

Texas Clean Rivers Program

— 2021 Basin Highlights Report

A Characterization of
Impaired Water Bodies in the
Lower Colorado River Basin

May 15, 2021

*Prepared by the Lower Colorado River Authority
in cooperation with the Texas Commission on
Environmental Quality under the authorization
of the Texas Clean Rivers Act.*

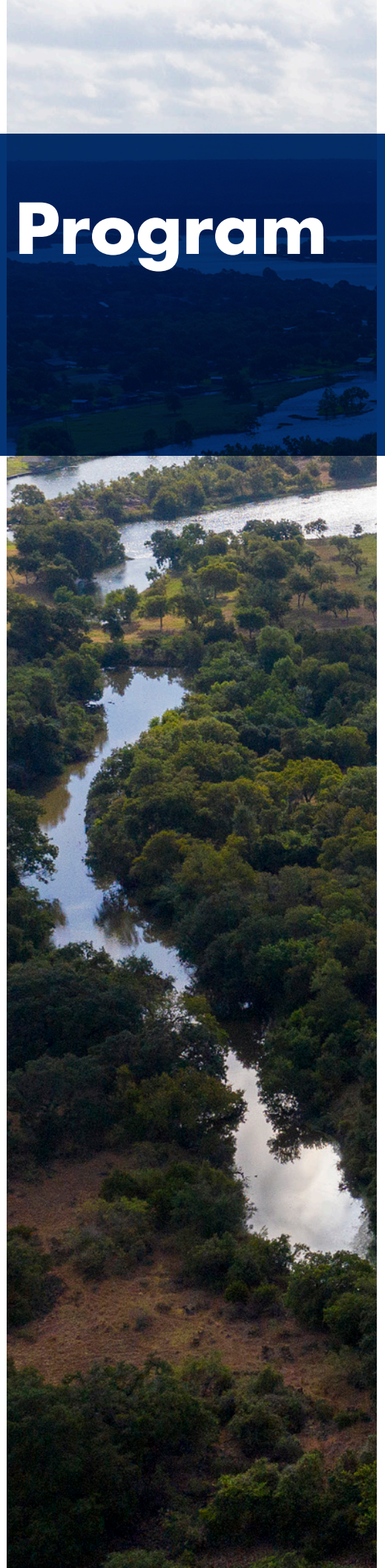


Table of Contents

Introduction

Clean Rivers Program.....	2
Acronyms.....	2
Rationale and format for the 2021 Basin Highlights Report.....	3
List of impaired water bodies in the Colorado River basin.....	4
Restoring impaired water bodies.....	5

Watershed Characterizations by Segment

Segment 1402C – Buckners Creek.....	6
Segment 1402H – Skull Creek.....	8
Segment 1403A – Bull Creek.....	10
Segment 1403J – Spicewood Tributary to Shoal Creek.....	12
Segment 1403K – Taylor Slough South.....	14
Segment 1427A – Slaughter Creek.....	16
Segment 1428B – Walnut Creek.....	18
Segment 1428C – Gilleland Creek.....	20
Segment 1429C – Waller Creek.....	22
Segment 1434G – Alum Creek.....	24
Segment 1501 – Tres Palacios Creek Tidal.....	25

Appendix A

Colorado River basin water bodies removed from the 303(d) List in the 2020 Integrated Report.....	27
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Appendix B

Summary of Texas Surface Water Quality Standards.....	27
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Introduction

About the Clean Rivers Program

The [Texas Clean Rivers Program](#) (CRP) provides a foundation for partnerships between the [Texas Commission on Environmental Quality](#) (TCEQ), river authorities, local governments, industries and citizens. The program began in 1991 to provide funding for water quality monitoring and comprehensive watershed management on a local level. TCEQ and CRP partners routinely collect water quality data from more than 1,800 sampling locations throughout the state. The data is used to establish wastewater permit limits and [Texas Surface Water Quality Standards](#) (TSWQS), and to evaluate water quality and establish priorities for corrective actions.

In the Colorado River basin, the [Lower Colorado River Authority](#) (LCRA) and [Upper Colorado River Authority](#) (UCRA) implement the program in their respective areas (Fig. 1). Monitoring is performed by LCRA, UCRA, the [City of Austin](#) (COA), TCEQ and the [U.S. Geological Survey](#) (USGS). Each agency collects and analyzes samples according to a Quality Assurance Protection Plan (QAPP), which ensures comparability.

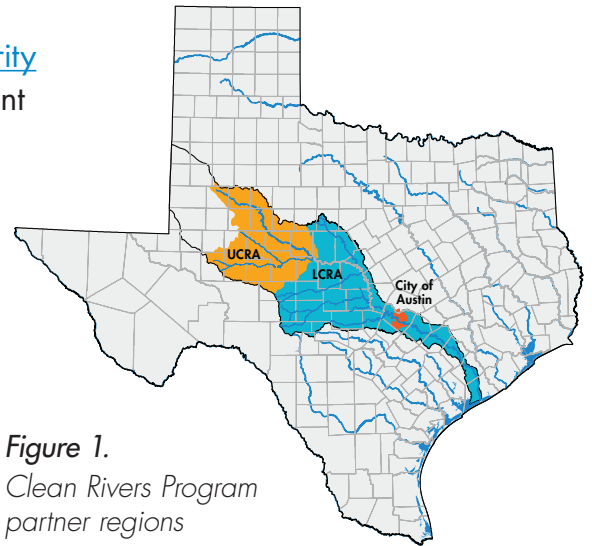


Figure 1.
Clean Rivers Program
partner regions

Acronyms

AU	assessment unit
BMP	best management practices
CAFO	concentrated animal feeding operation
CFU/100ml	colony forming units per 100 milliliters
COA	city of Austin
CRMWD	Colorado River Municipal Water District
CRP	Clean Rivers Program
EPA	Environmental Protection Agency
GIS	geographic information system
LCRA	Lower Colorado River Authority
mg/L	milligrams per liter (parts per million)
MGD	million gallons per day
NLCD	National Land Cover Database
NPS	nonpoint-source pollution
QAPP	Quality Assurance Project Plan

RRC	Railroad Commission of Texas
RUAA	Recreational Use Attainability Analysis
SWCD	soil and water conservation district
SWQM	surface water quality monitoring
TCEQ	Texas Commission on Environmental Quality
TDS	total dissolved solids
TLAP	Texas Land Application Permit
TMDL	Total Maximum Daily Load
TSWQS	Texas Surface Water Quality Standards
UAA	Use Attainability Analysis
UCRA	Upper Colorado River Authority
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
µg/L	microgram per liter

Rationale for the 2021 Basin Highlights Report

Every two years, TCEQ compares all available quality-assured data to the TSWQS and publishes the results in the Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d) (Integrated Report). On May 12, 2020, the Environmental Protection Agency (EPA) approved the [2020 Integrated Report](#). The report, which is based on data collected between Dec. 1, 2011, and Nov. 30, 2018, identified 11 impaired water bodies in the lower Colorado River basin (Table 1).

The 2021 Basin Highlights Report (BHR) characterizes impaired water bodies identified in the 2020 Integrated Report based on water quality data, land use, hydrology and communication with monitoring personnel and local stakeholders. The characterization of these watersheds helps prioritize monitoring efforts and restorative measures for impaired water bodies in the basin. The 2020 BHR was a summary of water quality throughout the basin. The 2019 BHR focused on impairments upstream of Austin. This BHR focuses on impaired waters in Austin and the lower Colorado River basin.

Each section in this report represents a water body that is organized by segment number. The following headings are included for each water body:

- **Segment description** – Describes the geographic units based on TSWQS, assessment units (AUs), monitoring stations and hydrological conditions within each segment.
- **Land use** – A description of the land surrounding the impaired segment based on satellite imagery and knowledge of the area.
- **Impairment description** – Identifies the impairment and when it first appeared on the 303(d) List. It includes number of samples, parameter(s) of concern or impairment, assessment results, and the designated state water quality standard for comparison.
- **Potential causes of impairment** – Identifies possible causes of the impairment based on land use, communication with monitors, agency staff and CRP water quality advisory committee members.
- **Potential stakeholders** – Lists companies, agencies or organizations that have a vested interest in the impairment and that may serve as stakeholders.
- **Actions taken** – Identifies actions taken by TCEQ or CRP partners since the water body was first placed on the 303(d) List.
- **Recommendations** – Proposed next step(s) to help the water body attain TSWQS.
- **Maps** – Maps and aerial imagery that define land uses, segments and other boundaries, monitoring, permitted discharges and Texas land application permits (TLAPs).



Table 1. Impaired Water Bodies in the Colorado River basin based on the 2020 Texas Integrated Report

Segment ID	Waterbody	County	Impairment	Assessment Unit	Category
1402C	Buckners Creek	Fayette	Dissolved Oxygen	1402C_01	5c
1402H	Skull Creek	Colorado	Dissolved Oxygen	1402H_01	5b
1403A	Bull Creek	Travis	Dissolved Oxygen	1403A_04	5c
1403J	Spicewood Tributary to Shoal Creek	Travis	Bacteria	1403J_01	4a
1403K	Taylor Slough South	Travis	Bacteria	1403K_01	4a
1407A	Clear Creek	Burnet	Aluminum, Copper, Nickel, Zinc in water; pH; Sulfate; Total Dissolved Solids	1407A_01	5c
1411	E.V. Spence Reservoir	Coke	Chloride, Sulfate, Total Dissolved Solids	1411_01, 1411_02	5c, 4a
1412	Colorado River Below Lake J.B. Thomas	Coke, Scurry	Bacteria	1412_02	5b
1412B	Beals Creek	Mitchell, Howard	Bacteria	1412B_03	5b
1413	Lake J.B. Thomas	Scurry	Chloride, Total Dissolved Solids	1413_01	5b
1416	San Saba River	San Saba, Schleicher	Bacteria	1416_01	5c
1416A	Brady Creek	San Saba, McCulloch	Dissolved Oxygen	1416A_03	5c
1421	Concho River	Concho, Tom Green	Dissolved Oxygen	1421_08	5c
1425	O.C. Fisher Lake	Tom Green	Chloride, Total Dissolved Solids	1425_01	5c
1427A	Slaughter Creek	Travis	Macrobenthics	1427A_01	5b
1428B	Walnut Creek	Travis	Bacteria	1428B_05	4a
1428C	Gilleland Creek	Travis	Bacteria	1428C_01, 03, 04	4a
1429C	Waller Creek	Travis	Bacteria, Macrobenthics	1429C_01, 02, 03	5a, 5c
1433	O.H. Ivie Reservoir	Concho, Coleman	Excessive Algae	1433_01, 02, 03, 04	5c
1434G	Alum Creek	Bastrop	Bacteria	1434G_01	5c
1501	Tres Palacios Creek Tidal	Matagorda	Bacteria, Dissolved Oxygen	1501_01	4a, 5b

Restoring Impaired Water Bodies

In 2010, TCEQ developed watershed action planning to help identify and prioritize watershed restoration projects for impaired water bodies. As part of the watershed action planning process, stakeholders and monitoring agencies provide input about local water quality problems. Information about potential sources of pollution, geographic factors in the watershed and community interest is stored in a database and used to implement water quality protection strategies described below.

Total Maximum Daily Loads

The first step toward restoration is to determine the source(s) of pollution. One way to determine the source is to develop a scientific model called a total maximum daily load (TMDL). A TMDL involves a historical water quality data review, targeted monitoring, detailed water quality analysis, and the amount or “load” of a pollutant that a water body can receive and still support its designated uses. Once the load is determined among all potential sources of pollution, an implementation plan outlines strategies to reduce pollutant loads.

Watershed Protection Plans

A Watershed Protection Plan (WPP) is another way to restore impaired water bodies. Unlike the TMDL, a Watershed Protection Plan is non-regulatory. Stakeholders develop the plans to address causes of the identified impairments. Similar to a TMDL, a WPP uses monitoring data and local input to outline strategies that reduce pollutant loads.

Use Attainability Analyses

Another option for addressing impaired water bodies is a use attainability analysis (UAA). While a TMDL and WPP are designed to improve water quality by limiting pollutants, a UAA is designed to evaluate TSWQS and, if appropriate, establish new standards. Similarly, a Recreational Use Attainability Analysis (RUAA) is a study that confirms the level of recreation that takes place in a waterway.



Shoreline view of Inks Lake

Segment 1402C: Buckners Creek

Impairment: Low Dissolved Oxygen

Segment Description

The Buckners Creek watershed is approximately 176 square miles and is located on the south side of the Colorado River near La Grange. Segment 1402C begins at the confluence with the Colorado River and ends 26 miles upstream at the headwaters near Rosanky in Bastrop County. The stream consists of two AUs. It is perennial according to TSWQS Appendix D, but recommended revisions following the completion of a UAA in 2019 are that the upper portion of the stream be designated as intermediate aquatic life use with a flow regime of “intermittent with pools”. The stream is not currently monitored. It was monitored at one station by TCEQ Region 11 until 2009:

16160 – Buckners Creek approximately 200 feet upstream of Fayette County Road 154

During the period of record, flow data in Buckners Creek ranged from no flow to 390 cubic feet per second (cfs). Of 15 sampling events, only three were above 1 cfs. The seasonal hydrology of the creek is typical (lower flows in hotter months and higher flows in the cooler periods).

Land Use

The Buckners Creek watershed is rural. Based on aerial imagery, most of the watershed has been cleared, but land along the riparian area surrounding the creek remains intermittently intact, particularly in the upper end of the watershed.

There are two land application permits in the watershed; neither is upstream, nor would they have any influence on water quality at the sampling point.

Impairment Description

Buckners Creek was first listed on the 303(d) List in 2010 for not supporting its designated aquatic life use based on the 24-hour DO average and minimum. At this time, it is designated as high aquatic life use in both AUs. But following the 2019 UAA conducted by LCRA, TCEQ recommended a revision to Appendix D that would lower the aquatic life use to intermediate and change the associated TSWQS for this AU. This revision is still pending.

Buckners Creek is currently in category 5c. New data are needed to confirm if the water body is meeting the assigned and recommended aquatic life use.

The 2020 Integrated Report also carries forward chlorophyll *a* as a concern in Buckners Creek.

Potential Causes of Impairment at Station 16160

Sluggish flow and decomposition of organic matter is a likely cause of low DO in the stream.

Actions Taken

LCRA performed a UAA in 2019. As a result, TCEQ recommended revisions to TSWQS to remove the most upstream portion of Buckners Creek from Appendix D due to an intermittent flow regime. The section of the creek that starts from the confluence with Pin Oak Creek and upstream to the confluence with Live Oak Creek was recommended for an intermediate aquatic life use due to an “intermittent with pools” flow regime designation. Revisions are still pending.

Potential Stakeholders

- TCEQ
- Rural landowners

Recommendations

- Await final results of 2019 UAA to determine if standards will be altered.



Buckners Creek at Monitoring Station 16160

Segment 1402H: Skull Creek

Impairment: Low Dissolved Oxygen

Segment Description

The Skull Creek watershed is approximately 112 square miles located on the south side of the Colorado River near Columbus, Texas. Segment 1402H begins at its confluence with the Colorado River upstream to the perennial portion southwest of Columbus. The stream is approximately 30 miles long and consists of one AU. TCEQ Region 12 routinely monitors at the following stations:

16805 – Skull Creek at Colorado County Road 16 South of Altair

21177 – Skull Creek upstream of County Road 103 Northwest of Altair

Site 16805 is monitored for 24-hour DO, metals in water and sediment, organics in water and sediments, conventional, bacteria, flow, and field parameters. Site 21177 is monitored for conventional, bacteria, flow and field parameters.

Land Use

The Skull Creek watershed is rural. Based on aerial imagery, much of the riparian area in the upper part of the watershed has been cleared. The landscape is primarily pastureland. Some appear to be used for grazing and some for growing row crops. The riparian area in the lower watershed remains intact with the exception of gravel operations located east of the creek's intersection with US Hwy 90 and along Dry Branch, a tributary. The mines compose about 7.5 square miles of the watershed just upstream of Station 16805.

In spring of 2019, TCEQ and LCRA monitoring during a reported pollution event near the Inland Environmental and Remediation Facility revealed high levels of chemicals associated with oil and gas waste (xylene, toluene ethylbenzene, etc.). Efforts to resolve this matter, with the goal of remediation, are ongoing.

There is one permitted wastewater treatment plant discharge (Rice CISD) in the watershed approximately 6 miles upstream of the monitoring station. Rice CISD is permitted to discharge 60,000 gallons of treated effluent per day by TCEQ. However, the permit was not issued until 2008, the tail end of the assessment period for the 2008 listing, so it is unlikely that the discharge is the source of low DO.

Impairment Description

Skull Creek was first placed on the 2008 303(d) List – with limited data collected from Station 16805 – for not supporting its designated aquatic life use based on the 24-hour DO average. TCEQ continued collecting 24-hour data and subsequent integrated reports showed that the stream consistently did not meet a high aquatic life use designation.

The 2020 Integrated Report also carried forward concerns for chlorophyll *a* levels.

Potential Causes of Impairment at Station 16805

Decomposition of organic matter coupled with sluggish flow regimes is a likely cause of low DO in the stream. Stormwater runoff from gravel operations may influence the stream. According to TCEQ Region 12 staff who monitor at Station 16805, the stream is turbid which may be a result of runoff from gravel mines.

Actions Taken

- TCEQ Region 12 completed aquatic life monitoring in 2012 that found that the creek supports a diverse aquatic community despite chronic low dissolved oxygen levels and upstream gravel mines affecting water clarity. Fish, benthic macroinvertebrate and habitat samples indicated a high aquatic life use at that time. It is unclear how the pollution event of 2019 impacted aquatic life.
- Based on results of previous aquatic life monitoring, in 2014 TCEQ assigned a site-specific 24-hour average DO criterion of 3.0 mg/L and a 24-hour minimum dissolved oxygen criterion of 2.0 mg/L that apply from March 15 to Oct. 15.

Potential Stakeholders

- Texas AgriLife Extension
- TCEQ
- Texas Railroad Commission
- Gravel operators
- Landowners
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board

Recommendations

- Continue routine monitoring at Station 16805 and include 24-hour DO to determine if the stream meets the new seasonal criteria assigned in 2014.
- Discuss if additional aquatic life monitoring is needed to determine if the 2019 pollution event impacted aquatic life use.



Segment 1403A: Bull Creek

Impairment: Low Dissolved Oxygen

Segment Description

The Bull Creek watershed is 25 square miles and is located on the north side of Lake Austin in the city of Austin. Segment 1403A begins at the creek's confluence with Lake Austin and ends 11 miles upstream near the intersection of RR 2222 and RR 620. The creek has five AUs. During the period of record, it was monitored by the COA, USGS and LCRA at the following stations.

12215 – Bull Creek at Ranch Road 2222 west of Lakewood Drive

12216 – Bull Creek at Loop 360 one mile north of Ranch Road 2222

12218 – Bull Creek at Spicewood Springs Road fifth crossing

16312 – Bull Creek just upstream of the confluence with West Bull Creek near the intersection of Ranch Road 2222 and Loop 360

16322 – Bull Creek south of the intersection of Syndham Drive and Corley Drive

Flow conditions on Bull Creek during the period of record ranged from 0 to 12 cfs, with a median value of 5.3 cfs. The monitoring location on this second order stream showed a uniform distribution of flows, mainly due to its proximity to the headwaters spring source.

Land Use

The Bull Creek watershed is comprised largely of preserve, park land, or undeveloped natural space.

Impairment Description

In 2002, TCEQ placed Bull Creek on the 303(d) List based on benthic macroinvertebrate data acquired from COA. The data, which was collected from Station 12218 in AU 04, showed that the stream supported a limited aquatic life use. In 2010, the listing was removed from the 303(d) List based on additional biological data that indicated support for a high aquatic life use. However, AU 05 was placed on the 2010 303(d) List for low dissolved oxygen levels based on data from Station 16322. In 2012, AU 04 was again placed on the 303(d) List for the same reason. Both AU's remain on the 2014 303(d) List based on 24-hour average and minimum criteria. The city's 24-hour data collected since the 2014 assessment shows some improvement, but the stream will remain on the 303(d) List for the 2020 assessment.

The stream is influenced by groundwater spring discharge, which is naturally low in dissolved oxygen but which maintains excellent water quality that supports a population of the threatened Jollyville Plateau salamander (*Eurycea nana*). The presence of the salamander restricts biological monitoring in the segment but is a clear indicator of high aquatic life use.

Potential Causes of Impairment

According to COA Water Quality Protection staff, the upper reaches of the Bull Creek are strongly influenced spring discharges with low dissolved oxygen. Given that the stations are in a preserve, the low dissolved oxygen levels are not likely due to anthropogenic sources.

Actions Taken

- The COA continues to collect water quality data throughout the watershed and has committed to additional diurnal sampling this year.

Potential Stakeholders

- Bull Creek Foundation
- COA
- Colorado River Watch Network
- Neighborhood associations
- TCEQ SWQM staff
- LCRA

Recommendations

- TCEQ will evaluate the most recent 24-hour diel data during the 2022 Assessment.



Segment 1403J: Spicewood tributary to Shoal Creek

Impairment: Bacteria

Segment Description

This small tributary is in the upper portion of the Shoal Creek watershed, which lies on the north side of Lady Bird Lake in Austin. This tributary creek begins near the west side of the MoPac Expressway in north Austin, where Spicewood Springs discharge into Spicewood Tributary near Ceberry Drive. It ends a half mile upstream just west of Hart Lane. The shallow, spring fed stream is monitored by COA at the following station:

16316 – Spicewood tributary to Shoal Creek, at the intersection of Spicewood Springs Road and Ceberry Drive

The Spicewood tributary to Shoal Creek is a first order stream. Flows are typically under 1 cfs.

Land Use

The 5.5-square-mile watershed contains dense residential and commercial development. The spring discharge maintains a very small population of threatened Jollyville Plateau salamanders (*Eurycea nana*).

Impairment Description

Segment 1403J was first placed on the 2002 303(d) List for not supporting contact recreation due to elevated levels of fecal coliform bacteria. In 2003, recognizing that *E.coli* is a better indicator for determining if a water body is contaminated with disease-causing pathogens, TCEQ began using *E.coli* to determine if contact recreation criteria were met. Subsequent *E.coli* samples collected by COA indicate that bacteria levels have remained high.

Potential Causes of Impairment at Station 16316

Wastewater pipes frequently cross the small tributary. COA staff has reported high bacteria counts, algae and sewage from leaking lines near the station during some monitoring events. There are domestic pets in the yards of some residences that border the stream which could be a source of fecal contamination as well as wildlife. Elevated stream nutrient concentrations suggest that wastewater is a likely source of fecal contamination at this station.

Actions Taken

The station was not monitored for several years. In 2008, COA began monthly sampling for *E.coli* at Station 16316. The increased sampling showed that bacteria samples remained high and confirmed the original listing.

In 2012, TCEQ initiated [a bacteria TMDL for several Austin streams](#) including Spicewood Tributary of Shoal Creek. TCEQ contracted with the University of Texas Center for Public Policy Dispute Resolution to facilitate public input and develop a TMDL implementation plan in partnership with the City of Austin Watershed Protection Department and other stakeholders. Strategies proposed by the stakeholder group included riparian zone restoration, wastewater infrastructure maintenance, domestic pet waste education, resident outreach and stormwater treatment. These strategies are currently being implemented as a part of the implementation plan. In January 2015, TCEQ Commissioners adopted the TMDL for Spicewood Tributary.

Potential Stakeholders

- Established TMDL stakeholders

Recommendations

- Monitor effectiveness of the TMDL.
- Recommend TCEQ reclassify the tributary under Segment 1429.



Segment 1403K: Taylor Slough South

Impairment: Bacteria

Segment Description

The half-square-mile Taylor Slough South watershed is located on the north side of Lake Austin in Austin. Segment 1403K begins at the confluence with Lake Austin and ends at a point upstream of Exposition Drive near South Meadow Circle. The stream is approximately 1 mile long and consists of one AU. Flows at this site are typically below 1 cfs. The following site is monitored by the City of Austin Watershed Protection Department.

17294 – Taylor Slough downstream of Pecos Street in Reed Park

Land Use

The watershed is a dense urban landscape composed mostly of single-family residences. Site 17294 is located in Reed Park, a small municipal park frequented by dog walkers. Sewer mains cross the creek at several locations in the watershed. Contact recreation (wading) occurs at Reed Park near Pecos Street.

Impairment Description

Segment 1403K was first placed on the 2002 303(d) List for not supporting contact recreation. Out of 12 fecal coliform samples collected from Station 17294, six exceeded the single sample criteria of 400. The geometric mean was 414 CFU/100mL exceeding the criteria of 200 for fecal coliform. Because of the COA rotating monitoring schedule, bacteria samples were collected quarterly every third year for the assessment time frame (i.e., 1998, 2001, 2004, 2007, etc) such that samples were not collected during the year or year after the initial listing in 2002 and the stream remained on subsequent 303(d) Lists as a carryover.

In 2008, COA began monitoring the creek for *E.coli* annually on a quarterly basis (*E.coli* was selected by TCEQ as the new freshwater indicator species for determining contact recreation in 2003). The geometric mean for 13 samples collected from 2008 to 2010 was 516, four times the contact recreation standard of 126. The stream was included in a bacteria TMDL in 2012.

Potential Causes of Impairment at Station 17294

The stream receives urban storm water runoff from roads, roof tops and parking lots. Uncollected pet waste from Reed Park may contribute to bacteria levels in the creek.

Actions Taken

The station was not monitored in 2002-2003 and 2005-2006. However, in 2008, the COA began monthly sampling for *E.coli* at Station 16316 which continues to present day. The increased sampling showed that bacteria samples remained high and confirmed the original listing; however, these concentrations appear to be on the decline overall.

In 2012, TCEQ initiated [a bacteria TMDL for several Austin streams](#) including Taylor Slough. TCEQ contracted with the University of Texas Center for Public Policy Dispute Resolution to facilitate public input and develop a TMDL implementation plan in partnership with the City of Austin Watershed Protection Department and other stakeholders. Strategies proposed by the stakeholder group included riparian zone restoration, wastewater infrastructure maintenance, domestic pet waste education and waste stations, resident outreach, and stormwater treatment. These strategies are currently being implemented as a part of the implementation plan. In January 2015, TCEQ Commissioners adopted the TMDL for Taylor Slough.

The City of Austin is optimistic that the elevated E.coli concentration will be resolved in the next few years. Illicit cross connections have been identified and fixed and segments of crumbling wastewater lines/laterals have been rehabilitated. In addition, an investigation is currently underway in a joint effort by Austin Water and City of Austin Watershed Protection Department to identify the source and resolution of an apparent wastewater leak from a previously unknown source in a tributary/stormwater drain.

Existing Stakeholders

- TCEQ
- COA
- Travis County
- University of Texas
- LCRA
- Numerous Austin nongovernmental organizations

Recommendations

- Monitor effectiveness of the TMDL.



Segment 1427A: Slaughter Creek

Impairment: Benthic Macroinvertebrate Community

Segment Description

Located in southern Travis County, the Slaughter Creek watershed is approximately 31 square miles. Slaughter Creek begins at its confluence with Onion Creek in east Austin and ends about 17 miles upstream near SH 290. A 6-mile section of the creek near Loop 1 (MoPac) lies over the Edwards Aquifer recharge zone and this mid-reach portion of the creek does not normally maintain base flow. Slaughter Creek is composed of one AU. It has been monitored by TCEQ and USGS at the following stations:

12184 – Slaughter Creek at IH 35

12185 – Slaughter Creek at Old San Antonio Road

12186 – Slaughter Creek at FM 1826

17964 – Slaughter Creek downstream of FM 2304

Slaughter Creek is a second order stream. Because it lies over the Edwards Aquifer recharge zone, the middle portion of the stream is intermittent. Flow data during the assessment period is limited, but a USGS stream gauge located approximately 3 river miles upstream of the impaired site indicates that the stream does not flow 85% of the time.

Land Use

While the Slaughter Creek watershed is urban, the riparian area surrounding the creek remains largely intact. The lower watershed consists primarily of densely clustered residential subdivisions. The upper watershed is less developed.

Impairment Description

Segment 1427A was placed on the 303(d) List in 2002 for not supporting a high aquatic life use due to an impaired invertebrate community. The impairment was based on two data points collected in 2001 from Station 12184, Slaughter Creek at IH 35. The resulting average IBI score was 20. At the time, Slaughter Creek was assigned a high aquatic life use in Appendix D of the TSWQS, which assumes a score of 29. However, in 2018 changes were proposed to the aquatic life use designation and DO criteria for Slaughter Creek such that the headwater AU was recommended to have an intermediate aquatic life use with a 24-hour minimum DO criterion of 2.0 mg/L, and the middle portion of the creek was recommended to have a moderate aquatic life use designation. Both segments were identified as intermittent and the changes in Appendix D of the TSWQS are still under EPA review. However, it is not expected that the recommended change in standards will remove the impairment status because the data that caused the impairment are from the lowermost AU.

Potential Causes of Impairment at Station 12184

There are no permitted discharges. The most likely reason for the low diversity of the macrobenthic community is that the creek is intermittent and goes dry in places, primarily due to the watershed straddling the Edwards Aquifer Recharge Zone where baseflow slips subsurface.

Actions Taken

TCEQ conducted a UAA in 2004. The findings were inconclusive due to drought conditions and no accurate aquatic life use designations could be determined. Based on historical flow data provided by COA, TCEQ recommended that the upper reach be designated an intermediate aquatic life use. This recommendation was adopted in the 2018 revision of the TSWQS. TCEQ conducted another UAA in 2007 as well as ALM in 2020.

Potential Stakeholders

- COA
- Colorado River Watch Network
- Neighborhood associations
- TCEQ SWQM staff
- LCRA

Recommendations

- Monitor biology under an approved Quality Assurance Project Plan (QAPP).



Segment 1428B: Walnut Creek

Impairment: Bacteria

Segment Description

The 44-square-mile Walnut Creek watershed is located on the north side of the Colorado River in Austin. Segment 1428B begins at its confluence with the Colorado River in east Austin upstream to the perennial portion of the stream in north Austin. The segment is approximately 20 miles long and consists of five AUs. It was monitored by COA and USGS at the following stations during the period of record:

12231 – Walnut Creek at Southern Pacific RR, 1.2 miles south of FM 969

12232 – Walnut Creek at FM 969 in east Austin

15743 – Walnut Creek at I-35 West Frontage Road

17469 – Walnut Creek just downstream of Old Manor Road

17251 – Walnut Creek immediately downstream of Loop 1 (MoPac)

As expected, flows are low in this first order stream. At the bottom of the watershed, just upstream of the confluence with the Colorado River, the creek receives treated effluent.

Land Use

The Walnut Creek watershed is urban, comprised mostly of residential and commercial development.

Impairment Description

First listed in 2006, three of five AUs in this segment were impaired: 01, 03 and 05. Subsequent assessments found that bacteria numbers have decreased, and data reviewed for the 2014 Integrated Report showed that only AU 05 – the uppermost AU – was impaired. This impairment carried over due to continued results that supported the impairment in subsequent reports, including the 2020 Integrated Report. The monitoring station responsible for the listing is 17251. The geometric mean at the station remains well above the criteria of 723 CFU/100mL. A TMDL is ongoing.

Potential Causes of Impairment

Nonpoint sources of pollution may include leaking wastewater pipes located near the creek, pet waste from the Walnut Creek Metro Park and storm water runoff.

Actions Taken

COA has worked extensively to determine the source of bacteria at Station 17251. City staff conducted longitudinal bacteria sampling in Walnut Creek and found a source of fecal contamination was bracketed spatially to a small pipe outfall upstream of the monitoring location. COA has investigated the wastewater infrastructure near the station and mapped on-site sewage facilities in the area, and continues to search for issues that may contribute through longitudinal sampling investigations, spring sampling and tributary sampling.

In 2012, TCEQ initiated [a bacteria TMDL for several Austin streams](#) including Walnut Creek. TCEQ contracted with the University of Texas Center for Public Policy Dispute Resolution to facilitate public input and develop a TMDL implementation plan in partnership with the City of Austin Watershed Protection Department and other stakeholders. Strategies proposed by the stakeholder group included riparian zone restoration, wastewater infrastructure maintenance, domestic pet waste education, resident outreach and stormwater treatment. In January 2015, TCEQ Commissioners adopted the Walnut Creek TMDL. Implementation is ongoing.

Existing Stakeholders

- TCEQ
- COA
- Travis County
- University of Texas
- LCRA
- Numerous Austin nongovernmental organizations

Recommendations

- Monitor the effectiveness of the TMDL.



Walnut Creek at Metric Boulevard (Photo courtesy of Donna Blumberg)

Segment 1428C: Gilleland Creek

Impairment: Bacteria

Segment Description

Located in eastern Travis County, the Gilleland Creek watershed is approximately 76 square miles. The creek begins at its confluence with the Colorado River and ends 31 miles upstream in Pflugerville near the intersection of IH 35 and SH 45. The segment consists of four AUs. Gilleland Creek was monitored at the following stations during the period of record:

12235 – Gilleland Creek at FM 973

12236 – Gilleland Creek at US 290

17257 – Gilleland Creek downstream of Webberville Road

20474 – Gilleland Creek in Northeast Metropolitan Park

Gilleland Creek is an effluent-dominated stream, which means that the hydrology depends largely on discharges from wastewater treatment facilities both from the City of Pflugerville and smaller entities. Gilleland Creek is a third order stream.

Land Use

Land in the Gilleland Creek watershed has been historically used for agriculture, but it has rapidly transitioned over the past two decades to a more urban environment for residential and commercial uses. The lower two-thirds of the watershed still contain some farmland used for pastures and row crops. The upper one-third of the watershed is composed primarily of housing developments. The creek has little riparian area for much of its length. There are six wastewater treatment facilities that are permitted to discharge into Gilleland Creek with a total combined permit limit of 10 MGD. While 10 MGD is not the typical discharge under normal conditions, base flows in the creek are often dominated by treated wastewater effluent.

Impairment Description

Segment 1428C was first placed on the 2000 303(d) List for not supporting primary contact recreation due to high bacteria levels. Levels of fecal coliform and *E.coli* were above the TSWQS-established criterion at Station 17257 near the creek's confluence with the Colorado River.

Subsequent assessments found that bacteria levels remained above the criteria and in 2004, TCEQ contracted with LCRA to perform a TMDL. As part of the TMDL, sampling was expanded upstream to include all four AUs. The increased monitoring showed that the bacteria problem was prevalent throughout the stream. Monitoring is ongoing as a part of the implementation plan established by stakeholders.

Potential Causes of Impairment

While point sources of pollution should not be ruled out as a potential source, wastewater treatment facilities in the Colorado River watershed must comply with the Colorado River Watershed Protection Rule (October 1986, 30 Texas Administrative Code Chapter 311 Subchapter E), which mandates stringent effluent requirements and mandates chlorination concentrations for disinfection. Probable nonpoint sources of pollution in the Gilleland Creek watershed include malfunctioning septic tanks, storm sewer overflows, agriculture practices (horses and other livestock), and pet and wildlife waste.

Actions Taken

- TCEQ contracted with LCRA to perform a TMDL in 2004.
- TCEQ adopted the TMDL in August 2007; it was approved by EPA in April 2009.
- TCEQ approved the [Gilleland Creek implementation plan](#) in February 2011. Implementation is ongoing.
- TCEQ holds an annual stakeholder meeting to provide implementation plan updates to the public.
- At the 2021 Gilleland Creek Implementation Plan progress meeting, stakeholders asked for the addition of an upstream monitoring station to help shed light on bacteria sources in the uppermost AU. As a result, LCRA will be monitoring at Grand Avenue Parkway in FY 2022-2023.

Recommendations

- Monitor the effectiveness of the TMDL.



Gilleland Creek at Webberville Road

Segment 1429C: Waller Creek

Impairment: Bacteria and Benthic Macroinvertebrate Community

Segment Description

The Waller Creek watershed is six square miles. It is located on the north side of Lady Bird Lake in downtown Austin. Segment 1429C begins at its confluence with Lady Bird Lake and ends in north Austin. The segment is approximately 5 miles long and is delineated into three AUs. Waller Creek was monitored at the following stations during the period of record:

12222 – Waller Creek at 2nd Street

15962 – Waller Creek at 24th Street on UT Campus

16331 – Waller Creek at Avenue H at the Elisabet Ney Museum

Waller Creek is a second order stream. The stream is urbanized and is therefore prone to rapid rises and flooding.

Land Use

Waller Creek is arguably the most densely urbanized watershed with the oldest historic development in the Colorado River basin. Sewer lines cross the creek at many locations and storm water outlets drain runoff from downtown Austin into the creek. Few storm water and/or water quality controls are located in the watershed due to development under pre-Land Development Code rules and wastewater infrastructure being so old. To address flooding issues on the creek in the downtown area, COA initiated a massive project to build a 5,600-foot tunnel that lies as much as 70 feet below the surface to capture floodwaters and release them into Lady Bird Lake thereby circumventing the lower segment of Waller Creek. Within this lower segment, water from Lady Bird Lake is circulated through the channel and the tunnel to maintain baseflow and avoid stagnation of tunnel water, which provides a constant flow of water in the creek. Water quality samples in the lower segment, therefore, are more similar to the character of Lady Bird Lake than that of Waller Creek.

Impairment Description

Segment 1429C was first placed on the 2002 303(d) List for not supporting a high aquatic life use due to an impaired benthic macroinvertebrate community. The impairment was based on four monitoring events performed by the COA at Station 12222 (AU 01) between March 1996 and February 2001. The mean score of the four samples was 21.3, which indicates a limited aquatic life use. COA began collecting data in recent years to help address the impairment. The segment has remained on subsequent 303(d) lists and is on the 2020 303(d) List as a carry forward.

AUs 01 and 03 were first identified for not supporting contact recreation on the 2004 303(d) List due to elevated levels of fecal coliform bacteria. AU 02 was first identified for not supporting contact recreation on the 2006 303(d) List due to elevated levels of *E.coli*. Monthly *E.coli* data collected from each of the AUs in 2010 continued to indicate that the stream was impaired. The 2020 Integrated Report continues to show all three AUs as impaired.

Potential Causes of Impairment

In 2002, TCEQ acquired the biological data from Waller Creek at COA's request. The resulting impairment was based on four sampling events. More biological data has been collected since the completion of the Waller Creek Tunnel in 2015, however the creek remains on the 303(d) List.

The elevated bacteria levels in Waller Creek may be attributed to pet and human waste, direct human inputs, leaking wastewater infrastructure, and storm water runoff. These sources contribute pollutants from multiple locations and in variable amounts making it difficult to track sources and loading.

Actions Taken

In 2012, TCEQ initiated [a bacteria TMDL for several Austin streams](#) including Waller Creek. TCEQ contracted with the University of Texas Center for Public Policy Dispute Resolution to facilitate public input and develop a TMDL implementation plan in partnership with the City of Austin Watershed Protection Department and other stakeholders. Strategies proposed by the stakeholder group included riparian zone restoration, wastewater infrastructure maintenance, domestic pet waste education, resident outreach and stormwater treatment. In January 2015, TCEQ Commissioners adopted the TMDL for Waller Creek.

Existing Stakeholders

- TCEQ
- COA
- Travis County
- University of Texas
- LCRA
- Numerous Austin nongovernmental organizations

Recommendations

- Monitor the effectiveness of the TMDL.
- Perform a UAA that includes fish, benthic macroinvertebrates, habitat and 24-hour dissolved oxygen.



Segment 1434G: Alum Creek

Impairment: Bacteria Geomean

Segment Description

The Alum Creek watershed covers a 54-square-mile area in Bastrop County, just east of the city of Bastrop. This segment begins at the confluence with the Colorado River upstream to the headwaters near US 290 southwest of the town of McDade. It is currently unmonitored.

Land Use

The Alum Creek watershed is primarily rural and undeveloped. There is one permitted discharge, which is at the headwaters, for Aqua Water Supply Corporation. This watershed was heavily impacted during the Bastrop County Complex Fire of 2011.

Impairment Description

Alum Creek was first placed on the 303(d) List for a bacteria impairment in the 2020 Integrated Report.

Potential Causes of Impairment

Nonpoint source pollution from a variety of unknown sources is the likely cause of the impairment. Leaking septic systems, agricultural waste and/or wildlife are the most likely causes. More information is needed on all potential sources of bacteria loading.

Actions Taken

- Alum Creek was placed on the 303(d) List beginning in the 2020 Integrated Report.
- In the Coordinated Monitoring Meeting for fiscal year 2022 that took place in spring 2021, it was decided that water quality data (conventional, field, bacteria) will be collected on Alum Creek. LCRA will be conducting the monitoring.

Potential Stakeholders

- LCRA
- Local landowners
- Bastrop County
- Natural Resource Conservation Service
- TCEQ
- Texas AgriLife Extension
- Texas Department of Agriculture
- Texas Parks and Wildlife Department
- Texas State Soil and Water Conservation Board

Recommendations

- Conduct a review of existing data and an aerial satellite imagery survey to begin to identify potential sources of bacteria in the creek.
- Communicate with local stakeholders to determine if there are any obvious nonpoint sources of pollution.
- Discuss monitoring of the creek in the upcoming Coordinated Monitoring Meeting.

Segment 1501: Tres Palacios River Tidal

Impairment: Bacteria and Dissolved Oxygen

Segment Description

The tidally influenced portion of the Tres Palacios River watershed begins at the mouth of Tres Palacios Bay and ends upstream at a point just upstream of its confluence with Wilson Creek. The segment is approximately 8 miles long and consists of one AU. It was monitored at the following stations during the period of record:

12515 – Tres Palacios River Tidal at FM 521

20636 – Tres Palacios River at Riverside Drive

Data responsible for the listing are from stations 12515 and 20636. This segment is tidally influenced and flow is not measured. Based on specific conductance readings, there is generally a salt wedge present at the location. A salt wedge is a wedge-shaped bottom layer of saltwater intruding in the overlying freshwater.

Land Use

The Segment 1501 watershed is rural. Much of the land along the river is used for agriculture. Agricultural practices such as crop type and fertilizer rates are unknown. There is a subdivision approximately 3 miles upstream of Station 12515.

Impairment Description

Segment 1501 was first placed on the 2006 303(d) List for not supporting contact recreation due to elevated levels of *Enterococcus* bacteria. It has remained on subsequent 303(d) Lists. The bacteria impairment is classified as 4a.

Tres Palacios River Tidal was first identified for not supporting its designated aquatic life use on the 1996 303(d) List. The original listing was based on low levels of dissolved oxygen obtained from grab samples. 24-hour DO data collected since the original listing confirmed the impairment. The segment remains on the 303(d) List as a category 5b for dissolved oxygen.

Potential Causes of Impairment

Stormwater runoff from crop lands in the immediate watershed, livestock and wildlife may be a source of bacteria, but further study is necessary to determine the extent of their influence on water quality. Failing septic systems in a subdivision near Station 20636 may also be a source of bacteria. Tidal flows may influence bacteria.

Actions Taken

In 2014, Texas Water Resources Institute (TWRI) began working with TCEQ and local stakeholders to develop a TMDL for the watershed. TWRI and stakeholders developed a WPP and TMDL implementation plan for Tres Palacios. The WPP was approved by the EPA in May 2018. The TMDL was approved in March 2018, and then the implementation plan was approved in January 2018. These documents outline the voluntary strategies to achieve water quality goals.

Potential Stakeholders

- TWRI
- LCRA
- Local landowners
- Matagorda County
- Mad Island Marsh Wildlife Refuge
- Natural Resource Conservation Service
- TCEQ
- Texas A&M Marine Advisory Service
- Texas AgriLife Extension
- Texas Department of Agriculture
- Texas Parks and Wildlife Department
- Texas State Soil and Water Conservation Board

Recommendations

- Communicate with TCEQ to determine if standards are appropriate for aquatic life.
- Continue implementation under the WPP and implementation plan.



Tres Palacios Creek (Photo by Michael Schram, Texas Water Resources Institute)

Appendix A

Segments Delisted in 2020 in the Lower Colorado River Basin

Segment 1427 – Onion Creek

Onion Creek was listed as impaired for sulfate in water following the drought of the late 2000s and early 2010s. With additional data collected in non-drought conditions, the impairment was lifted, and Onion Creek was delisted in the 2020 Integrated Report.

Appendix B

Summary of Texas Surface Water Quality Standards

TCEQ protects water quality by establishing Texas Surface Water Quality Standards for all water bodies in the state. The standards are made up of two components: designated uses and criteria. Designated uses are purposes for water, including general use, aquatic life use, contact recreation and public water supply. Criteria are usually numeric (sometimes narrative) limits used to compare water quality data or conditions. The designated uses and their associated criteria are described as follows:

- **General Use** – The category was created to protect overall water quality. Temperature, pH, chloride, sulfate and TDS criteria are used to gauge support for this use. Numeric criteria for these parameters vary among water bodies in the Colorado River basin. A complete list is in [TSWQS](#).
- **Aquatic Life Use** – TCEQ has established different criteria (Table 2) to determine support for aquatic life in freshwater. For each standard, there are four levels: exceptional, high, intermediate and limited. As a general rule, all perennial streams are assumed to have a high aquatic life use designation.

Table 2. Aquatic Life Use Criteria

Level of Aquatic Life Use Attainment	Dissolved Oxygen (grab sample or 24-hour average)	Dissolved Oxygen (24-hour minimum)	Fish Community Index Score	Benthic Community Index Score	Habitat Index Score
Exceptional	6.0	4.0	58-60	>36	26-31
High	5.0	3.0	48-52	29-36	20-25
Intermediate	4.0	2.0	40-44	22-28	14-19
Limited	3.0	2.0	<34	<22	<14

- **Contact Recreation** – This use refers to a waterbody’s ability to safely support physical contact such as swimming, wading or boating. Recreational use consists of five categories: primary contact recreation 1, primary contact recreation 2, secondary contact recreation 1, secondary contact recreation 2 and noncontact recreation waters. All classified segments in the state are designated for primary contact recreation 1 unless site-specific standards have been established. Visit the TCEQ [TSWQS website](#) for more information.

All waters in the Colorado River basin are currently primary contact recreation 1. The standard for primary contact recreation 1 is a measure of bacteria levels (Table 3). In freshwater, the indicator is *E.coli*. In saltwater and coastal areas, *Enterococci* bacteria are used as the indicator.

Table 3. Criteria for Bacteria Based on Texas Surface Water Quality Standards

Bacteria	Geometric Mean Criteria (CFU/100mL)	Single Sample Criteria (CFU/100mL)
<i>E. coli</i>	126	399
<i>Enterococcus</i>	35	104

- **Public Water Supply** – This use is evaluated by assessing finished drinking water and/or surface water conditions. Finished drinking water is assessed for toxic contaminants at the point of entry to distribution systems. Finished drinking water also is assessed for elevated levels of dissolved minerals: chloride, sulfate and TDS, which have criteria of 300, 300 and 1000 mg/L, respectively. These criteria for dissolved solids are applied statewide and were developed to ensure that water supply utilities could treat and deliver water that is free of taste and odor.