)	31.7	38.2	28.1	30	50.00
Total Dissolved Solids (mg/L)	384	402	374	30	400.00
NH3-N (mg/L)	<0.10	0.29	<0.02	30	0.33
Total Phosphorus (mg/L)	<0.02	<0.02	<0.02	30	0.69
Chlorophyll-a (µg/L)	<1.0	2.0	<1.0	30	14.10
Nitrate Nitrogen (mg/L)	1.85	2.10	1.57	30	1.95
TKN (mg/L)	<0.20	<0.20	<0.20	30	N/A
AU 1811_02 Recreational Use					
E. coli (MPN/100 mL)	141 Geomean	650	20	30	126 Geomean
AU 1811_02 Aquatic Life Use					
Dissolved Oxygen (mg/L)	7.8	10.3	5.2	30	≥4.0 Minimum & ≥6.0 Average

Table 3

Station 12570 – Dry Comal Creek at Knights of Columbus 12/2002 - 11/2016					
AU 1811A_01 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	21.5	31.7	9.0	171	25.6
pH (S.U.)	7.6	8.1	7.1	170	6.5 – 9.0
Chloride (mg/L)	28.3	55.1	3.65	164	50.00
Sulfate (mg/L)	60.7	138	12	164	50.00
Total Dissolved Solids (mg/L)	445	725	149	170	400.00
NH3-N (mg/L)	0.12	0.36	<0.02	84	0.33
Total Phosphorus (mg/L)	<0.06	0.49	<0.02	164	0.69
Chlorophyll-a (µg/L)	5.3	117.0	<1.0	162	14.10
Nitrate Nitrogen (mg/L)	0.83	2.60	0.15	163	1.95
TKN (mg/L)	0.45	1.22	<0.2	67	N/A
AU 1811A_01 Recreational Use					
E. coli (MPN/100 mL)	257 Geomean	9600	29	169	126 Geomean
AU 1811A_01 Aquatic Life Use					
Dissolved Oxygen (mg/L)	9.2	18.2	4.8	169	≥4.0 Minimum & ≥6.0 Average

COMAL RIVER

Figure 1



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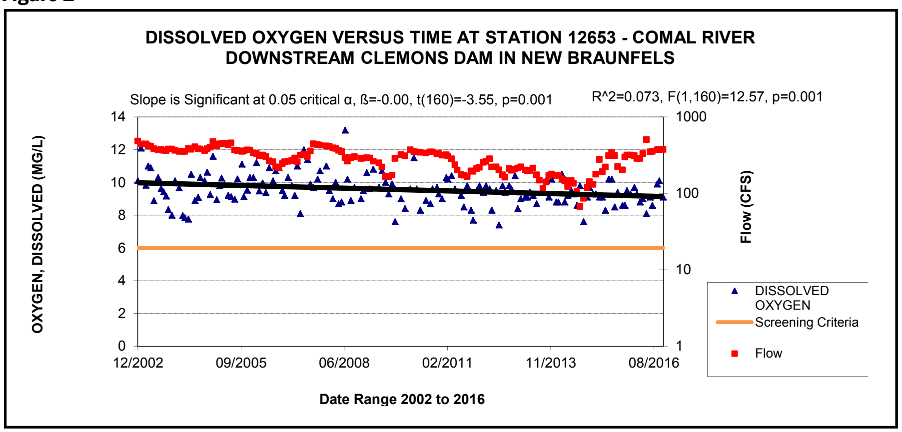

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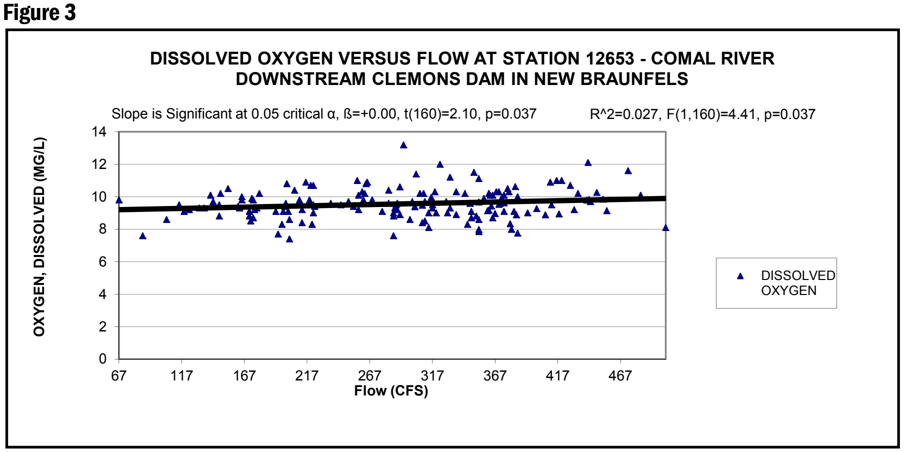

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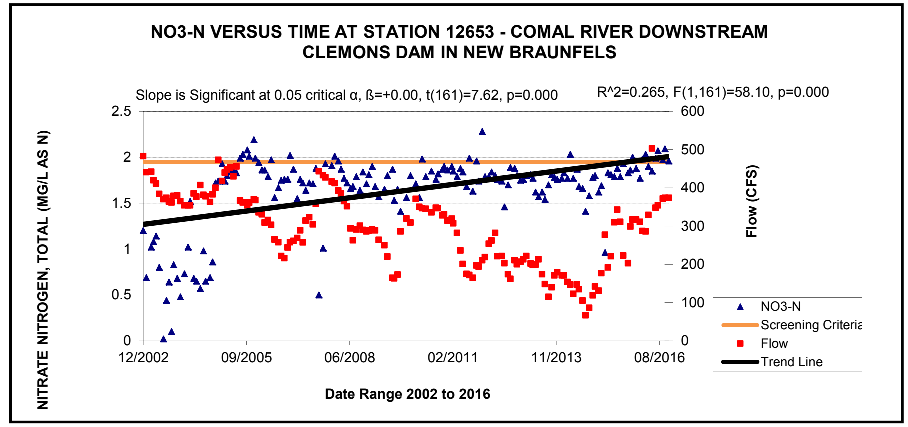

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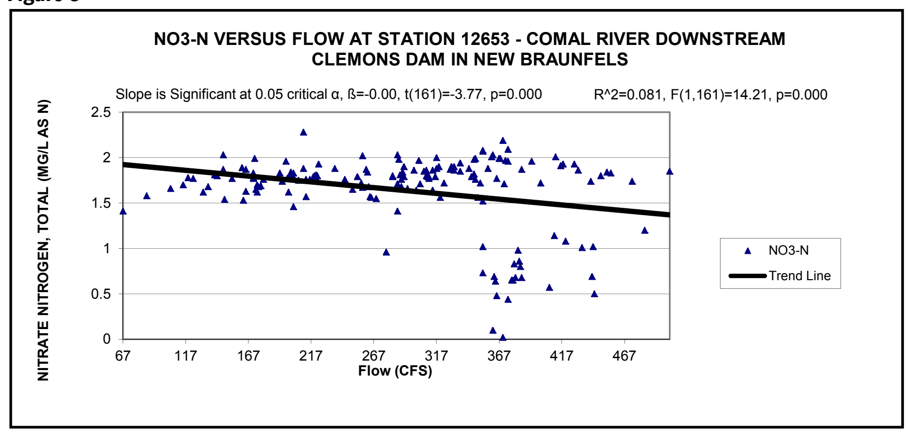

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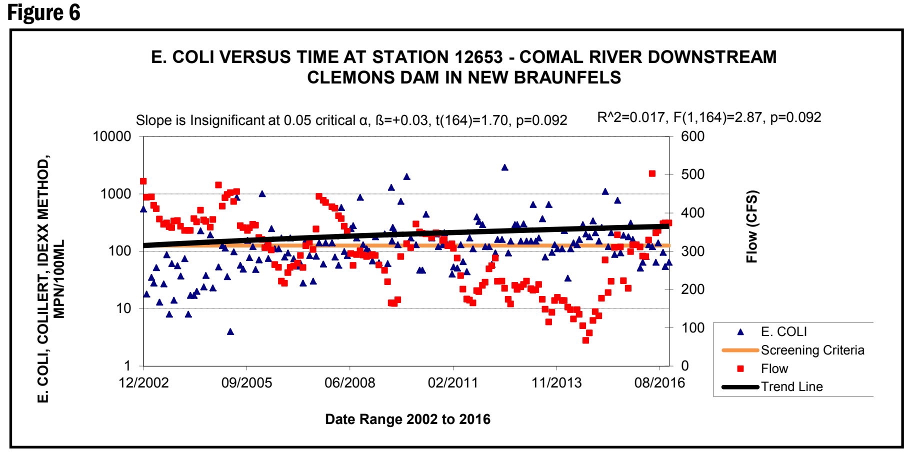
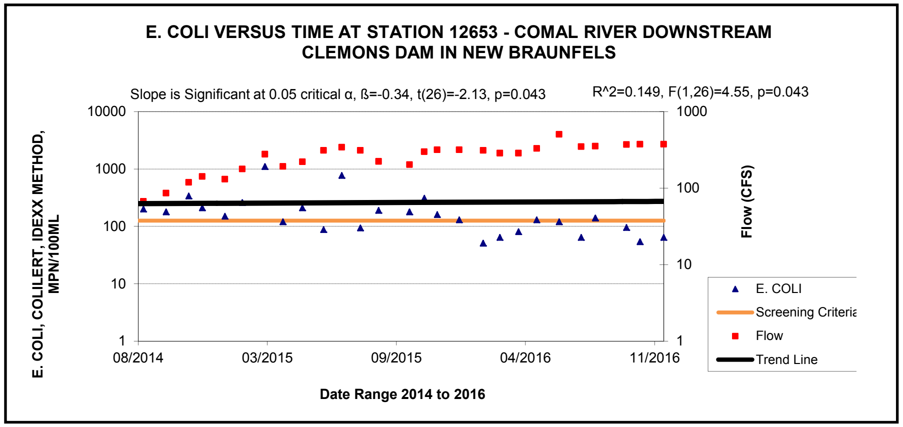


COMAL RIVER

Figure 7



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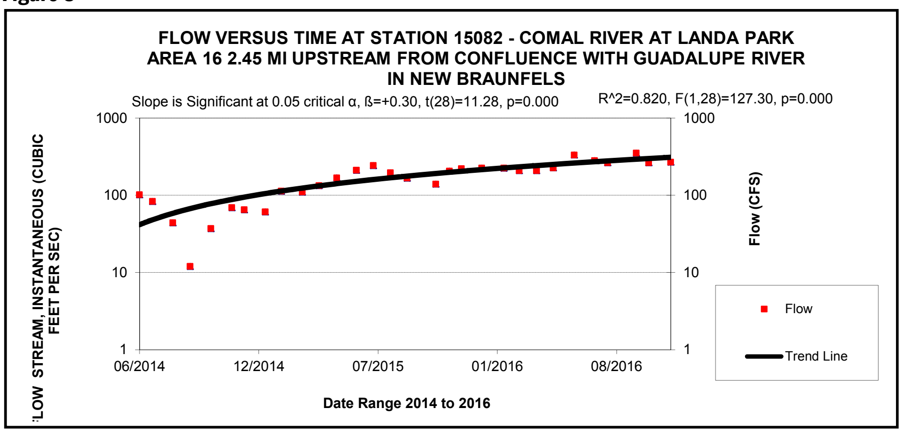

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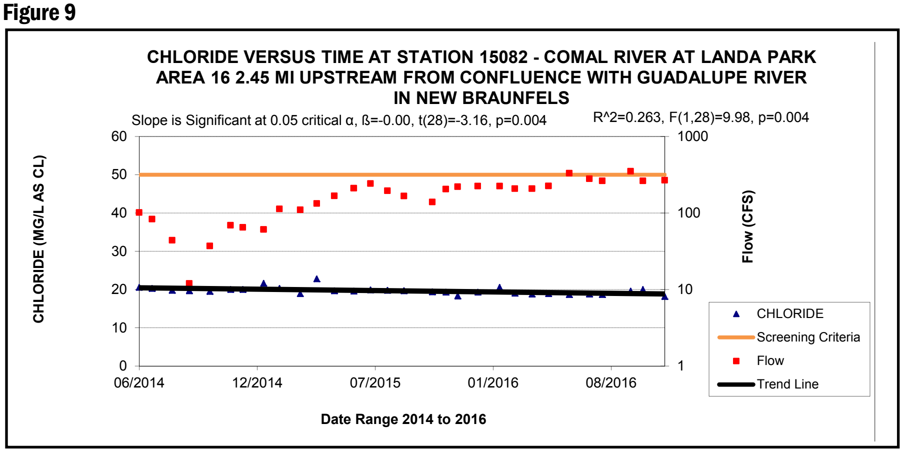

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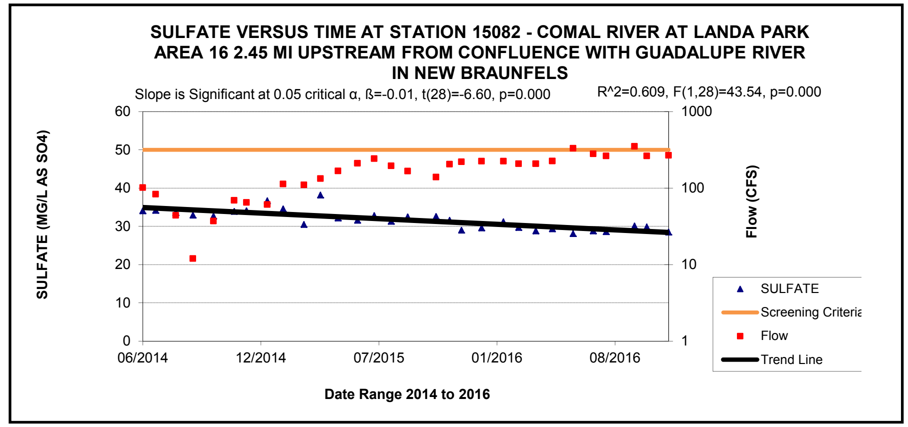

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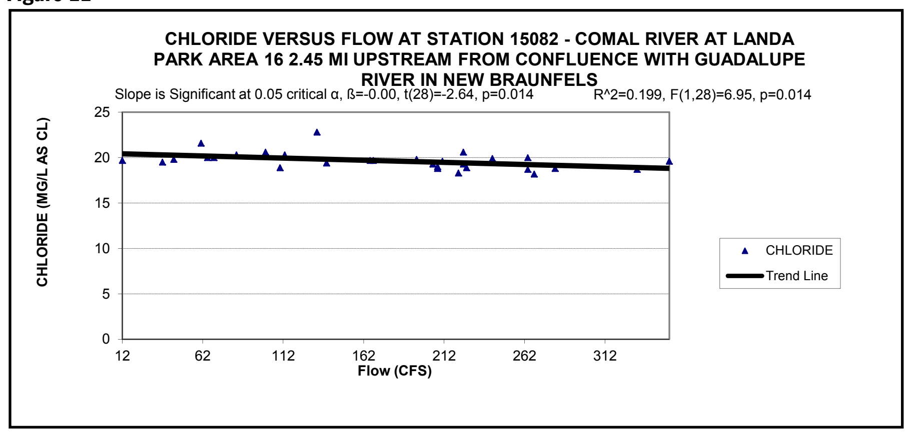

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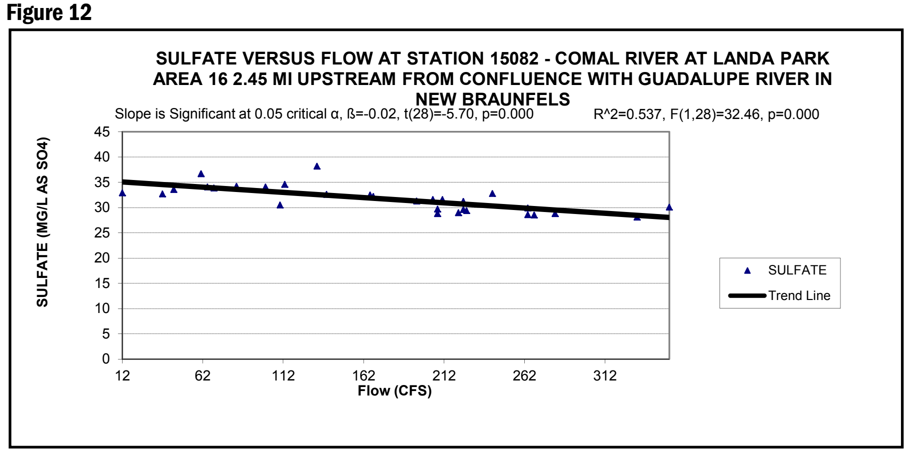
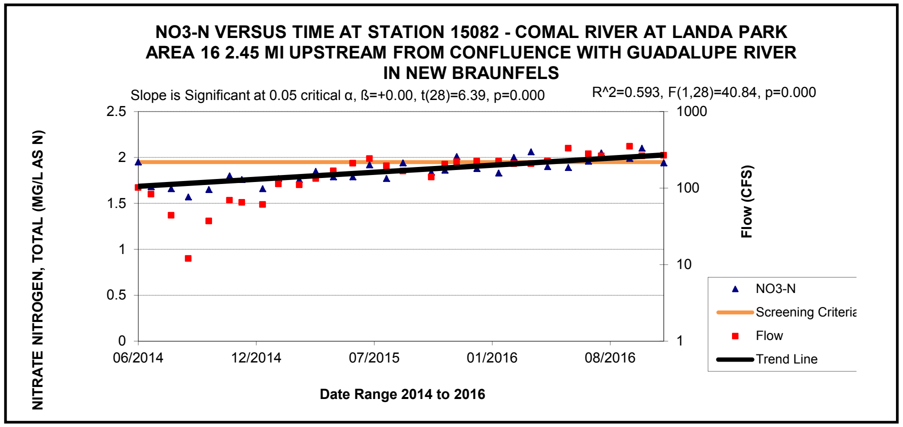


COMAL RIVER

Figure 13



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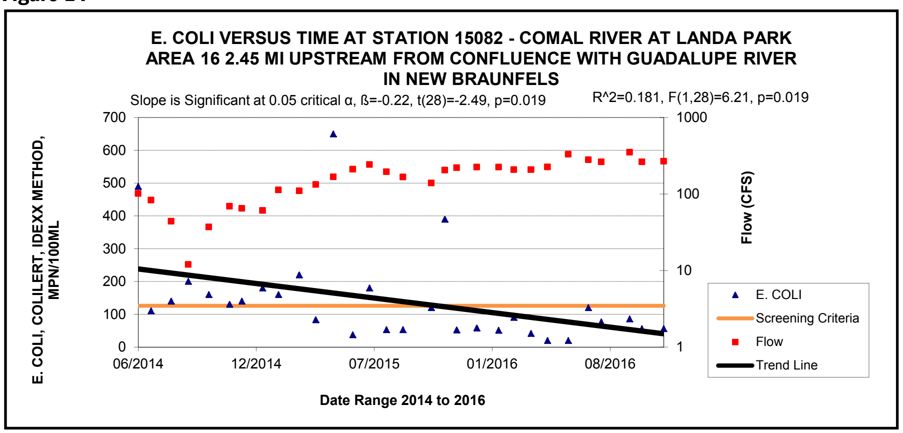

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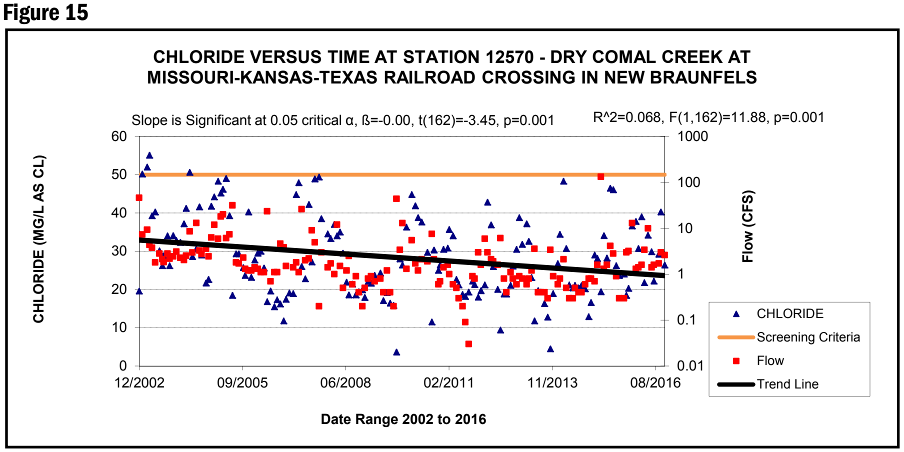

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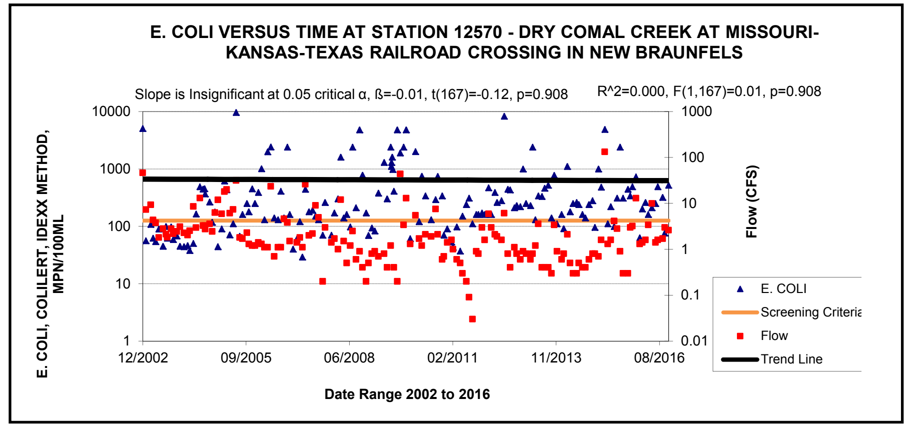

Figure 17