January 2022 Update to the Texas Water Quality Management Plan

Prepared by
Water Quality Division, Office of Water

Draft TCEQ SFR-121/2021-02
[Draft for Public Comment: January 2022]

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY • PO BOX 13087 • AUSTIN, TX 78711-3087

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Office of Water
Water Quality Division

Draft WQMP updates for public comment are available on the TCEQ webpage:
www.tceq.texas.gov/permitting/wqmp/WQmanagement_comment.html

Developed in accordance with Sections 205(j), 208,
and 303 of the Federal Clean Water Act
and applicable regulations thereto.

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Introduction

The Texas Water Quality Management Plan (WQMP) is the product of a wastewater treatment facility (WWTF) planning process developed and updated in accordance with provisions of Sections 205(j), 208, and 303 of the federal Clean Water Act (CWA), as amended. The WQMP is an important part of the State's program for accomplishing its clean water goals.[1]

The Texas Department of Water Resources, a predecessor agency of the Texas Commission on Environmental Quality (TCEQ), prepared the initial WQMP for waste treatment management during the late 1970s. The Clean Water Act mandates that the WQMP be updated as needed to fill information gaps and revise earlier certified and approved plans. Any updates to the plan need involve only the elements of the plan that require modification. The original plan and its subsequent updates are collectively referred to as the "State of Texas Water Quality Management Plan."

The WQMP is tied to the State's water quality assessments that identify priority water quality problems. WQMPs are used to direct planning for implementation measures that control and/or prevent water quality problems. Several elements may be contained in the WQMP, such as effluent limitations of wastewater facilities, total maximum daily loads (TMDLs), nonpoint source management controls, identification of designated management agencies, and groundwater and source-water protection planning. Some of these elements may be contained in separate documents, which are prepared independently of the current WQMP update process, but may be referenced as needed to address planning for water quality control measures.

This document, as with previous updates[2], will become part of the WQMP after completion of the public comment period, certification by TCEQ, and approval by the United States Environmental Protection Agency (EPA).

The materials presented in this document revise only the information specifically addressed in the following sections. Previously certified and approved WQMPs remain in effect.

[1] See the formal definition of a water quality management plan in Title 40 Code of Federal Regulations (CFR) 130.2(k).

[2] Fiscal Years 1974, 1975, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984/85, 1986/88, 1989, 1990, 1991, 1992, 1993/94, 1995, 1996, 1997/98, 02/1999, 05/1999, 07/1999, 10/1999, 01/2000, 04/2000, 07/2000, 10/2000, 01/2001, 04/2001, 07/2001, 10/2001, 01/2002, 04/2002, 07/2002, 10/2002, 01/2003, 04/2003, 07/2003, 10/2003, 01/2004, 04/2004, 07/2004, 10/2004, 01/2005, 04/2005, 07/2005, 10/2005, 01/2006, 04/2006, 07/2006, 10/2006, 01/2007, 04/2007, 07/2007, 10/2007, 01/2008, 04/2008, 07/2008, 10/2008, 01/2009, 04/2009, 07/2009, 10/2009, 01/2010, 04/2010, 07/2010,10/2010, 01/2011, 04/2011, 07/2011, 10/2011, BPUB 2011, 01/2012, 04/2012, 07/2012,10/2012, 01/2013, 04/2013, 07/2013,10/2013, 01/2014, 04/2014, 07/2014, 10/2014, 01/2015, 04/2015, 07/2015, 10/2015, 01/2016, 04/2016, 07/2016, 10/2016, 01/2017, 04/2017, 07/2017, 10/2017, 01/2018, 04/2018, 07/2018, 10/2018, 01/2019, Terra Verde 2019, 04/2019, 07/2019, 10/2019, 01/2020, 04/2020, 07/2020, 10, 2020, 01/2021, 04/2021, and 07/2021.

The January 2022 WQMP update addresses the following topics for water quality planning purposes:

1. Projected Effluent Limits Updates
2. Total Maximum Daily Load (TMDL) Revisions

The public comment period for the draft January WQMP update will be from February 11, 2022 through March 15, 2022.

The "Projected Effluent Limit Update" section provides information compiled from November 1, 2021 through January 31, 2022 and is based on Texas water quality standards (WQS). Projected effluent limits may be used for water quality planning purposes in Texas Pollutant Discharge Elimination System (TPDES) permit actions.

The "Total Maximum Daily Load Revisions" section provides information on proposed wasteload allocations for new dischargers and revisions to existing TMDLs and was developed by the TCEQ TMDL Program in the Water Quality Planning Division.

Projected Effluent Limit Updates

Table 1 reflects proposed effluent limits for new dischargers and preliminary revisions to original proposed effluent limits for preexisting dischargers. Abbreviations used in the table heading include:

- BOD_5–5-Day Biochemical Oxygen Demand
- $CBOD_5$–5-Day Carbonaceous Biochemical Oxygen Demand
- DO–Dissolved Oxygen
- lbs/day–Pounds per Day
- MGD–Million Gallons per Day
- mg/L–Milligrams per Liter
- NH_3-N–Ammonia-Nitrogen

Effluent flows indicated in Table 1 reflect future needs and do not reflect current permits for these facilities. These revisions may be useful for water quality management planning purposes. The effluent flows and constituent limits indicated in the table have been preliminarily determined to be appropriate to satisfy the stream standards for dissolved oxygen in their respective receiving waters. These flow volumes and effluent sets may be modified at the time of permit action. These limits are based on the Texas WQS effective at the time of the production of this update. The WQS are subject to revision on a triennial basis.

Table 1. Projected Effluent Limit Updates

State Permit Number	*Segment Number*	*EPA ID Number*	*Permittee Name and County*	*Flow (MGD)*	*$CBOD_5$ (mg/L)*	*$CBOD_5$ (lbs/day)*	*NH_3-N (mg/L)*	*NH_3-N (lbs/day)*	*BOD_5 (mg/L)*	*BOD_5 (lbs/day)*	*DO (mg/L)*	*Months/ Comments*
10399-002	0506	TX0099112	City of Canton Van Zandt	1.8	10	150.12	3	45.04			4	Outfall 001 (Outfalls 001 and 002 total combined flow not to exceed 1.8 MGD)
				0.77	5	32.11	2	12.84			6	Outfall 002 (Outfalls 001 and 002 total combined flow not to exceed 1.8 MGD)
10641-003	1421	TX0141534	City of San Angelo Tom Green	12	5	500.40	3	300.24			6	April – September
				12	10	1000.80	4	400.32			6	November - March
10698-002	0823	TX0123781	Upper Trinity Regional Water District Denton	1.7	5	56.70	1	14.18			6	April – September/ Outfall 001 (more stringent $CBOD_5$ loading limit required than that which would correspond to the concentration limit)

				1.7	7	99.25	3	42.53		6	October – March/ Outfall 001
				8.3	5	277.00	1	69.22		6	April – September/ Outfall 002 (more stringent $CBOD_5$ loading limit required than that which would correspond to the concentration limit)
				8.3	7	484.55	3	207.67		6	October – March/ Outfall 002
13872-001	1108	TX0118397	City of Manvel Brazoria	4.0	5	166.80	2	66.72		6	
14589-001	1014	TX0127647	Harris County MUD No. 432 Harris	1.45	5	60.47	2	24.19		6	
14887-001	1228	TX0104558	City of Godley Johnson	1.36	10	113.42	3	34.03		6	
15032-001	1008	TX0141852	Grimes Co. Water Reclamation, LLC Grimes	0.12	10	10.01	3	3.00		4	
15264-001	1014	TX0135461	Harris County MUD No. 171 Harris	3.0	5	125.10	2	50.04		4	

15536-001	0823	TX0137464	Mustang Special Utility District Denton	15	5	625.50	1	125.10		6	April – September
				15	5	625.50	1.5	187.65		6	October - March
15597-001	0801	TX0137901	River Ranch Holdings, LLC Liberty	0.9	10	75.06	3	22.52		6	
15669-001	0826	TX0140775	New Fairview MUD No. 1 Wise	0.45	10	37.53	2	7.51		5	
15964-001	0815	TX0141046	LVPT Holdings, LLC Ellis	1.2	5	50.04	1.1	11.01		6	
15992-001	1009	TX0141291	Harris County MUD No. 418 Harris	1.8	5	75.06	1.3	19.52		6	
15998-001	1244	TX0141321	Hutto 525 Development Partners LP Williamson	0.5	5	20.85	1	4.17		6	
16020-001	1434	TX0141542	Davaus Three, LP Travis	0.455	5	18.97	2	7.59		4	
16028-001	1016	TX0141615	Ali Mohammad Soljou Harris	0.07	10	5.84	3	1.75		4	
16030-001	1101	TX0141623	Land Baron Holdings, LLC Brazoria	0.14	5	5.84	2	2.34		4	

16034-001	1004	TX0141640	FMRWD LLC Montgomery	0.03	10	2.50	3	0.75	6
16036-001	0507	TX0141666	Camden Parc MUD of Rockwall County Rockwall	0.55	10	45.87	3	13.76	4
16040-001	0507	TX0141704	Hunt County MUD No. 4 Hunt	0.21875	10	18.24	3	5.47	4
16041-001	1014	TX0141712	Quadvest, L.P. Waller	2.0	10	166.80	2	33.36	6
16044-001	1203	TX0141739	DynaEnerget-ics US, Inc. Hill	0.02	10	1.67	3	0.50	4
16049-001	1808	TX0141798	Rattler Ridge, LLC Guadalupe	0.4	10	33.36	2	6.67	5
16050-001	1008	TX0141801	MGW Development Company Montgomery	0.8	10	66.72	3	20.02	4
16051-001	1228	TX0141810	Stockhome Trading Corp. Johnson	0.75	10	62.55	3	18.77	4
16053-001	0830	TX0141836	Civitas at Crowley, LLC Tarrant	0.1	10	8.34	3	2.50	4
16054-001	1209	TX0141844	Pure Strike Development, LP and B&T Realty, L.L.C. Brazos	0.04	10	3.34	3	1.00	4
16056-001	0803	TX0141861	Two Creeks Crossing Resort, LLC Polk	0.045	10	3.75	3	1.13	4

16060-001	1908	TX0141909	South Central Water Company Comal	0.6	5	25.02	2	10.01	4
16063-001	1244	TX0141933	Civitas at Hutto LLC Williamson	0.225	10	18.77	2	3.75	6

Total Maximum Daily Load Revisions

The TMDL Program works to improve water quality in impaired or threatened waters bodies in Texas. The program is authorized by and created to fulfill the requirements of Section 303(d) of the federal Clean Water Act.

The goal of a TMDL is to restore the full use of a water body that has limited quality in relation to one or more of its uses. The TMDL defines an environmental target, and based on that target, TCEQ and stakeholders develop an implementation plan with wasteload allocations for point source dischargers to mitigate human-caused sources of pollution within the watershed and restore full use of the water body.

TMDLs are developed based on intensive data collection and scientific analysis. After adoption by TCEQ, TMDLs are submitted to EPA for review and approval.

The attached appendixes may reflect proposed wasteload allocations for new dischargers and/or additions or revisions to TMDLs. Updates and addendums will be provided in the same units of measure used in the original TMDL document and will include the segment and assessment unit (AU) numbers of the affected segments. Also, note that for bacteria TMDLs, loads will typically be expressed as colony-forming units per day (cfu/day). On occasion, other expressions may be used due to different laboratory methods, such as counts or most probable number per day. For the purposes of the TMDL program, these terms are considered to be synonymous.

Appendix I. Updates to Five TMDLs for Indicator Bacteria in Brays Bayou Above Tidal and Tributaries

Segments 1007B, 1007C, 1007E, and 1007L

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Brays Bayou Above Tidal and Tributaries.

The report *Five Total Maximum Daily Loads for Indicator Bacteria in Brays Bayou Above Tidal and Tributaries For Segment Numbers 1007B, 1007C, 1007E, and 1007L* was adopted by TCEQ on 09/15/10 and approved by EPA on 09/27/10. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated three times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document. Additionally, TCEQ submitted two addenda to the original TMDL in the April 2013 and January 2021 WQMP updates. These addenda added four new AUs to the original TMDL project.

The purpose of this update is to make the following change to the TMDL:

- update the WLA for one facility that has decreased its permitted discharge (presented in Table I-1)

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for FG in two AUs. This was originally presented in Table 17 in the original TMDL document. The two affected AUs in this update are included here as Table I-2.

In Table 18 of the original TMDL, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for FG within each AU. These overall numbers did not change; Table 18 of the original TMDL remains the same.

Table I-1 - Changes to individual WLAs for the TMDL watersheds

Updates Table 15, pp. 35-36 in the original TMDL document.

The WLA is expressed in billion MPN/day *E. coli*.

State Permit Number	*Outfall*	*EPA Permit Number*	*AU*	*Permittee Name*	*Flow (MGD)*	*WLA*	*TMDL Comments*
14418-001	001	TX0056481	1007B_02	CHELFORD CITY MUD	11.0	26.23	Decreased discharge

Table I-2 - TMDL summary calculations for two AUs in the TMDL watersheds

Updates Table 17, p. 41 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	Segment Name	TMDL	WLA $_{WWTF}$	WLA $_{SW}$	LA	MOS	FG
1007B_01	Brays Bayou Above Tidal	2,390	359.5	1,839.1	0	120	71.4
1007B_02	Brays Bayou Above Tidal	162	30.5	102.1	0	8	21.4

Appendix II. Updates to Eighteen Total Maximum Daily Loads for Bacteria in Buffalo and Whiteoak Bayous and Tributaries

Segments 1013, 1013A, 1013C, 1014, 1014A, 1014B, 1014E, 1014H, 1014K, 1014L, 1014M, 1014N, 1014O, 1017, 1017A, 1017B, 1017D, and 1017E

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Buffalo and Whiteoak Bayous and Tributaries.

The report *Eighteen Total Maximum Daily Loads for Bacteria in Buffalo and Whiteoak Bayous and Tributaries For Segment Numbers 1013, 1013A, 1013C, 1014, 1014A, 1014B, 1014E, 1014H, 1014K, 1014L, 1014M, 1014N, 1014O, 1017, 1017A, 1017B, 1017D, and 1017E* was adopted by TCEQ on 04/08/09 and approved by EPA on 06/11/09. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated 29 times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document. Additionally, TCEQ submitted addenda to the original TMDL in the April 2013, April 2015, and January 2021 WQMP updates. These addenda added three new AUs to the original TMDL project.

The purpose of this update is to make the following changes to the TMDL (presented in Table II-1):

- update the WLAs for two facilities that have increased their permitted discharges and one facility that has decreased its permitted discharge,
- add one new permit,
- remove two canceled permits, and
- update the name of one facility.

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for future growth (FG) in four AUs. This was originally presented in Table 53 in the original TMDL document. The affected AUs in this update are included here as Table II-2.

For AU 1014H_02, the existing FG allocation was insufficient to cover the increased flow to the AU for this update. However, ample loading is available in the $WLA_{StormWater}$ and load allocation (LA) terms. A small amount was taken proportionally from each of those terms and allotted to FG. This results in no change to the overall TMDL allocation.

In Table 54 of the TMDL, the WLAs for permitted facilities are the sum of the individual WLAs and the FG within each AU. Because a small amount of loading was moved from

the $WLA_{StormWater}$ and LA terms to be used for FG for AU 1014H_02, that AU is updated in Table II-3. Again, this results in no change to the overall TMDL allocation.

Table II-1 - Changes to individual WLAs for the TMDL watershed

Updates Table 45, pp. 99-103 in the original TMDL document.

The WLA is expressed in billion MPN/day *E. coli*.

State Permit Number	*Outfall*	*EPA Permit Number*	*AU*	*Permittee Name*	*Flow (MGD)*	*WLA*	*TMDL Comments*
16041-001	001	TX0141712	1014B_01	QUADVEST, L.P.	2.0	4.770	New permit
12427-001	001	TX0088218	1014B_01	GEORGE AIVAZIAN	NA	NA	Permit canceled
12927-001	001	TX0095532	1014E_01	HARRIS CO MUD 276	0.48	1.145	Decreased discharge
14589-001	001	TX0127647	1014H_02	HARRIS COUNTY MUD 432	1.45	3.458	Increased discharge
15264-001	001	TX0135461	1014H_02	HARRIS COUNTY MUD 171	3.0	7.154	Increased discharge and updated name
13764-001	001	TX0092932	1017_04	HC III LIMITED PARTNERSHIP	NA	NA	Permit canceled

Table II-2 - TMDL summary calculations for four AUs in the TMDL watershed

Updates Table 53, pp. 116-117 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	Segment Name	TMDL	WLA WWTF	WLA SW	LA	MOS	Upstream Load	FG
1014B_01	Buffalo Bayou	626.91	104.78	482.44	38.60	0	0	1.09
1014E_01	Langham Creek	236.83	74.07	145	7.78	0	0	9.98
1014H_02	South Mayde Creek	175.43	50.96	112.00	12.44	0	0	0.03
1017_04	Whiteoak Bayou Above Tidal	537.09	0.14	482.69	53.63	0	0	0.63

Table II-3 – Final TMDL calculations for one AU in the TMDL watershed

Updates Table 54, pp. 118-119 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	Segment Name	TMDL	WLA WWTF	WLA SW	LA	MOS
1014H_02	South Mayde Creek	175.43	50.99	112.00	12.44	0

Appendix III. Updates to Nine TMDLs for Bacteria in Clear Creek and Tributaries

Segments 1101, 1101B, 1101D, 1102, 1102A, 1102B, 1102C, 1102D, and 1102E

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Clear Creek and Tributaries.

The report *Nine Total Maximum Daily Loads for Bacteria in Clear Creek and Tributaries: Segments 1101, 1101B, 1101D, 1102, 1102A, 1102B, 1102C, 1102D, and 1102E* was adopted by TCEQ on 09/10/08 and approved by EPA on 03/06/09. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated eight times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document. TCEQ submitted two addenda to the original TMDL in the October 2012 and October 2018 WQMP updates. These addenda added five new AUs to the original TMDL project.

The purpose of this update is to make the following change to the TMDL:

- add one new permit (presented in Table III-1)

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for FG in one AU. This was originally presented in Tables 18 and 21 in the original TMDL document. The affected AU in this update is included here as Tables III-2 and III-3.

For Segment 1101B/AU 1101B_01, the existing FG allocation was insufficient to cover the increased flow to the AU for this update. However, ample loading is available in the $WLA_{StormWater}$ and LA terms. Loading was taken from each of those terms (in a way that maintains the proportions for them as updated in the July 2016 WQMP update) and allotted to future growth for the AU. This results in no changes to the overall TMDL allocation.

Table III-1 - Changes to individual WLAs within the TMDL watersheds

Updates Table 16, pp. 47 in the original TMDL document.

All loads expressed as MPN/day.

State Permit Number / EPA Permit Number	*Outfall*	*AU*	*Permittee Name*	*Flow (MGD)*	*WLA – Fecal Coliform MPN/day*	*WLA – E. coli MPN/day*	*WLA – Enterococci MPN/day*	*TMDL Comments*
16030-001 / TX0141623	001	1101B_01	LAND BARON HOLDINGS, LLC	0.14	1.06E+09	6.68E+08	NA	New permit

Table III-2 - *E. coli* and Fecal Coliform TMDL Calculations for Freshwater Segments

Updates Table 18, p. 50 in the original TMDL document.

All loads expressed as MPN/day *E. coli*.

Segment	Sampling Location	Stream Name	Indicator Bacteria	TMDL	WLA WWTF	WLA SW	LA	MOS	FG
1101B	16493	Chigger Creek	*E. coli*	1.75E+10	6.68E+08	5.09E+09	1.08E+10	8.71E+08	4.95E+07

Table III-3 - TMDL Allocation Table

Updates Table 21, p. 53 in the original TMDL document.

All loads expressed as MPN/day *E. coli*.

Segment	Stream Name	AU	Indicator Bacteria	TMDL	WLA WWTF	WLA SW	LA	MOS	FG
1101B	Chigger Creek	1101B_01	*E. coli*	1.74E+10	6.68E+08	5.07E+09	1.08E+10	8.71E+08	1.95E+07

Appendix IV. Updates to Eight TMDLs for Indicator Bacteria in Greens Bayou Above Tidal and Tributaries

Segments 1016, 1016A, 1016B, 1016C, and 1016D

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Greens Bayou Above Tidal and Tributaries.

The report *Eight Total Maximum Daily Loads for Indicator Bacteria in Greens Bayou Above Tidal and Tributaries: Segments 1016, 1016A, 1016B, 1016C, and 1016D* was adopted by TCEQ on 06/02/10 and approved by EPA on 08/12/10. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated 12 times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document.

The purpose of this update is to make the following change to the TMDL:

- add one new permit (presented in Table IV-1)

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for FG in two AUs. This was originally presented in Table 17 in the original TMDL document. The two affected AUs in this update are included here as Table IV-2.

In Table 18 of the original TMDL, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for FG within each AU. These overall numbers did not change; Table 18 of the original TMDL remains the same.

Table IV-1 - Changes to individual WLAs for the TMDL watersheds

Updates Table 15, pp. 39-42 in the original TMDL document.

The WLA is expressed in billion MPN/day *E. coli*.

State Permit Number	*Outfall*	*EPA Permit Number*	*AU*	*Permittee Name*	*Flow (MGD)*	*WLA*	*TMDL Comments*
16028-001	001	TX0141615	1016_02	ALI MOHAMMAD SOLHJOU	0.07	0.167	New permit

Table IV-2 - TMDL summary calculations for two AUs in the TMDL watersheds

Updates Table 17, p. 46 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	Segment Name	TMDL	WLA $_{WWTF}$	WLA $_{SW}$	LA	MOS	FG
1016_02	Greens Bayou Above Tidal	1,020	106.7	789	0	51.2	73.1
1016_03	Greens Bayou Above Tidal	1,780	205.9	1,114	167	89.0	204.1

Appendix V. Updates to Fifteen TMDLs for Indicator Bacteria in Watersheds Upstream of Lake Houston

Segments 1004E, 1008, 1008H, 1009, 1009C, 1009D, 1009E, 1010, and 1011

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Watersheds Upstream of Lake Houston.

The report *Fifteen Total Maximum Daily Loads for Indicator Bacteria in Watersheds Upstream of Lake Houston For Segment Numbers 1004E, 1008, 1008H, 1009, 1009C, 1009D, 1009E, 1010, and 1011* was adopted by TCEQ on 04/06/11 and approved by EPA on 06/29/11. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated 36 times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document. Additionally, TCEQ submitted three addenda to the original TMDL in the October 2013, October 2019, and October 2020 WQMP updates. These addenda added nine new AUs to the original TMDL project.

The purpose of this update is to make the following changes to the TMDL (presented in Table V-1):

- add two new permits, and
- account for one permit that has been amended from land disposal to authorize discharge into waters of the State.

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for FG in seven AUs. This was originally presented in Table 18 in the original TMDL document. The seven affected AUs in this update are included here as Table V-2.

For AUs 1008_02 and 1009_01, the existing future growth allocations were insufficient to cover the increased flow to the AUs for this update. However, ample loading is available in the $WLA_{StormWater}$ and LA terms. Loading was taken from each of those terms (in a way that maintains the proportions for them as updated in the July 2016 WQMP update) and allotted to future growth for both AUs. This results in no changes to the overall TMDL allocations.

In Table 19 of the original TMDL, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for FG within each AU. Because loading was moved from the $WLA_{StormWater}$ and LA terms to be used for future growth for AUs 1008_02 and

1009_01, these AUs are updated in Table V-3. These overall numbers for the other AUs did not change, and again this results in no changes to the overall TMDL allocations.

Table V-1 - Changes to individual WLAs for the TMDL watershed

Updates Table 16, pp. 49-56 in the original TMDL document.

The WLA is expressed in billion MPN/day *E. coli*.

State Permit Number	*Outfall*	*EPA Permit Number*	*AU*	*Permittee Name*	*Flow (MGD)*	*WLA*	*TMDL Comments*
15032-001	001	TX0141852	1008_02	GRIMES CO. WATER RECLAMATION, LLC	0.12	0.286	Permit amended from land disposal to discharge
16050-001	001	TX0141801	1008_03	MGW DEVELOPMENT COMPANY	0.8	1.908	New permit
15992-001	001	TX0141291	1009_01	HARRIS COUNTY MUD #418	1.80	4.293	New permit

Table V-2 - TMDL summary calculations for seven AUs in the TMDL watershed

Updates Table 18, p. 61 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	Sampling Locaion	Segment Name	TMDL	WLA WWTF	WLA SW	LA	MOS	FG
1008_02	11314	Spring Creek	287	11.22	70.53	190.71	14.4	0.14
1008_03	11313	Spring Creek	1,420	110.63	322	869	70.9	47.47
1008_04	11312	Spring Creek	1,510	146.30	334	902	75.7	52.0
1009_01	11333	Cypress Creek	227	27.80	78.86	108.90	11.4	0.04
1009_02	11331	Cypress Creek	615	111.79	196	270	30.8	6.41
1009_03	11328	Cypress Creek	1,340	195.55	415	574	67.0	88.45
1009_04	11324	Cypress Creek	1,550	234.73	469	648	77.4	120.87

Table V-3 - TMDL final calculations

Updates Table 19, p. 62 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	TMDL	WLA WWTF	WLA SW	LA	MOS
1008_02	287	11.36	70.53	190.71	14.4
1009_01	227	27.84	78.86	108.90	11.4

In addition, Table V-4 below provides an update to Table 8 found in the October 2020 addendum to this TMDL project (*Addendum Three to Fifteen Total Maximum Daily*

Loads for Indicator Bacteria in Watersheds Upstream of Lake Houston: One Total Maximum Daily Load for Indicator Bacteria in Walnut Creek For AU 1008I_01). One of the permits discussed earlier in this update also affects one AU in this addendum.

Table V-5 below provides updates to Table 9 found in the October 2020 addendum to this TMDL project. The addendum added one AU that was not included in the original TMDL. This AU (1008I_01) was included as an upstream loading to 1008_02 in the original TMDL. One of the permits (15032-001/ TX0141852) affects the loading of 1008I_01 as well as the original TMDL AU 1008_02.

In Table 10 of the October 2020 TMDL addendum, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for future growth within the single AU. Therefore, these overall numbers did not change, and Table 10 of the TMDL addendum remains the same.

Table V-4 - Changes to individual WLAs in the Walnut Creek watershed

Updates Table 8, p. 18 in the TMDL addendum document.

The WLA is expressed in billion cfu/day *E. coli*.

State Permit Number	***Outfall***	***EPA Permit Number***	***AU***	***Permittee Name***	***Flow (MGD)***	***WLA***	***TMDL Comments***
15032-001	001	TX0141852	1008I_01	GRIMES CO. WATER RECLAMATION, LLC	0.12	0.286	Permit amended from land disposal to discharge

Table V-5 - TMDL summary calculations for one AU in the Walnut Creek watershed

Updates Table 9, p. 19 in the TMDL addendum document.

All loads expressed as billion cfu/day *E. coli*.

Water Body	**AU**	**TMDL**	**WLA WWTF**	**WLA SW**	**LA**	**FG**	**MOS**
Walnut Creek	1008I_01	335.982	8.335	40.845	254.706	15.297	16.799

Appendix VI. Updates to Seven TMDLs for Indicator Bacteria in Lake Houston, East Fork San Jacinto River, West Fork San Jacinto River, and Crystal Creek Watersheds

Segments 1002, 1003, 1004, and 1004D

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Lake Houston, East Fork San Jacinto River, West Fork San Jacinto River, and Crystal Creek Watersheds.

The report *Seven Total Maximum Daily Loads for Indicator Bacteria in Lake Houston, East Fork San Jacinto River, West Fork San Jacinto River, and Crystal Creek Watersheds For Segments 1002, 1003, 1004, and 1004D* was adopted by TCEQ on 08/24/16 and approved by EPA on 10/07/16. Upon EPA approval, the TMDLs became part of the state's WQMP.

The Texas WQMP has since been updated 10 times prior to this update for this TMDL. The previous updates have revised the list of individual WLAs in the original TMDL document. Additionally, TCEQ submitted an addendum to the original TMDL in the October 2018 WQMP update. This addendum added one new AU to the original TMDL project.

The purpose of this update is to make the following change to the TMDL:

- add one new permit (presented in Table VI-1)

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for FG in three AUs. This was originally presented in Table 17 in the original TMDL document. The three affected AUs in this update are included here as Table VI-2.

In Table 18 of the original TMDL, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for FG within each AU. These overall numbers did not change; Table 18 of the original TMDL remains the same.

Table VI-1 - Changes to individual WLAs for the TMDL watersheds

Updates Table 13, pp. 54-55 in the original TMDL document.

The WLA is expressed in billion MPN/day *E. coli*.

State Permit Number	*Outfall*	*EPA Permit Number*	*AU*	*Permittee Name*	*Flow (MGD)*	*WLA*	*TMDL Comments*
16034-001	001	TX0141640	1004G_01[a]	FMRWD LLC	0.03	0.0715	New permit

[a] West Fork Crystal Creek (1004G_01) is not impaired, but is a tributary to impaired Crystal Creek (1004D_01).

Table VI-2 - TMDL summary calculations for three AUs in the TMDL watersheds

Updates Table 17, p. 59 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	Segment Name	TMDL	MOS	WLA WWTF	WLA SW	LA AU	LA TRIB	LA RES	LA TOTAL	FG
1002_06	Lake Houston	6,197	106.57	104.96	288.17	1,535.70	3,106.90	958.70	5,601.30	96.00
1004_01	West Fork San Jacinto River	2,779	88.77	101.71	196.81	1,294.21	44.86	958.70	2,297.77	93.94
1004D_01	Crystal Creek	137.8	6.89	10.25	18.79	100.92	0	0	100.92	0.95

Appendix VII. Updates to Two TMDLs for Indicator Bacteria in the Navasota River below Lake Limestone

Segment 1209

This appendix provides updates to TMDLs previously submitted through the state's WQMP for: Navasota River below Lake Limestone.

The report *Two Total Maximum Daily Loads for Indicator Bacteria in the Navasota River below Lake Limestone for Segment 1209* was adopted by TCEQ on 08/28/19 and approved by EPA on 10/25/19. Upon EPA approval, the TMDLs became part of the state's WQMP.

It has not had any WQMP updates prior to this one.

The purpose of this update is to make the following change to the TMDL:

- add one new permit (presented in Table VII-1)

The changes reflected in this update resulted in the shifting of allocations between the sum of the individual WLAs and the allowance for FG in one AU. This was originally presented in Table 12 in the original TMDL document. The one affected AU in this update is included here as Table VII-2.

For AUs 1209_03, the existing future growth allocation was insufficient to cover the increased flow to the AU for this update. However, ample loading is available in the WLA_{SW} and load allocation (LA) terms. Loading was taken from each of those terms (in a way that maintains the proportions for them in the adopted and approved TMDL) and allotted to future growth. This results in no changes to the overall TMDL allocation.

In Table 19 of the original TMDL, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for FG within each AU. Because loading was moved from the WLA_{SW} and LA terms to be used for future growth for AU 12009_03, that AUs is updated in Table VII-3. These numbers for the other AU did not change, and again this results in no changes to the overall TMDL allocations.

Table VII-1 - Changes to individual WLAs for the TMDL watershed

Updates Table 12, p. 35 in the original TMDL document.

The WLA is expressed in billion MPN/day *E. coli*.

State Permit Number	*Outfall*	*EPA Permit Number*	*AU*	*Permittee Name*	*Flow (MGD)*	*WLA*	*TMDL Comments*
16021-001	001	TX0141551	1209_03	CITY OF IOLA	0.098	0.467	New permit

Table VII-2 - TMDL summary calculations for one AU in the TMDL watershed

Updates Table 18, p. 41 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	TMDL	WLA WWTF	WLA SW	LA	FG	MOS
1209_03	11,084.534	0.949	136.881	10,392.406	0.072	554.226

Table VII-3 – Final TMDL summary calculations for one AU in the TMDL watershed

Updates Table 19, p. 41 in the original TMDL document.

All loads expressed as billion MPN/day *E. coli*.

AU	TMDL	WLA WWTF	WLA SW	LA	MOS
1209_03	11,084.534	1.021	136.881	10,392.406	554.226

Appendix VIII. Addendum One to Two TMDLs for Indicator Bacteria in Lavaca River Above Tidal and Rocky Creek

Adding one TMDL for AU 1602_02

One TMDL for Indicator Bacteria in Lavaca River Above Tidal

Introduction

TCEQ adopted *Two TMDLs for Indicator Bacteria in Lavaca River Above Tidal and Rocky Creek* (TCEQ, 2019a) on August 14, 2019. EPA approved the TMDLs on October 25, 2019. This document is the first addendum to the original TMDL report.

This first addendum includes information specific to one additional AU for Lavaca River Above Tidal (AU 1602_02; also referred to in this addendum as the TMDL watershed). This AU is located within the watershed of the approved original TMDLs for Lavaca River Above Tidal and Rocky Creek. The concentration of indicator bacteria in this additional AU exceeds the criterion used to evaluate support of the primary contact recreation 1 use.

This addendum details the development of the added TMDL allocation for this additional AU, which was not specifically addressed in the original TMDL report. For background or other explanatory information, please refer to the *Technical Support Document for One Total Maximum Daily Load for Indicator Bacteria in Lavaca River Above Tidal* (Jain and Schramm, 2021). Refer to the original, approved TMDL document for details about the overall project watershed as well as methods and assumptions used in developing the original TMDLs.

Problem Definition

TCEQ first identified the bacteria impairment for Lavaca River Above Tidal in the *2008 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)* (Texas Integrated Report; TCEQ, 2020). The bacteria impairment was subsequently identified through the 2012 Texas 303(d) List and then removed from the list in 2014. The impairment was identified again in the 2020 Texas 303(d) List, the latest EPA-approved edition. The Lavaca River Above Tidal (Segment 1602) contains two AUs; the impaired AU 1602_02 is addressed in this addendum and AU 1602_03 was addressed in the original TMDL. The TMDL watershed is primarily located in Lavaca County, with small portions of the watershed found in DeWitt, Fayette,

Gonzales, and Jackson counties. Figure VIII-1 shows the watershed added in this addendum in relation to the entire watershed of the original TMDLs.

The Texas Surface Water Quality Standards (TCEQ, 2018a) identify uses for surface waters and numeric and narrative criteria to evaluate attainment of those uses. The basis for the water quality target for the TMDL developed in this addendum is the numeric criterion for indicator bacteria from the 2018 Texas Surface Water Quality Standards. *Escherichia coli* (*E. coli*) is the indicator bacteria for assessing primary contact recreation 1 use in freshwater.

Table VIII-1 summarizes the ambient water quality data for the TCEQ surface water quality monitoring (SWQM) stations on AU 1602_02, as reported in the 2020 Texas Integrated Report (TCEQ, 2020). The data from the assessment indicate nonsupport of the primary contact recreation 1 use for the AU, because the geometric mean concentration for *E. coli* exceeds the freshwater geometric mean criterion of 126 colony forming units per 100 milliliters (cfu/100 mL) of water. Figure VIII-2 shows the locations of the TCEQ monitoring stations that were used in evaluating water quality in the 2020 Texas Integrated Report for the AU added by this addendum.

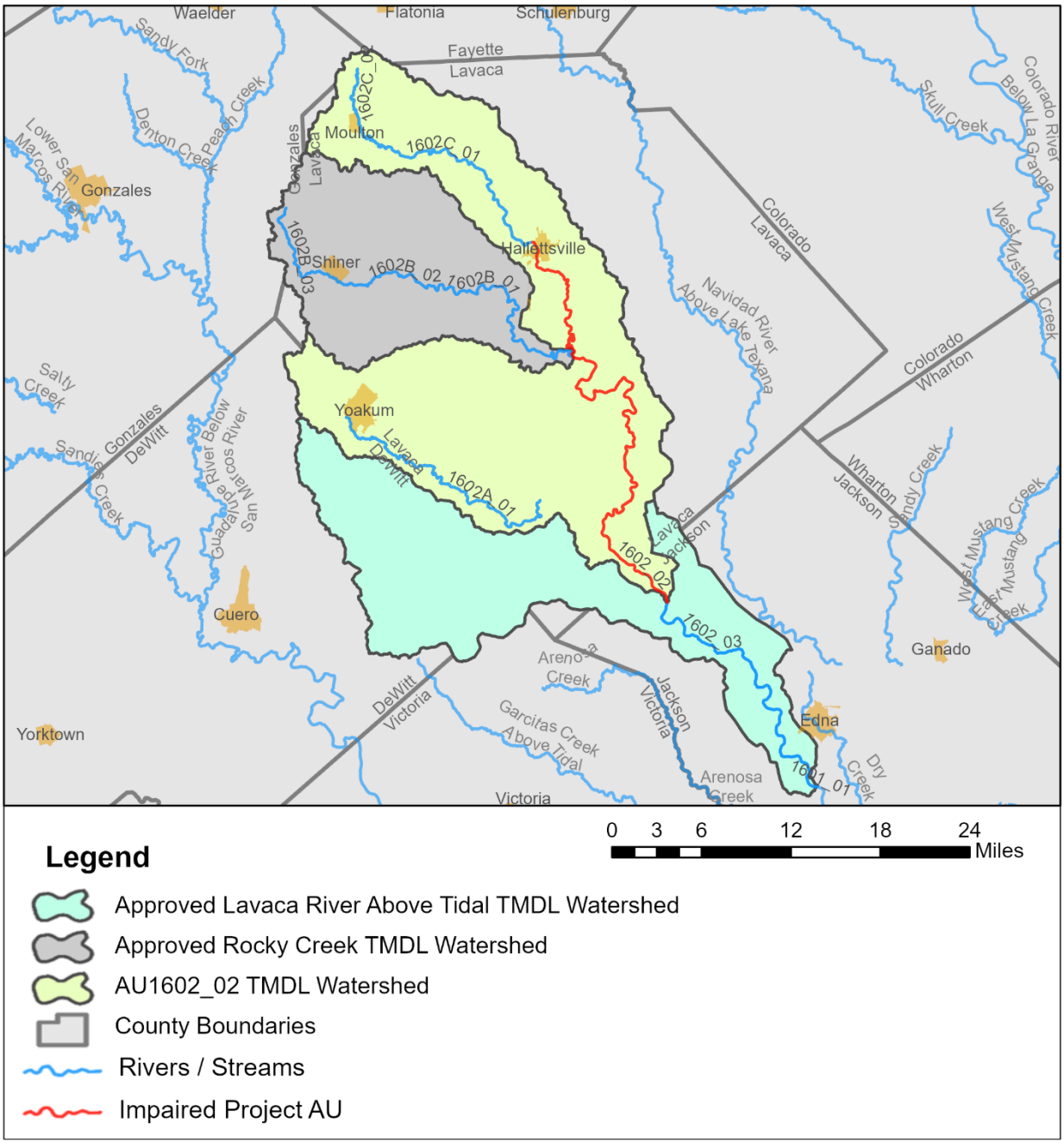

Figure VIII-1. Map showing the previously approved TMDL watersheds and the Lavaca River Above Tidal AU 1602_02 watershed added by this addendum

Table VIII-1. 2020 Texas Integrated Report summary for the TMDL watershed

AU	*Station*	*Parameter*	*Number of Samples*	*Date Range*	*E. coli Geometric Mean (cfu/100 mL)*
1602_02	12525, 12527	*E. coli*	45	12/01/2011 – 11/30/2018	202.74

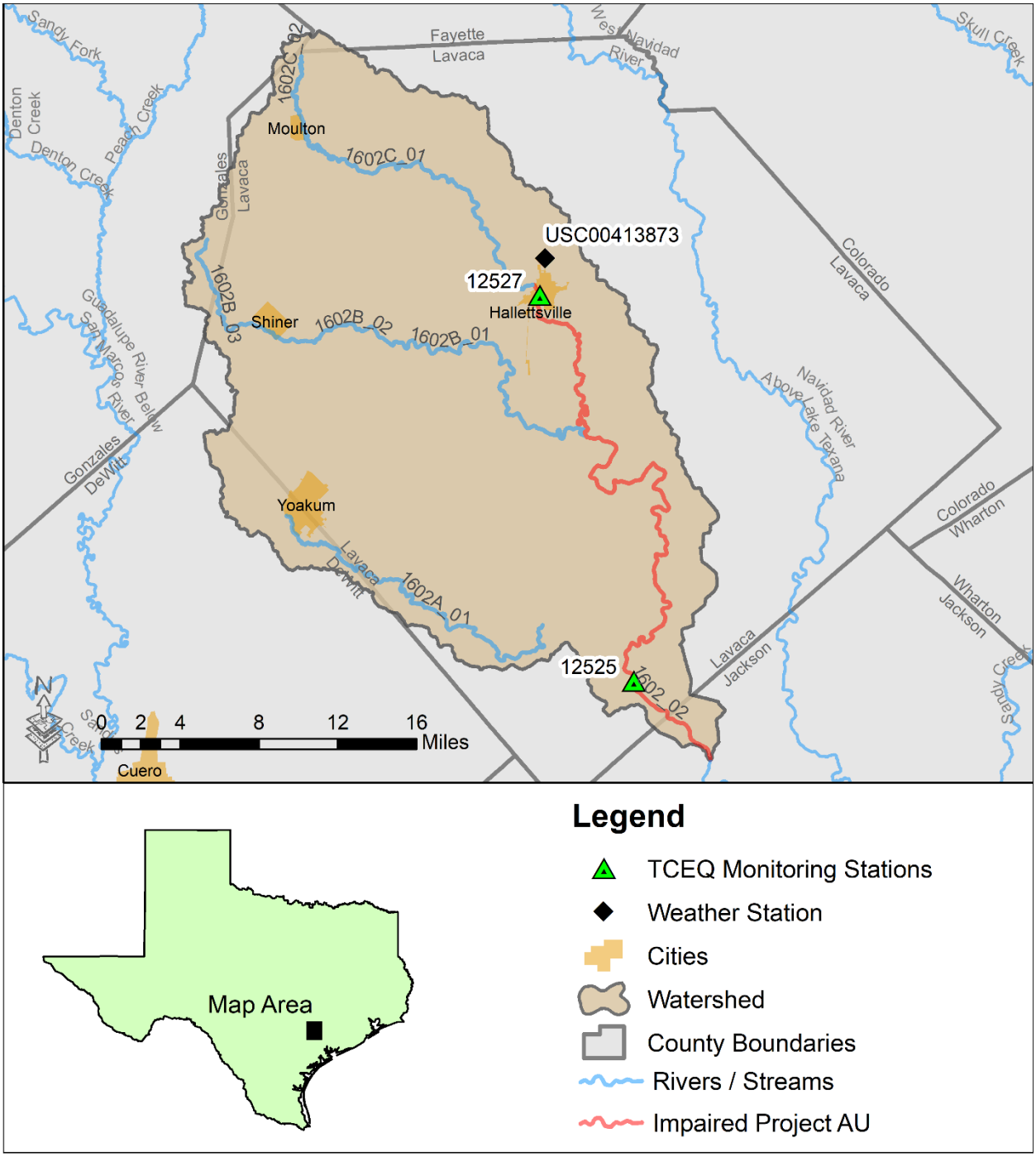

Figure VIII-2. AU 1602_02 watershed showing the TCEQ monitoring stations

Watershed Overview

The Lavaca River Above Tidal (Segment 1602) flows approximately 67 miles from the confluence of Campbell Branch west of Hallettsville in Lavaca County to Lavaca River Tidal (Segment 1601), 5.3 miles downstream of US 59 in Jackson County. This document addresses the contact recreation use impairment for the upstream AU of

Lavaca River Above Tidal (AU 1602_02). The total drainage area for the TMDL watershed is 587 square miles in Gonzales, DeWitt, Fayette, Jackson, and Lavaca counties.

The 2020 Texas Integrated Report (TCEQ, 2020) provides the following segment and AU descriptions:

- 1602 (Lavaca River Above Tidal) – From a point 8.6 kilometers (5.3 miles) downstream of US 59 in Jackson County to the confluence of Campbell Branch west of Hallettsville in Lavaca County.
    - AU 1602_02 – From the confluence of Beard Branch upstream to the upper end of segment at the confluence of Campbell Branch in Hallettsville.

Watershed Climate

Weather data were obtained for the 16-year period from January 2005 through December 2020 from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center Database. The City of Hallettsville weather station (USC00413873) located within the TMDL watershed area (Figure VIII-2) was used to retrieve the precipitation and temperature data from 2005 through 2020 (NOAA, 2020; Figure VIII-3). Data from this 16-year period indicate that the average monthly high temperature typically reaches a maximum of 97.1 °F in August, and the average monthly low temperature reaches a minimum of 42.9 °F in January. Annual rainfall averages 35.1 inches. The wettest month is May (3.8 inches), while February (1.8 inches) is the driest month, with rainfall occurring throughout the year.

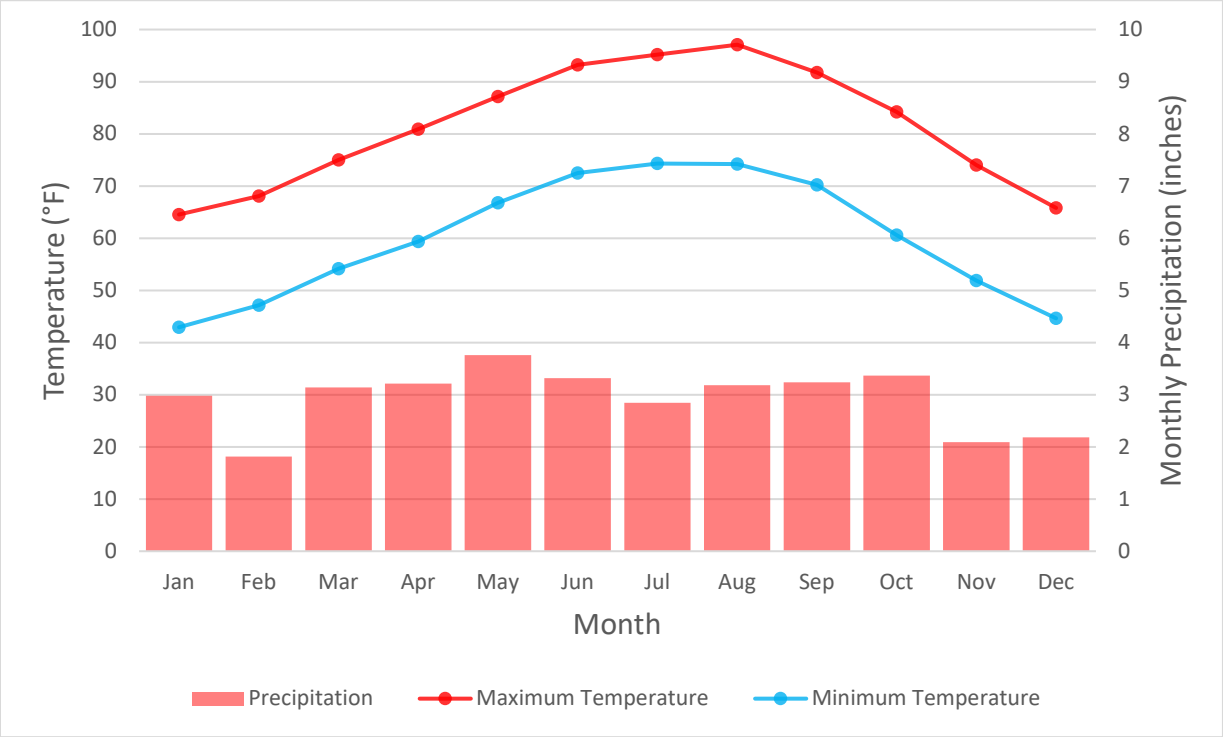

Figure VIII-3. Average monthly temperature and precipitation (2005–2020) at the City of Hallettsville weather station

Watershed Population and Population Projections

The TMDL watershed is primarily located in Lavaca County, with small portions of the watershed found in DeWitt, Fayette, Gonzales, and Jackson counties. According to the United States Census Bureau (USCB) 2010 Census (USCB, 2010), the TMDL watershed had an estimated population of 19,618 people in 2010.

Population projections in Table VIII-2 are estimated from the Texas Water Development Board (TWDB) 2021 Regional Water Plan Population and Water Demand Projection data (TWDB, 2019a; TWDB, 2019b; TWDB, 2019c) and historical population estimates (TWDB, 2017a; TWDB, 2017b).

Table VIII-2. Estimated 2020 population and 2070 population projection for the TMDL watershed

Area	*2020 Estimated Population*	*2070 Projected Population*	*Projected Population Increase*	*Percent Change*
Lavaca River Above Tidal (AU 1602_02) watershed	19,698	20,006	308	1.56%

The following steps detail the method used to estimate the 2020 and projected 2070 populations in the TMDL watershed.

1. The 2010 Census block population data were obtained for the five counties in the watershed (Gonzales, DeWitt, Fayette, Jackson, and Lavaca).
2. The 2010 watershed population was developed using the block level data for the portion of the five counties in the watershed.
3. For the census blocks that were partially located in the watershed, population was estimated by multiplying the block population to the proportion of its area in the watershed.
4. Lavaca County encompasses the majority of the watershed area and is expected to have no population growth (TWDB, 2019a).
5. The rural area population in DeWitt, Fayette, Gonzales, and Jackson counties only cover a small portion of the watershed population. The TWDB Population Projections by Regional Water Planning Group, regions K, L, and P, (TWDB, 2019b) provide projections for "County-Other" which were used to determine population projections for the rural areas in these counties.
6. The portion of City of Yoakum Water User Group (WUG) in DeWitt County has a projected population increase between 2010-2070 (TWDB, 2019c) and was used to estimate population projections in the City of Yoakum.
7. The 2010 populations for the above mentioned WUG (TWDB, 2017a) and "County-Other" (TWDB, 2017b) areas were obtained from historical population estimates provided by TWDB.
8. The projected percentage increases for the four "County-Other" areas in the watershed and the City of Yoakum were applied to their 2010 population estimates to obtain the decadal population projections for each of these areas in the watershed.
9. The projected population estimates obtained in Step 8 were summed and added to the static 2010 population of the rest of the Lavaca County in the watershed to obtain population projections for the watershed out to 2070.

Land Cover

The land cover data were obtained from the 2016 National Land Cover Database (NLCD; United States Geological Survey (USGS), 2019). The land cover for the TMDL watershed are shown in Figure VIII-4. A summary of the land cover data is provided in Table VIII-3 and indicates that the dominant land covers in the TMDL watershed are Hay/Pasture (60.15%), followed by Deciduous Forest (11.31%) and Shrub/Scrub (9.36%). The watershed is predominantly rural in land use, as only approximately 5% of the total watershed area is classified as Developed land cover (Open Space, Low Intensity, Medium Intensity, and High Intensity).

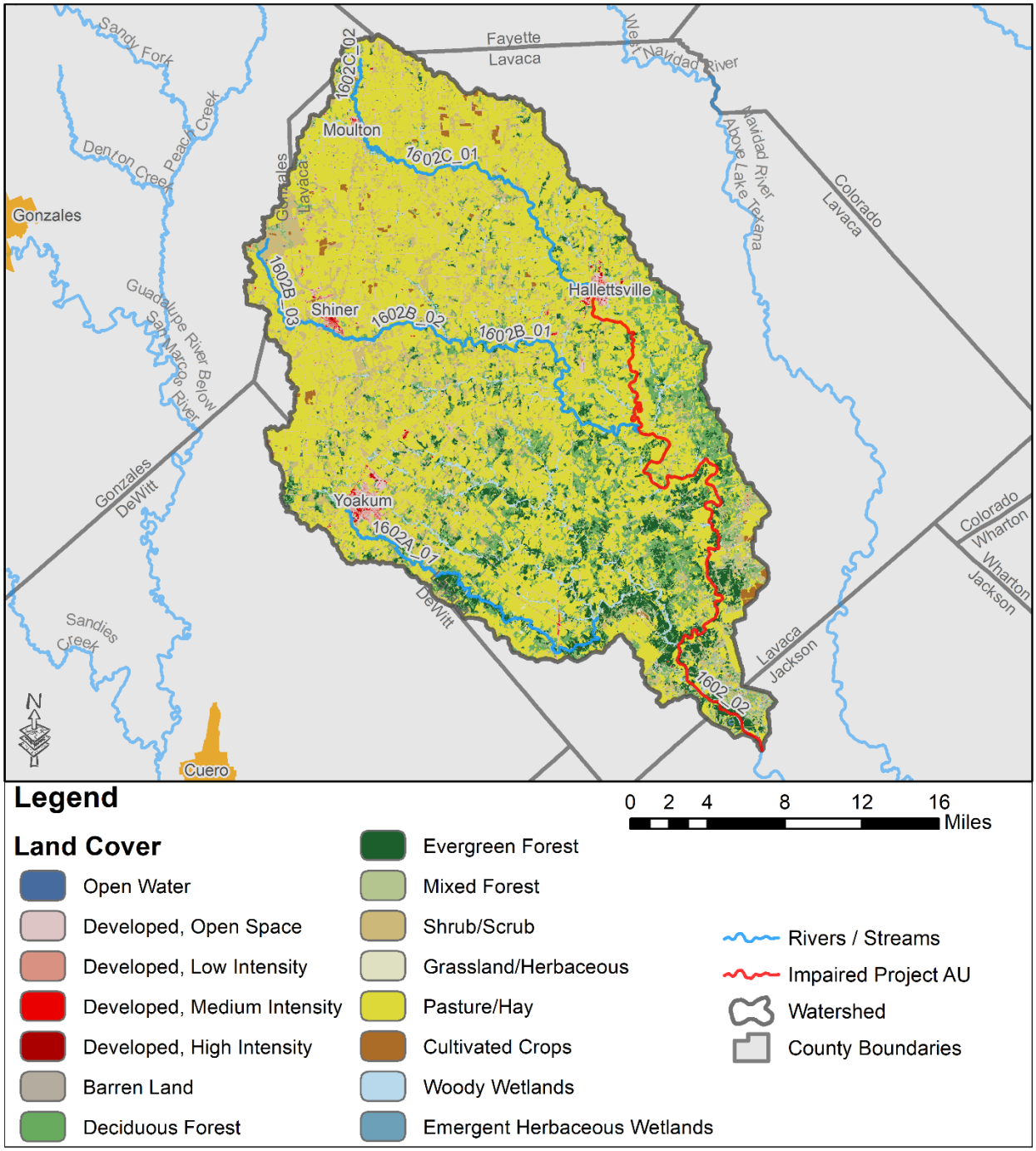

Figure VIII-4. 2016 land cover

Table VIII-3. Land cover summary

2016 NLCD Classification	*Area (Acres)*	*% of Total*
Open Water	813.52	0.22%
Developed, Open Space	14,462.32	3.85%
Developed, Low Intensity	3,016.76	0.80%
Developed, Medium Intensity	955.59	0.25%
Developed, High Intensity	346.69	0.09%
Barren Land	126.14	0.03%
Deciduous Forest	42,488.14	11.31%
Evergreen Forest	23,053.80	6.14%
Mixed Forest	13,811.38	3.68%
Shrub/Scrub	35,147.19	9.36%
Grassland/Herbaceous	1,860.07	0.50%
Pasture/Hay	225,978.32	60.15%
Cultivated Crops	2,635.24	0.70%
Woody Wetlands	10,347.83	2.75%
Emergent Herbaceous Wetlands	651.67	0.17%
Total	**375,694.64**	**100%**

Endpoint Identification

The endpoint for the TMDL is to maintain the concentration of *E. coli* below the geometric mean criterion of 126 cfu/100 mL, which is protective of the primary contact recreation 1 use in freshwater.

Source Analysis

Pollutants may come from several sources, both regulated and unregulated. Pollutants in regulated discharges, referred to as “point sources,” come from a single definable point, such as a pipe, and are regulated by permit under the TPDES program. WWTFs and stormwater discharges from industries, construction activities, and the separate storm sewer systems of cities are considered point sources of pollution.

Unregulated sources are typically nonpoint source in origin, meaning the pollutants originate from multiple locations and rainfall runoff washes them into surface waters. Nonpoint sources are not regulated by permit.

Except for WWTFs, which receive individual wasteload allocations (WLAs; see the Wasteload Allocation section), the regulated and unregulated sources in this section are presented to give a general account of the different sources of bacteria expected in the watershed. These are not meant to be used for allocating bacteria loads or interpreted as precise inventories and loadings.

Regulated Sources

Regulated sources are controlled by permit under the TPDES program. The regulated sources in the TMDL watershed include WWTF outfalls and stormwater discharges from industries and regulated construction activities.

Domestic and Industrial WWTFs

As of December 2020, there were four WWTFs with TPDES permits within the TMDL watershed (Table VIII-4 and Figure VIII-5). All the facilities treat solely domestic wastewater.

Table VIII-4.TPDES-permitted WWTFs discharging in the TMDL watershed

AU	*TPDES Number*	*NPDES[a] Number*	*Permittee*	*Outfall Number*	*Bacteria (E. coli) Limits (cfu/100 mL)*	*Primary Discharge Type*	*Daily Average Flow – Permitted Discharge (MGD)*
1602_02	WQ0010013001	TX0025232	City of Hallettsville	001	126	Treated domestic wastewater	0.8
1602C_02	WQ0010227001	TX0053287	City of Moulton	001	126	Treated domestic wastewater	0.242
1602B_02	WQ0010280001	TX0026042	City of Shiner	001	126	Treated domestic wastewater	0.85
1602A_01	WQ0010463001	TX0026034	City of Yoakum	001	126	Treated domestic wastewater	0.95

[a]NPDES: National Pollutant Discharge Elimination System

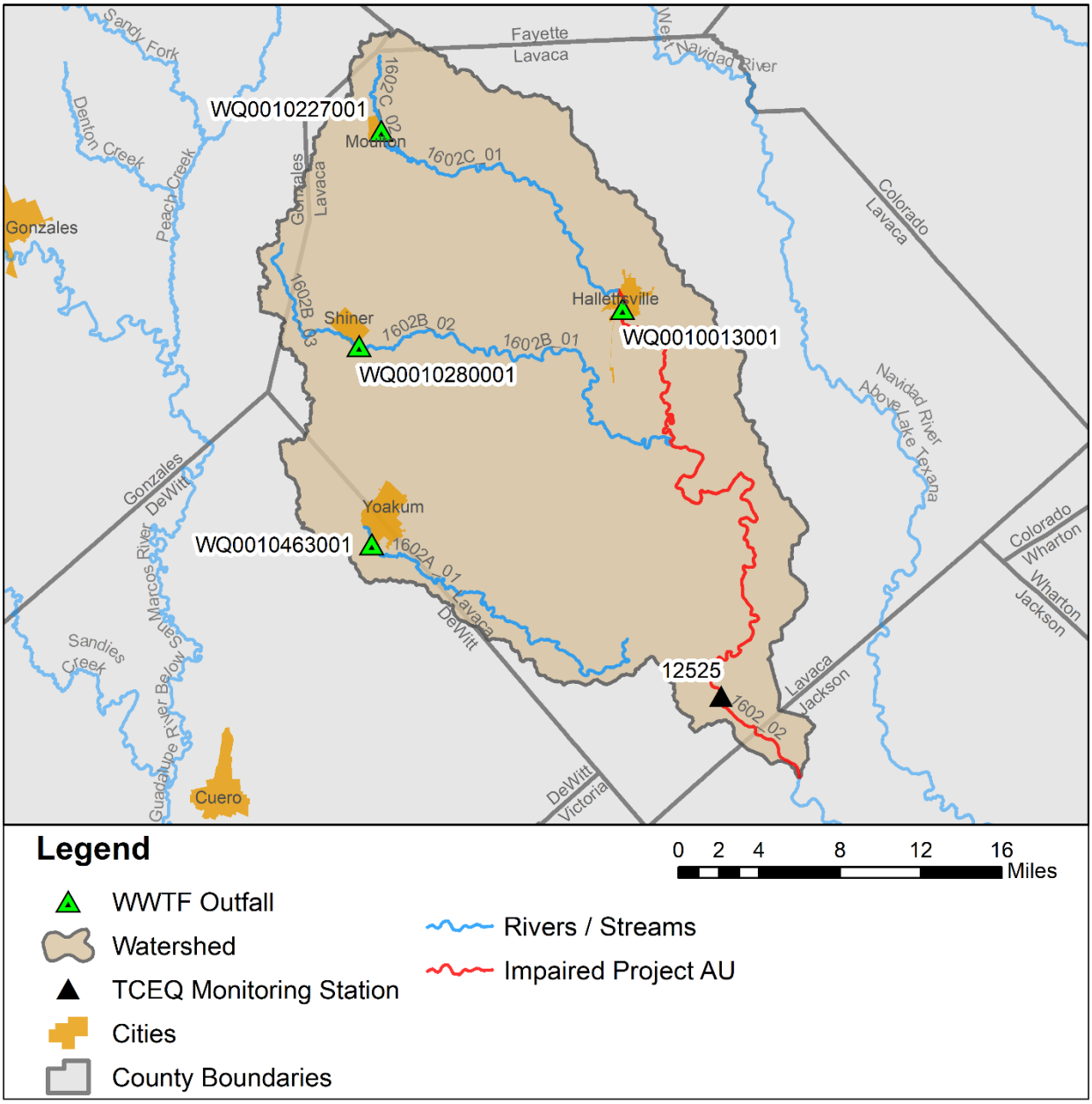

Figure VIII-5. WWTFs in the TMDL watershed

TCEQ/TPDES Water Quality General Permits

Certain types of activities are required to be covered by one of several TCEQ/TPDES wastewater general permits:

- TXG110000 – concrete production facilities
- TXG130000 – aquaculture production
- TXG340000 – petroleum bulk stations and terminals
- TXG640000 – conventional water treatment plants
- TXG670000 – hydrostatic test water discharges

- TXG830000 – water contaminated by petroleum fuel or petroleum substances
- TXG870000 – pesticides (application only)
- TXG920000 – concentrated animal feeding operations
- WQG100000 – wastewater evaporation
- WQG200000 – livestock manure compost operations (irrigation only)

A review of active general permit coverage (TCEQ, 2021a) in the TMDL watershed, as of December 2020, found two concrete production facilities covered by the general permit. The same review revealed one pesticide permittee covered by the general permit. These facilities and pesticide management areas do not have bacteria reporting requirements or limits in their permits. Pesticide application in the pesticide management areas is assumed to contain inconsequential amounts of indicator bacteria; therefore, it was unnecessary to allocate bacteria loads to them. No other active wastewater general permit authorizations were found in the TMDL watershed.

Sanitary Sewer Overflows

A summary of sanitary sewer overflow (SSO) incidents that occurred during a 12-year period from 2009 through 2020 in the TMDL watershed was obtained from TCEQ Region 14 Office and Central Office in Austin (TCEQ, 2019b; TCEQ, 2021b). The summary data indicated nine SSO incidents had been reported within the TMDL watershed. Two SSOs had unknown discharge volumes, while the other seven had a total discharge of 12,600 gallons with a minimum of 100 gallons and a maximum of 5000 gallons.

TPDES-Regulated Stormwater

When evaluating stormwater for a TMDL allocation, a distinction must be made between stormwater originating from an area under a TPDES-regulated discharge permit and stormwater originating from areas not under a TPDES-regulated discharge permit. Stormwater discharges fall into two categories:

1. Stormwater subject to regulation, which is any stormwater originating from TPDES-regulated municipal separate storm sewer system (MS4) entities, stormwater discharges associated with regulated industrial activities, and construction activities.
2. Stormwater runoff not subject to regulation.

Discharges of stormwater from a Phase II MS4 area, regulated industrial facility, construction area, or other facility involved in certain activities must be covered under the following TCEQ/TPDES general permits:

- TXR040000 – Phase II MS4 General Permit for small MS4s located in urbanized areas
- TXR050000 – Multi-sector General Permit (MSGP) for industrial facilities

- TXR150000 – Construction General Permit (CGP) for construction activities disturbing more than one acre or are part of a common plan of development disturbing more than one acre

A review of active stormwater general permit authorizations (TCEQ, 2021a) in the TMDL watershed as of February 27, 2021, found nine active MSGP authorizations within the watershed. A search of active, terminated, and expired CGP authorizations between January 2011 and December 2020 was conducted. On average 48.76 acres of land in the watershed were under CGP authorizations each year in the 10-year period.

The TMDL watershed does not include any active Phase II MS4 permits.

Illicit Discharges

Pollutant loads can enter water bodies from MS4 outfalls that carry authorized sources as well as illicit discharges under both dry- and wet-weather conditions. The term "illicit discharge" is defined in TPDES General Permit TXR040000 for Phase II or small MS4s as "Any discharge to a municipal separate storm sewer system that is not entirely composed of stormwater, except discharges pursuant to this general permit or a separate authorization and discharges resulting from emergency firefighting activities." Illicit discharges can be categorized as either direct or indirect contributions. The TMDL watershed does not include any area covered by active Phase II MS4 permits.

Unregulated Sources

Unregulated sources of bacteria are nonpoint and can originate from wildlife and feral hogs, various agricultural activities, agricultural animals, land application fields, urban runoff not covered by a permit, failing on-site sewage facilities (OSSFs), and domestic pets.

Unregulated Agricultural Activities and Domesticated Animals

A number of agricultural activities that do not require permits can be potential sources of fecal bacteria loading. Livestock are present throughout the more rural portions of the TMDL watershed.

Table VIII-5 provides estimated numbers of selected livestock in the TMDL watershed based on the 2017 Census of Agriculture conducted by U.S. Department of Agriculture (USDA, 2019). The county-level estimated livestock populations were reviewed by Texas State Soil and Water Conservation Board staff and were distributed based on GIS calculations of grazeable land (Pasture/Hay, Shrub/Scrub, and Grassland/Herbaceous) in the watershed, based on the 2016 NLCD. These livestock numbers, however, were not used to develop an allocation of allowable bacteria loading to livestock.

Table VIII-5. Estimated livestock populations

AU	Cattle and Calves	Goats	Sheep	Horses
1602_02	48,839	717	378	813

Fecal bacteria from dogs and cats is transported to streams by runoff in both urban and rural areas and can be a potential source of bacteria loading. Table VIII-6 summarizes the estimated number of dogs and cats within the TMDL watershed. Pet population estimates were calculated as the estimated number of dogs (0.614) and cats (0.457) per household (AVMA, 2018). The number of households in the TMDL watershed was estimated using 2010 Census data (USCB, 2010). The actual contribution and significance of bacteria loads from pets reaching the water bodies in the watershed is unknown.

Table VIII-6. Estimated households and pet population

Estimated Households	Estimated Dog Population	Estimated Cat Population
9,800	6,017	4,479

Wildlife and Unmanaged Animals

Fecal bacteria are common inhabitants of the intestines of all warm-blooded animals, including wildlife such as mammals and birds. In developing bacteria TMDLs, it is important to identify by watershed the potential for bacteria contributions from wildlife. Wildlife are naturally attracted to riparian corridors of water bodies. With direct access to the stream channel, the direct deposition of wildlife waste can be a concentrated source of bacteria loading to a water body. Fecal bacteria from wildlife are also deposited onto land surfaces, where they may be washed into nearby water bodies by rainfall runoff.

The Texas Parks and Wildlife Department (TPWD) provided deer population-density estimates by Deer Management Unit (DMU) and Ecoregion in the state (TPWD, 2020). The TMDL watershed lies within DMU 11 (Post Oak Savannah), with an average deer density of 21 acres per deer in the suitable land cover over the period 2005-2019. Based on 355,973.63 acres of suitable land in the watershed (land covers classified in the 2016 NLCD as Pasture/Hay, Shrub/Scrub, Grassland/Herbaceous, Cultivated Crops, Forests, Wetlands), there are an estimated 16,951 deer in the watershed.

AgriLife Extension (2012) estimates one hog per 39 acres of suitable land cover as a statewide average density of feral hogs. This density was applied to the suitable land in the watershed (land covers classified in the 2016 NLCD as Pasture/Hay, Shrub/Scrub, Grassland/Herbaceous, Cultivated Crops, Forests, Wetlands), resulting in an estimated 9,128 feral hogs in the watershed.

Onsite Sewage Facilities

Estimates of the number of OSSFs in the TMDL watershed were determined by using the 911 addresses that lie outside of the Certificates of Convenience and Necessity boundaries (Gregory et al., 2014). Residential and business locations were selected from the 911 address points by using aerial imagery data. These sources indicate that there are 4,045 OSSFs located within the TMDL watershed. The OSSF density is shown in Figure VIII-6. Several pathways of the liquid waste in OSSFs afford opportunities for bacteria to enter ground and surface waters, if the systems are not properly operating. Properly designed and operated, however, OSSFs would be expected to contribute virtually no fecal bacteria to surface waters.

Linkage Analysis

The load duration curve (LDC) method was used to examine the relationship between instream water quality and the source of indicator bacteria loads. Inherent to the use of LDCs as the mechanism of linkage analysis is the assumption of a one-to-one relationship between instream loadings and loadings originating from point sources as regulated and from the landscape as unregulated sources. Further, this one-to-one relationship was also inherently assumed when using the LDC to define the TMDL pollutant load allocation. The LDC method allows for estimation of TMDL loads by utilizing the cumulative frequency distribution of streamflow and measured pollutant concentration data (Cleland, 2003). In addition to estimating stream loads, this method allows for the determination of the hydrologic conditions under which impairments are typically occurring, can give indications of the broad origins of the bacteria (i.e., point or nonpoint source), and provides a means to allocate allowable loadings. The technical support document for this addendum (Jain and Schramm, 2021) provides details about the linkage analysis along with the LDC method and its application.

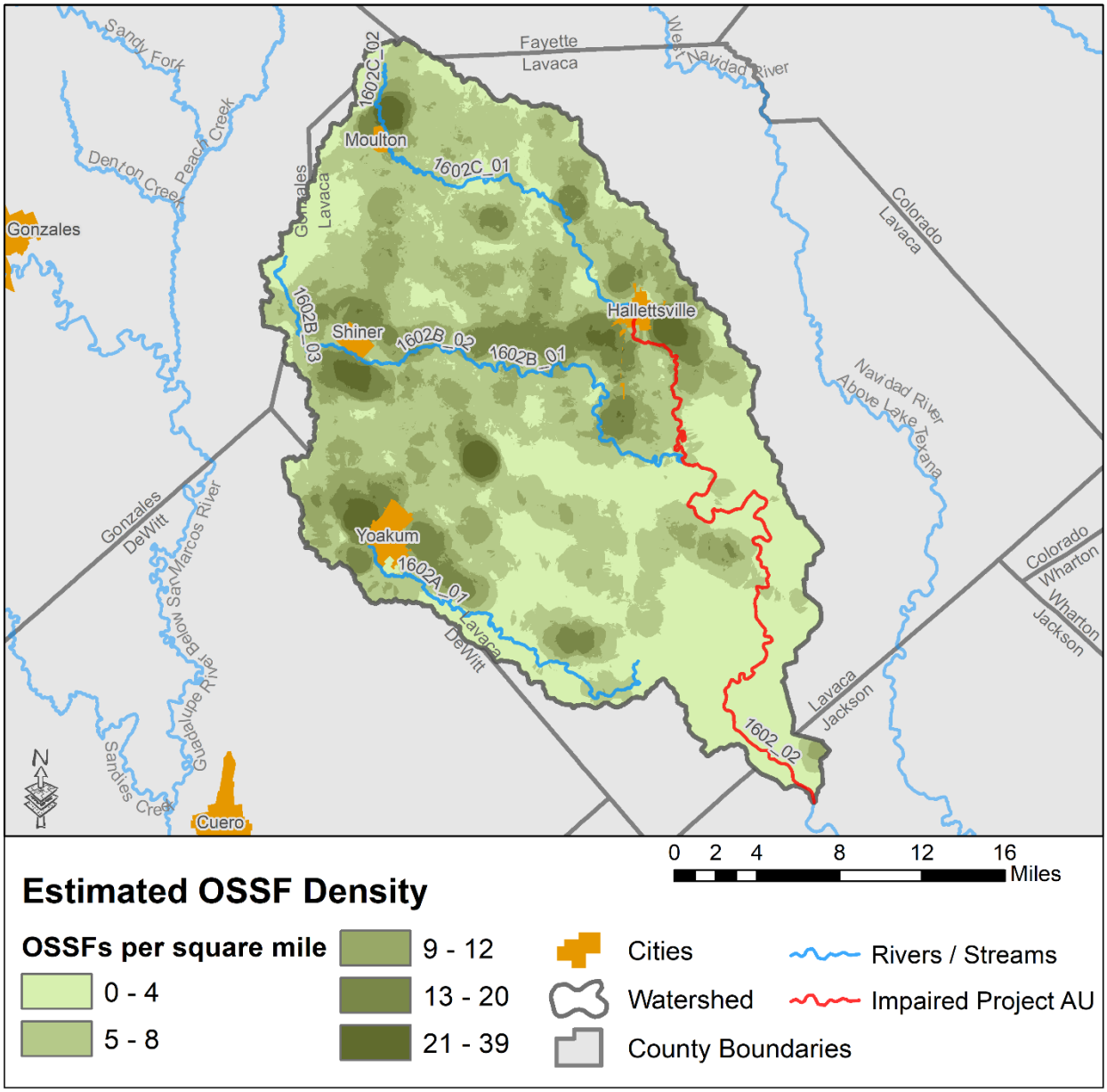

Figure VIII-6. OSSF density

The *E. coli* data plotted on the LDC for TCEQ Station 12525 in Figure VIII-7 show exceedances of the geometric mean criterion primarily occur under High Flows, Moist Conditions, Mid-range Flows, and Dry Conditions. However, bacteria loads are most elevated under the High Flows regime. Loadings fall below the geometric mean criterion under the Low Flows regime. The allowable load at the single sample criterion (399 cfu/100 mL) is included on the LDC for comparison with individual *E. coli* samples, although it is not used for assessment or allocation purposes.

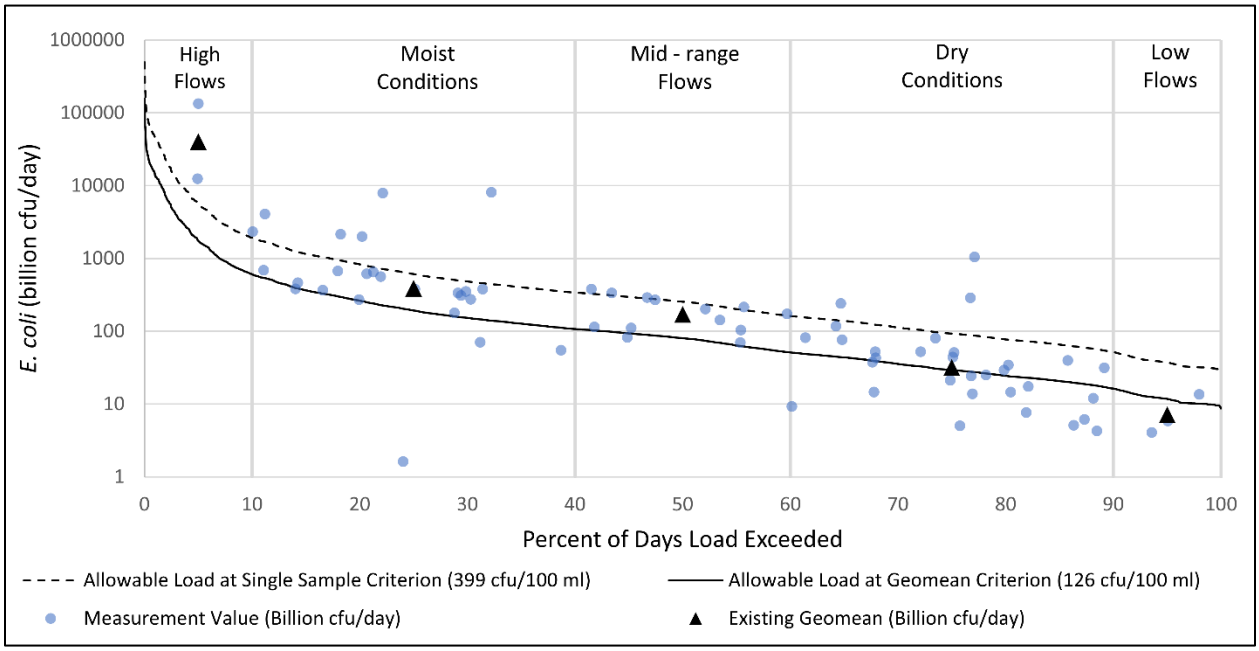

Figure VIII-7. LDC at SWQM station 12525

Margin of Safety

The margin of safety (MOS) is designed to account for any uncertainty that may arise in specifying water quality control strategies for the complex environmental processes that affect water quality. Quantification of this uncertainty, to the extent possible, is the basis for assigning an MOS. The TMDL in this report incorporates an explicit MOS of 5% of the total TMDL allocation.

Pollutant Load Allocation

The TMDL represents the maximum amount of a pollutant that the stream can receive in a single day without exceeding water quality standards. The pollutant load allocations for the selected scenarios were calculated using the following equation:

TMDL = WLA + LA + FG + MOS

Where:

WLA = wasteload allocations, the amount of pollutant allowed by regulated dischargers

LA = load allocations, the amount of pollutant allowed by unregulated sources

FG = loadings associated with future growth from potential regulated facilities

MOS = margin of safety load

AU-Level TMDL Calculation

To be consistent with previously completed TMDLs in the original watershed, the TMDL for Lavaca River Above Tidal AU 1602_02 was derived using the median flow within the High Flows regime (or 5% flow) of the LDC developed for TCEQ Station 12525. This station represents the location within Lavaca River Above Tidal AU 1602_02 where an adequate number of *E. coli* samples was collected.

Margin of Safety Calculation

The TMDL in this report incorporates an explicit MOS of 5%.

Wasteload Allocation

The WLA is the sum of loads from regulated sources, which are WWTFs and regulated stormwater.

Wastewater Treatment Facilities

TPDES-permitted WWTFs are allocated a daily wasteload (WLA_{WWTF}) calculated as their full permitted discharge flow rate multiplied by the instream geometric mean criterion. Table VIII-7 presents the WLA for each WWTF and the resulting total allocation for the AU within the TMDL watershed.

Table VIII-7. WLAs for TPDES-permitted facilities

AU	*TPDES Number*	*Permittee*	*Bacteria Limit (cfu/100 mL)*	*Full Permitted Flow (MGD)*	*WLA_{WWTF} (billion CFU/day)*
1602_02	WQ0010013001	City of Hallettsville	126	0.8	3.816
1602C_02	WQ0010227001	City of Moulton	126	0.242	1.154
1602B_02	WQ0010280001	City of Shiner	126	0.85	4.054
1602A_01	WQ0010463001	City of Yoakum	126	0.95	4.531
			Total	**2.842**	**13.555**

Regulated Stormwater

Stormwater discharges from MS4, industrial, and construction areas are also considered regulated point sources. Therefore, the WLA calculations must also include an allocation for regulated stormwater discharges (WLA_{SW}). The percentage of the land area included in the TMDL watershed that is under the jurisdiction of stormwater permits is used to estimate the amount of the overall runoff load that should be allocated as the permitted stormwater contribution in the WLA_{SW} component.

The TMDL watershed does not contain any MS4 permits. Acreages associated with MSGP authorizations (155.66 acres), CGP authorizations (48.76 acres), and concrete production facilities (4.55 acres) were calculated using aerial imagery by measuring the estimated disturbed area at each facility location (or the “area disturbed” listed for CGP

authorizations). The percentage of land under the jurisdiction of stormwater permits in the TMDL watershed is 0.06%.

Load Allocation

The load allocation (LA) component of the TMDL corresponds to runoff or direct deposition from unregulated sources.

Allowance for Future Growth

The future growth (FG) component of the TMDL equation addresses the requirement of TMDLs to account for future loadings that might occur as a result of population growth, changes in community infrastructure, and development. Specifically, this TMDL component takes into account the probability that new flows from WWTF discharges may occur in the future. The assimilative capacity of water bodies increases as the amount of flow increases. The allowance for FG in this TMDL report will result in protection of existing uses and conform to Texas' antidegradation policy.

The FG component of the TMDL watershed was based on population projections and current permitted wastewater dischargers for the entire TMDL watershed. Because of the uneven distribution of projected population growth within the TMDL watershed, FG was not based on the total watershed population growth presented in Table VIII-2. Three of the WWTFs (City of Moulton, City of Shiner, and City of Hallettsville) are not projected to be affected by population growth between 2020 and 2070, while the City of Yoakum is projected to have a population growth in the portion located in the DeWitt County. Therefore, the future growth is estimated for the City of Yoakum WWTF based on its projected population change of 3.07% within the TMDL watershed for the time period 2020-2070. In addition, the original TMDL included an estimate for a potential WWTF within the Rocky Creek watershed which is located within the TMDL watershed. It was estimated to serve half of the population in the Rocky Creek watershed that are currently not connected to the City of Shiner WWTF. The discharge was estimated by multiplying the estimated population served by 100 gallons per capita per day and converted to MGD. This FG estimation procedure is also included here to ensure consistency with the FG term calculated for the upstream AU 1602B_01 calculated in the previous TMDL. Together these yield a value of 0.2166 MGD of future additional permitted discharge from WWTFs.

FG of existing or new point sources is not limited by this TMDL as long as the sources do not cause bacteria to exceed the limits. The assimilative capacity of water bodies increases as the amount of flow increases. Consequently, increases in flow allow for increased loadings. The LDC and tables in this TMDL report will guide determination of the assimilative capacity of the water body under changing conditions, including FG.

Summary of TMDL Calculations

Table VIII-8 summarizes the TMDL calculations for the TMDL watershed. The TMDL was calculated based on the median flow in the 0-10 percentile range (5% exceedance, High Flows regime) from the LDC developed for the TCEQ Station 12525. Allocations are based on the current geometric mean criterion for *E. coli* of 126 cfu/100 mL for each component of the TMDL.

Table VIII-8. TMDL allocation summary for AU 1602_02

All loads expressed as billion cfu/day *E. coli*

Water Body	*AU*	*TMDL*	*MOS*	*WLA$_{WWTF}$*	*WLA$_{SW}$*	*LA*	*FG*
Lavaca River Above Tidal	1602_02	1742.889	87.144	13.555	0.985	1640.172	1.033

The final TMDL allocations (Table VIII-9) needed to comply with federal requirements include the FG component within the WLA$_{WWTF}$ (40 CFR Section 103.7).

Table VIII-9. Final TMDL allocation for AU 1602_02

All loads expressed as billion cfu/day *E. coli*

Water Body	*AU*	*TMDL*	*MOS*	*WLA$_{WWTF}$*	*WLA$_{SW}$*	*LA*
Lavaca River Above Tidal	1602_02	1742.889	87.144	14.588	0.985	1640.172

Seasonal Variation

Federal regulations require that TMDLs account for seasonal variation in watershed conditions and pollutant loading [40 CFR Section 130.7(c)(1)]. Analysis of the seasonal differences in indicator bacteria concentrations were assessed by comparing *E. coli* concentrations obtained from 16 years (2005 through 2020) of routine monitoring data collected in the warmer months (May-September) against those collected during cooler months (November-March). The months of April and October were considered transitional between warm and cool seasons and were excluded from the seasonal analysis. Differences in seasonal concentrations were then evaluated with a Wilcoxon Rank Sum test (also known as the "Mann-Whitney" test). The analysis of *E. coli* data for the SWQM station 12525 indicated that there was no significant difference in indicator bacteria between the cool and warm weather seasons ($W = 242.5$, $p = 0.5794$) for the Lavaca River Above Tidal AU 1602_02. Seasonal variation was also addressed by using all available flow and *E. coli* records (covering all seasons) from the period of record used in LDC development for this project.

Public Participation

TCEQ maintains an inclusive public participation process. From the inception of TMDL development, the project team sought to ensure that stakeholders were informed and

involved. Communication and comments from the stakeholders in the watershed strengthen TMDL projects and their implementation.

The technical support document for this TMDL addendum (Jain and Schramm, 2021) was published on the TCEQ website on October 15, 2021. Project staff presented information about this addendum at the annual meeting of the Lavaca River Clean Rivers Program near Edna, Texas (held in person and online) on July 20, 2021. The public had an opportunity to comment on this addendum during the public comment period (February 11 through March 15, 2022) for the WQMP update in which this addendum is included. Notice of the public comment period for this addendum was emailed to stakeholders and posted on the TCEQ's TMDL Program TMDL Program News webpage.[c] Notice of the comment period, along with the document, was also posted on the WQMP Updates webpage.[d] TCEQ accepted public comments on the original TMDL report from February 1 through March 5, 2019. No comments were submitted.

Implementation and Reasonable Assurance

The AU covered by this addendum is within the existing bacteria TMDL watershed for Lavaca River Above Tidal and Rocky Creek. That TMDL watershed, including Lavaca River Above Tidal AU 1602_02, is within the area covered by the implementation plan (I-Plan) developed by stakeholders for the TMDL watershed, which was approved by the Commission on August 14, 2019. The I-Plan outlines an adaptive management approach in which measures are assessed annually by the stakeholders for efficiency and effectiveness. The iterative process of evaluation and adjustment ensures continuing progress toward achieving water quality goals and expresses stakeholder commitment to the process. Please refer to the original TMDL document for additional information regarding implementation and reasonable assurance.

[c] www.tceq.texas.gov/waterquality/tmdl/tmdlnews.html

[d] www.tceq.texas.gov/permitting/wqmp/WQmanagement_updates.html

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