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FINAL

October 2017 Update to the Texas Water Quality Management Plan

TCEQ

October 2017 Update to the Texas Water Quality Management Plan

Prepared by the
Office of Water
Water Quality Division

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WQMP updates are also available on the TCEQ web site at:

< *http://www.tceq.texas.gov/permitting/wqmp/WQmanagement_updates.html* >

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

Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

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Texas Commission on Environmental Quality

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Introduction

The Texas Water Quality Management Plan (WQMP) is the product of a wastewater treatment facility 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. The 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 ground water 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 its public participation process, certification by the 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 water quality management plans remain in effect.

The October 2017 WQMP update addresses the following topics:

1. Projected Effluent Limits Updates for water quality planning purposes
2. Service Area Population for Municipal Wastewater Facilities
3. Designation of Management Agencies for Municipal Wastewater Facilities
4. Total Maximum Daily Load Updates

[1] A formal definition for a water quality management plan is found in 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, and 10/2017.

The public comment period for the October WQMP update was from November 10, 2017 through December 12, 2017.

The Projected Effluent Limit Update section provides information compiled from August 1, 2017 through October 31, 2017, and is based on water quality standards, and may be used for water quality planning purposes in Texas Pollutant Discharge Elimination System (TPDES) permit actions.

The Service Area Population and Designation of Management Agency sections for municipal wastewater facilities has been developed and evaluated by the TCEQ in cooperation with the Texas Water Development Board (TWDB) and regional water quality management planning agencies.

The Total Maximum Daily Load (TMDL) Update section provides information on proposed wasteload allocations for new dischargers and revisions to existing TMDLs and has been developed by the Water Quality Planning Division, TMDL Program.

Projected Effluent Limit Updates

Table 1 reflects proposed effluent limits for new dischargers and preliminary revisions to original proposed effluent limits for preexisting dischargers (MGD-Million Gallons per Day, $CBOD_5$ – 5 Day Carbonaceous Biochemical Oxygen Demand, NH_3-N – Ammonia-Nitrogen, BOD_5 – 5 Day Biochemical Oxygen Demand and DO – Dissolved Oxygen).

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 water quality standards (WQS) effective at the time of the TCEQ production of this update. 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 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
10024-003	1209	TX0093262	City of College Station Brazos	5.0	10	417.00	2	83.40			6	
10766-003	1011	TX0137758	City of Cleveland Liberty	0.100	10	8.34	3	2.50			4	
14141-001	1008	TX0120073	Aqua Texas, Inc. Montgomery	0.675	10	56.30	3	16.89			4	
14273-001	0202	TX0023299	City of Savoy Fannin	0.150	10	12.51	3	3.75			4	
14577-001	0820	TX0127345	City of Lavon Collin	0.75	5	31.28	1.6	10.01			6	
15596-001	1009	TX0137898	Harris County MUD No. 418 Harris	0.65	10	54.21	2	10.84			4	
15597-001	0801	TX0137901	River Ranch Holdings, LLC Liberty	0.450	10	37.53	3	11.26			4	

Planning Information Summary

The Water Quality Planning Division of the TCEQ coordinated with the TWDB and regional planning agencies to compile the wastewater facility information in this section. Domestic facility financing decisions under the State Revolving Loan Fund (SRF) program must be consistent with the certified and approved WQMP.

The purpose of this section is to present data reflecting facility planning needs, including previous water quality management plan needs requiring revision. Data are also presented to update other plan information for the TWDB's SRF projects. Table 2 contains the updated Service area population information. The table is organized in alphabetical order and includes the following 10 categories of information:

1. *Planning Area* – Area for which facility needs are proposed. The facility planning areas are subject to change during the facility planning process and any such changes will be documented in a later water quality management plan update. All planning areas listed are also designated management agencies (DMAs) unless otherwise noted in the "Comments" column.

2. *Service Area* – Area that receives the provided wastewater service.

3. *Needs* – A "T" indicates a need for either initial construction of a wastewater treatment plant, additional treatment capacity, or the upgrading of a wastewater treatment plant to meet existing or more stringent effluent requirements. A "C" indicates a need for improvements to, expansion of, rehabilitation of, or the initial construction of a wastewater collection system in the facility planning area. "T/C" indicates a need for both treatment and collection system facilities. More detailed facility planning conducted during a construction project may define additional needs and those needs will be reflected in a future update to the WQMP.

4. *Needs Year* – The year in which the needs were identified for the planning area.

5. *Basin Name* – The river basin or designated planning area where the entity is located. The seven water quality management planning areas designated by the Governor are Corpus Christi [Coastal Bend Council of Governments (CBCOG)], Killeen-Temple [Central Texas Council of Governments (CTCOG)], Texarkana [Ark-Tex Council of Governments (ATCOG)], Southeast Texas [South East Texas Regional Planning Council (SETRPC)], Lower Rio Grande Valley [Lower Rio Grande Valley Development Council (LRGVDC)], Dallas-Fort Worth [North Central Texas Council of Governments (NCTCOG)] and Houston [Houston-Galveston Area Council (H-GAC)]. Basin names are shown for agencies outside one of these areas.

6. *Segment* – The classified stream segment or tributary into which any recommended facility may discharge existing or projected wastewater. In the case of no-discharge facilities, this is the classified stream segment drainage area in which the facilities are located.

7. *County* – The county in which the facility planning area is located.

8. *Date* – The date the planning information was reviewed by the TCEQ.

9. *Comments* – Additional explanation or other information concerning the facility planning area.

10. *Population* – The base year and projected populations for each facility planning area. Population projections presented are consistent with the latest available statewide population projections or represent the most current information obtained from facility planning analyses.

The facility information in this section is intended to be utilized in the preparation of facility plans and the subsequent design and construction of wastewater facilities. Design capacities of the treatment and collection systems will be based upon the population projections contained in this document plus any additional needed capacity established for commercial/industrial flows and documented infiltration/inflow volumes (treatment or rehabilitation). The probable needs shown under the "Needs" heading are preliminary findings; specific needs for an area shall be as established in the completed and certified detailed engineering studies conducted during facility planning under the SRF and other state loan programs.

Specific effluent quality for any wastewater discharges resulting from any of the facilities recommended in this document will be in accordance with the rule on the Texas Surface Water Quality Standards in effect at the time of permit issuance for the specific facility.

Table 2. Service Area Population Updates

Planning Agency	Service Area	Needs	Needs Year	Basin Name / COG	Segment	County	WQMP Date	Comments	Year	Population
City of Farwell	City Service Area	T	2018	Brazos River Basin	N/A	Parmer	10/6/2017	WWTP improvements. This project is not located on a river segment, and required a groundwater review.	2017	1,363
									2020	1,363
									2030	1,363
									2040	1,363
City of Savoy	Certificate of Convenience and Necessity Boundaries	T	2018	Red River Basin	0202	Fannin	9/28/2017	WWTP Improvements	2017	831
									2020	924
									2030	1,016
									2040	1,086
San Antonio River Authority (SARA)	District Boundaries	T	2018	San Antonio River Basin	1902	Bexar	9/15/2017	WWTP Improvements	2016	683
									2020	3,285
									2030	16,473
									2040	30,330

Designated Management Agencies

In order to be designated as a management agency for wastewater collection or treatment, an entity must demonstrate the legal, institutional, managerial and financial capability necessary to carry out the entity's responsibilities in accordance with Section 208 (c) of the Clean Water Act (see below list of requirements). Before an entity can apply for a state revolving fund loan, it must be recommended for designation as the management agency in the approved WQMP. Designation as a management agency does not require the designated entity to provide wastewater services, but enables it to apply for grants and loans to provide the services. The facilities listed in Table 3 have submitted Designated Management Agencies (DMA) resolutions to the TCEQ. The TCEQ submits this DMA information to the EPA for approval as an update to the WQMP.

Section 208 (c) (2) Requirements for Management Agency:

208(c)(2)(A): to carry out portions of an area-wide waste treatment plan.
208(c)(2)(B): to manage waste treatment works.
208(c)(2)(C): directly or by contract to design and construct new works.
208(c)(2)(D): to accept and utilize grants.
208(c)(2)(E): to raise revenues, including assessment of waste treatment charges.
208(c)(2)(F): to incur short and long term indebtedness.
208(c)(2)(G): to assure community pays proportionate cost.
208(c)(2)(H): to refuse to receive waste from non-compliant dischargers.
208(c)(2)(I): to accept for treatment industrial wastes.

Table 3. Designated Management Agencies

Planning Agency	Service Area	DMA Needs	DMA Date	DMA Comments
City of Farwell	City Service Area	T	4/18/2017	This project is conditionally in conformance as proposed. However, if the proposed holding pond is located over the preexisting closed landfill, it will need to be relocated.
City of Savoy	Certificate of Convenience and Necessity boundaries	T	9/28/2017	Original application was found to be in non-conformance. Since then, a permit amendment has been submitted and approved. The project is now in conformance with the WQMP.
San Antonio River Authority (SARA)	District Boundaries	T	5/17/2017	

Total Maximum Daily Load Updates

The Total Maximum Daily Load (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, the State develops an implementation plan with wasteload allocations for point source dischargers to mitigate anthropogenic (human-caused) sources of pollution within the watershed and restore full use of the water body.

The development of TMDLs is a process of intensive data collection and analysis. After adoption by the TCEQ, TMDLs are submitted to the EPA for review and approval.

The attached appendices may reflect proposed wasteload allocations for new dischargers and revisions to TMDLs. To be consistent, updates will be provided in the same units of measure used in the original TMDL document. Also note that for bacteria TMDLs, loads may be expressed in counts per day, organisms per day, colony forming units per day, or similar expressions. These typically reflect different lab methods, but for the purposes of the TMDL program, these terms are considered synonymous.

<u>Appendix I.</u> 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

TMDL Updates to the Water Quality Management Plan (WQMP): Watersheds Upstream of Lake Houston (1004E, 1008, 1008H, 1009, 1009C, 1009D, 1009E, 1010, and 1011)

The document *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 the TCEQ on 04/06/11 and approved by EPA on 06/29/11, and became an update to the state's WQMP. Twenty-two subsequent WQMP updates prior to this one have updated the list of individual wasteload allocations (WLAs) found in the original TMDL document. Additionally, an addendum to the original TMDL was submitted through the October 2013 WQMP update. This addendum added six new assessment units (AUs) to the original TMDL project.

The purpose of this update is to make the following changes to the TMDL, presented in Table 1:

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

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 in eight AUs. This was originally presented in Table 18 in the original TMDL document, and the eight affected AUs are included here as Table 2.

For AU 1009_01, 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 $WLA_{StormWater}$ and load allocation (LA) terms. A small amount 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. This results in no change 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 future growth within each AU. Because a small amount of loading was moved from the $WLA_{StormWater}$ and LA terms to be used for future growth for AU 1009_01, that AU is updated in Table 3. These overall numbers for the other AUs did not change, and again this results in no change to the overall TMDL allocation.

Table 1 – Changes to Individual Wasteload Allocations (Updates Table 16, pp. 49-56 in the TMDL document.)

State Permit Number	Outfall	EPA Permit Number	Segment Number	Permittee Name	Flow (MGD)	Waste Load Allocation (WLA) – *E. coli* in Billion MPN/day	TMDL Comments
14141-001	001	TX0120073	1008E_01	AQUA TEXAS, INC.	0.675	1.610	Increased discharge
14421-001	001	TX0125687	1008H_01	HARRIS COUNTY MUD NO. 401	0.45	1.073	Decreased discharge
14610-001	001	TX0127850	1008H_01	SOUTH CENTRAL WATER COMPANY	NA	NA	Permit canceled
15596-001	001	TX0137898	1009_01	HARRIS COUNTY MUD NO. 418	0.65	1.550	New permit
10766-003	001	TX0137758	1011_01	CITY OF CLEVELAND	0.1	0.238	New permit

Table 2 - *E. coli* TMDL Summary Calculations for Lake Houston Assessment Units (Updates Table 18, pp. 61 in the TMDL document.)

Assessment Unit	Sampling Location	Stream Name	TMDL (Billion MPN/day)	WLA_{WWTF} (Billion MPN/day)	$WLA_{StormWater}$ (Billion MPN/day)	LA (Billion MPN/day)	MOS (Billion MPN/day)	Future Growth (Billion MPN/day)
1008_03	11313	Spring Creek	1420	98.98	322	869	70.9	59.12
1008_04	11312	Spring Creek	1510	134.65	334	902	75.7	63.65
1008H_01	11185	Willow Creek	166	16.51	51.1	67.8	8.28	22.31
1009_01	11333	Cypress Creek	227	19.03	82.47	113.93	11.4	0.17
1009_02	11331	Cypress Creek	615	87.00	196	270	30.8	31.20
1009_03	11328	Cypress Creek	1340	172.45	415	574	67.0	111.55
1009_04	11324	Cypress Creek	1550	210.97	469	648	77.4	144.63
1011_02	17746	Peach Creek	422	4.46	34.5	348.5	21.1	13.44

Table 3 – *E. coli* TMDL Final Calculations for Lake Houston Assessment Units (Updates Table 19, pp. 62 in the TMDL document.)

Assessment Unit	TMDL (Billion MPN/day)	WLA_{WWTF} (Billion MPN/day)	$WLA_{StormWater}$ (Billion MPN/day)	LA (Billion MPN/day)	MOS (Billion MPN/day)
1009_01	227	19.20	82.47	113.93	11.4

In addition, Table 4 below provides an update to Table 11 found in the October 2013 addendum to this TMDL project (*Addendum One to Fifteen Total Maximum Daily Loads for Indicator Bacteria in Watersheds Upstream of Lake Houston: Six Additional Total Maximum Daily Loads for Indicator Bacteria in Watersheds Upstream of Lake Houston For Segments 1008B, 1008C, 1008E, and 1011 Assessment Units 1008B_01, 1008B_02, 1008C _01, 1008C_02, 1008E_01, and 1011_01*). One of the new permits discussed earlier in this update also affects an AU in this addendum. The permit with an increased discharge affects an additional AU in this this addendum.

Table 5 below provides updates to Table 12 found in the October 2013 addendum to this TMDL project. The addendum added six AUs that were not included in the original TMDL. Five of these (1008B_01, 1008B_02, 1008C_01, 1008C_02, and 1008E_01) were lumped together as contributing loading to 1008_03 and 1008_04 in the original TMDL. The sixth additional AU (1011_01) was treated as an upstream contributing load to 1011_02 in the original TMDL. The permit for one new facility (10766-003/ TX0137758) affects the loadings of both 1011_01 as well as the original TMDL AU 1011_02. The permit for an increased discharge from one facility (14141-001/ TX0120073) affects the loadings of both 1008E_01 as well as the original TMDL AUs 1008_03 and 1008_04.

Table 4 – Changes to Individual Waste Load Allocations and Permittee Names (Updates Table 11, p. 23 in the TMDL Addendum document.)

State Permit Number	Outfall	EPA Permit Number	Segment Number	Permittee Name	Flow (MGD)	Waste Load Allocation (WLA) – *E. coli* in Billion MPN/day	TMDL Comments
14141-001	001	TX0120073	1008E_01	AQUA TEXAS, INC.	0.675	1.610	Increased discharge
10766-003	001	TX0137758	1011_01	CITY OF CLEVELAND	0.1	0.238	New permit

Table 5 – E. coli TMDL Summary for Impaired AUs of the Addendum (Updates Table 12, p. 26 in the TMDL Addendum document.) Loads are in billion MPN/day.

AU	Stream Name	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA_{AU}	LA_{RES}	LA_{TOTAL}	Future Growth
1008E_01	Bear Branch	91.1	4.56	1.84	75.22	8.98	0	8.98	0.50
1011_01	Peach Creek	214.1	10.7	1.05	3.05	198.1	0	198.1	1.20

In Table 13 of the TMDL addendum, the WLAs for permitted facilities are the sum of the individual WLAs and the allowance for future growth within each assessment unit. Therefore, these overall numbers did not change, and Table 13 of the TMDL addendum remains the same.

Appendix II. Addendum One to Two Total Maximum Daily Loads for Indicator Bacteria in the Tidal Segments of the Mission and Aransas Rivers

Two Total Maximum Daily Loads for Indicator Bacteria in Aransas River Above Tidal and Poesta Creek

For Segments 2004 and 2004B
Assessment Units 2004_02 and 2004B_02

Introduction

The Texas Commission on Environmental Quality (TCEQ) adopted *Two Total Maximum Daily Loads for Indicator Bacteria in the Tidal Segments of the Mission and Aransas Rivers: Segments 2001 and 2003* (TCEQ, 2016a) on May 25, 2016. The total maximum daily loads (TMDLs) were approved by the United States Environmental Protection Agency (EPA) on August 9, 2016. This document represents an addendum to the original TMDL document.

This addendum includes information specific to two additional assessment units (AUs) located within the watershed of the approved TMDL project for bacteria in tidal segments of the Mission and Aransas Rivers. Concentrations of indicator bacteria in these AUs exceed the criteria used to evaluate attainment of the water quality standard for contact recreation. This addendum presents the new information associated with the two additional AUs. For background or other explanatory information, please refer to the *Technical Support Document for Total Maximum Daily Loads for Indicator Bacteria in Aransas River Above Tidal and Poesta Creek: Segments 2004 and 2004B* (Schramm, 2017). Refer to the original, approved TMDL document for details related to the overall Mission and Aransas Rivers watershed as well as the methods and assumptions used in developing all of these TMDLs.

This addendum focuses on the watersheds of two additional AUs. These watersheds, including the regulated facilities within them, were addressed in the original TMDL. This addendum provides the details related to developing the TMDL allocations for these additional AUs, which were not specifically addressed in the original document.

Problem Definition

The TCEQ first identified the bacteria impairments within the Aransas River Above Tidal and Poesta Creek segments included within this addendum in the *2014 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)* (2014 Integrated Report; TCEQ, 2015a) (Table 1). The impaired AUs are Aransas River Above Tidal (2004_02) and Poesta Creek (2004B_02), as shown in Figure 1. The project watershed is predominately in Bee County (98 percent of the watershed). Live Oak County includes approximately 1.5 percent of the watershed. San Patricio and Refugio counties each include less than 1 percent of the watershed area.

The Texas Surface Water Quality Standards (TSWQS) (TCEQ, 2010) provide numeric and narrative criteria to evaluate attainment of designated uses. The basis for water quality targets for all TMDLs developed in this report will be the numeric criteria for bacterial indicators from the 2010 TSWQS. *Escherichia coli* (*E. coli*) are the preferred indicator bacteria for assessing contact recreation use in freshwater.

Table 1. Synopsis of Integrated Report for addendum water bodies
Source: (TCEQ, 2015a)

Water Body	Segment	AU	Parameter	Contact Recreation Use	Year First Impaired	Category
Aransas River Above Tidal	2004	2004_02	*E. coli*	Nonsupport	2014	5c
Poesta Creek	2004B	2004B_02	*E. coli*	Nonsupport	2014	5c

Table 2 summarizes the ambient water quality data for the TCEQ water quality monitoring (WQM) stations on each impaired water body, as reported in the 2014 Integrated Report. The 2014 assessment data indicates non-support of the primary contact recreation use for the two addendum AUs, because the geometric mean concentrations exceed the geometric mean criterion of 126 most probable number (MPN)/100 milliliters (mL) *E. coli*. Figure 2 shows the location of the surface water quality monitoring (SWQM) stations as well as the United States Geological Survey (USGS) gage in the project watershed.

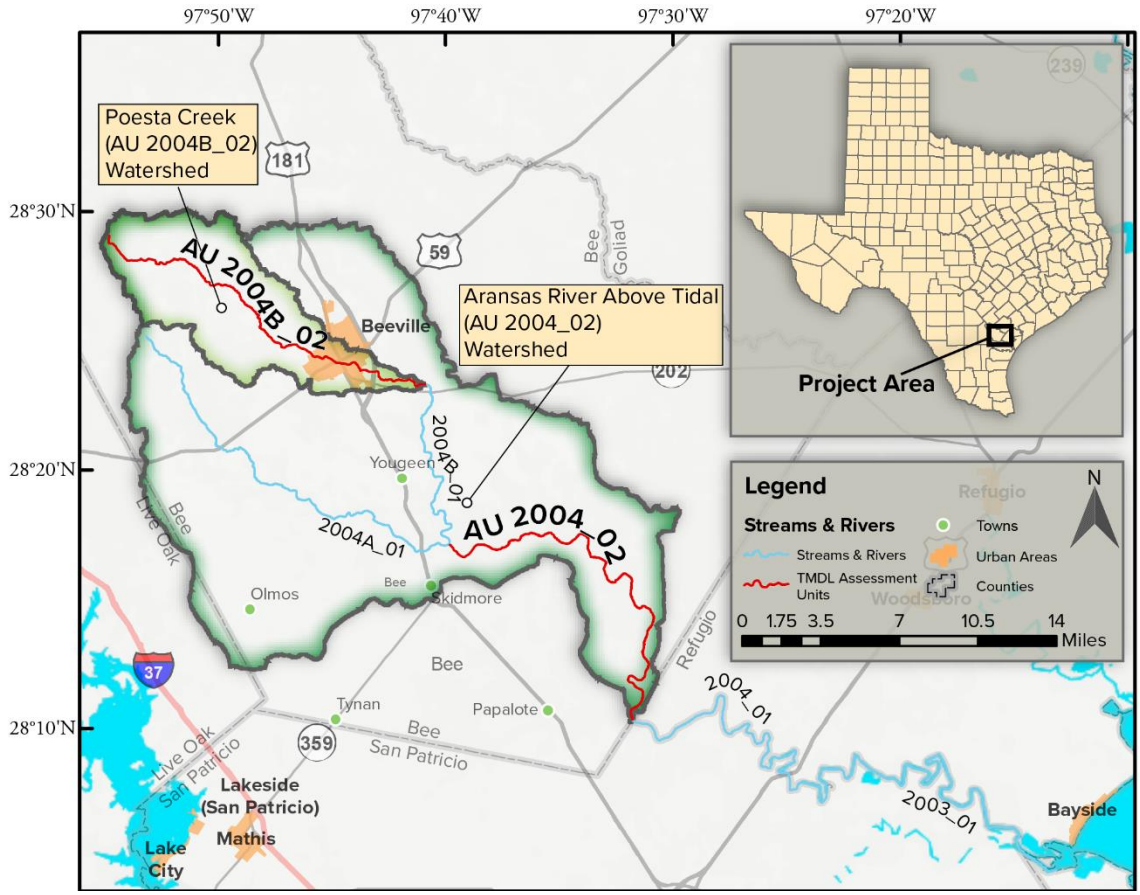

Figure 1. Total contributing drainage area for the study, including AUs 2004_02 and 2004B_02
Source: TCEQ Assessment Units (TCEQ, 2015b)

Table 2. 2014 Integrated Report summary for the addendum TMDL AUs
(The geometric mean criterion for primary contact recreation use is 126 MPN/100 mL of *E. coli*.)

Source: (TCEQ, 2015a)

Water Body	AU	Parameter	No. of Samples	Data Range	Station *E. coli* Geometric Mean (MPN/100 mL)
Aransas River Above Tidal	2004_02	*E. coli*	50	2005–2012	166
Poesta Creek	2004B_02	*E. coli*	21	2005–2012	311

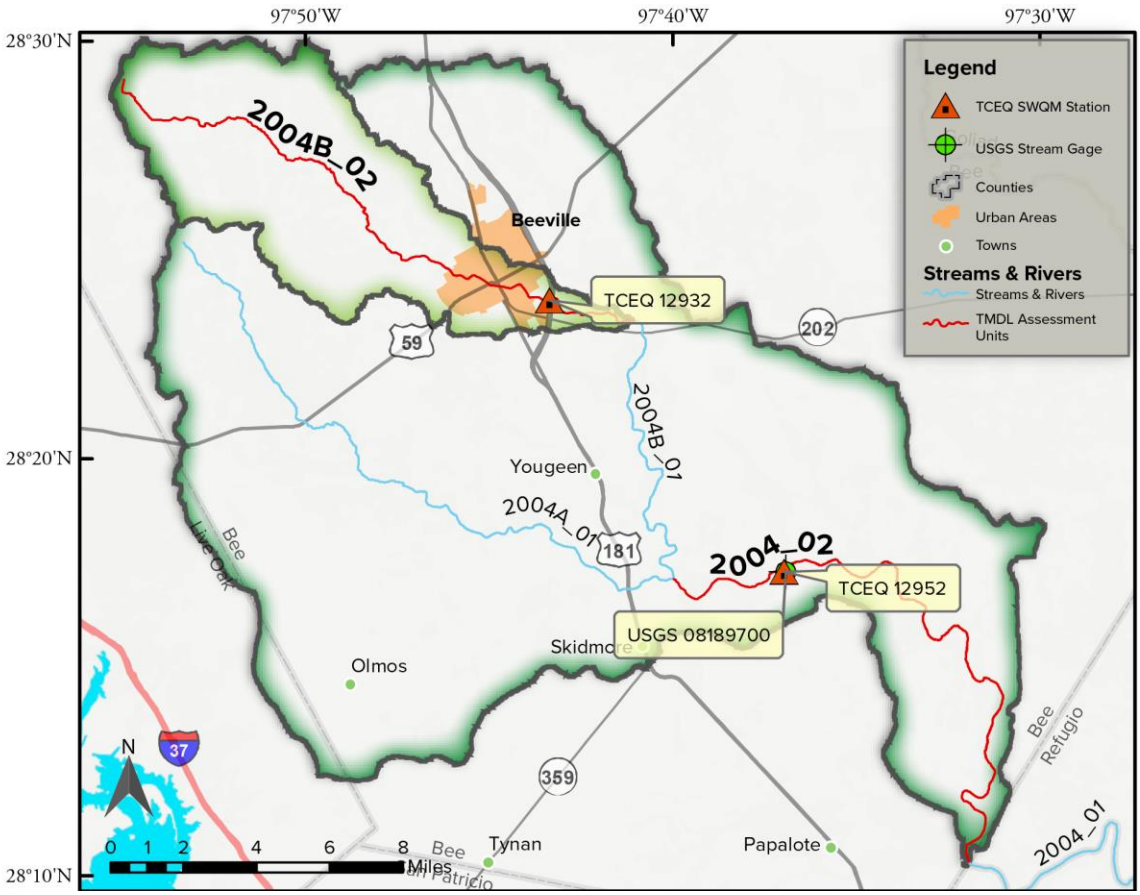

Figure 2. SWQM station and USGS streamflow gage locations in the Aransas River Above Tidal and Poesta Creek watersheds

Sources: TCEQ SWQM stations from TCEQ (TCEQ, 2012); USGS stream gage stations from USGS (USGS, 2011)

Watershed Overview

Both water bodies included in this study are located within the Aransas River watershed shown in Figure 3. Both water bodies are located upstream of the Aransas River Tidal (Segment 2003) and will be added to the existing TMDL, *Two Total Maximum Daily Loads for Indicator Bacteria in the Tidal Segments of the Mission and Aransas Rivers* (TCEQ, 2016a), through a Water Quality Management Plan (WQMP) update. This study incorporates a watershed approach where the drainage area upstream of each AU outlet is considered. The locations of Aransas River Above Tidal (AU 2004_02) and Poesta Creek (AU 2004B_02) in relation to the original Mission and Aransas Rivers TMDL project boundaries are shown in Figure 3. The full project watershed corresponds to the watershed for Aransas River Above Tidal (AU 2004_02), and the Poesta Creek (AU 2004B_02) watershed is a subwatershed within that area.

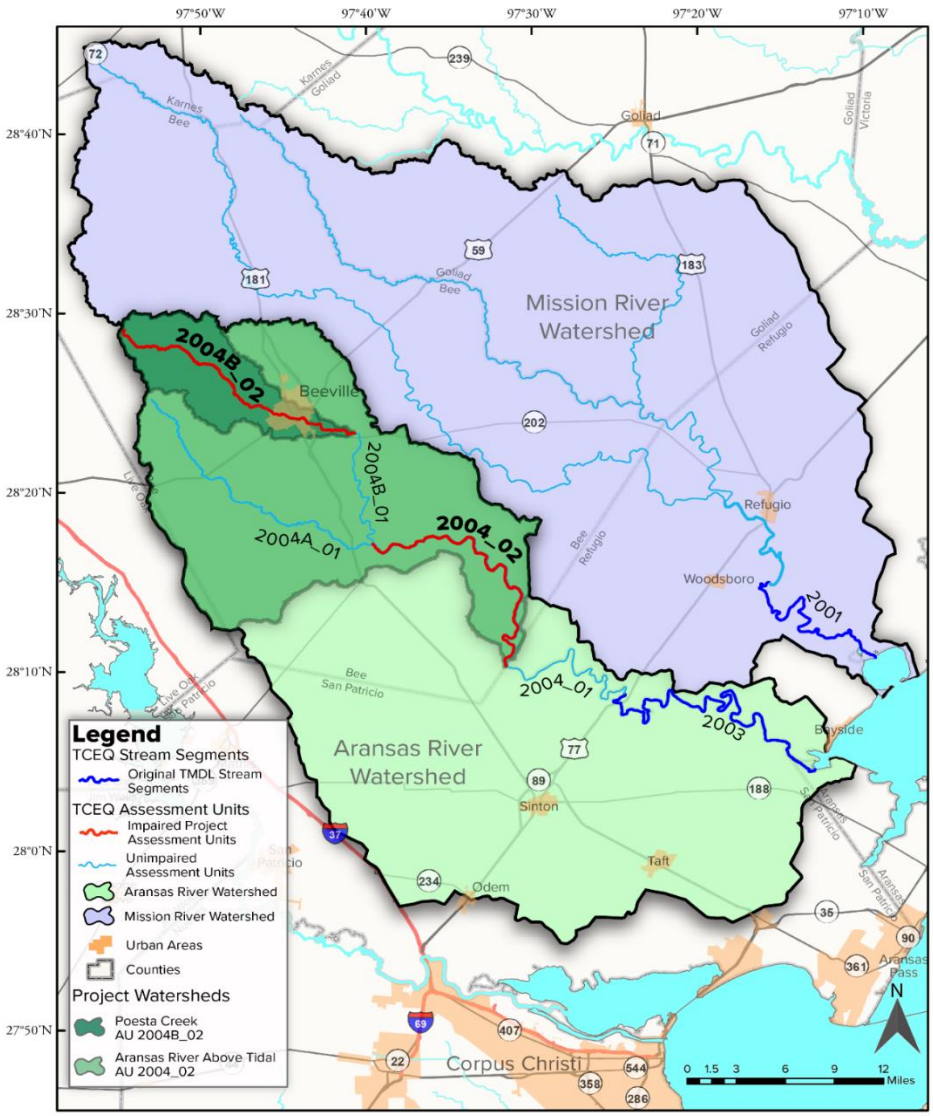

Figure 3. Addendum project boundaries in relation to original TMDL project watersheds.

The headwaters of Poesta Creek (Segment 2004B) begin in Bee County northwest of Beeville and flow 28.7 miles southeast to Aransas Creek (Segment 2004A) forming the Aransas River Above Tidal (Segment 2004). The Aransas River Above Tidal begins at the confluence of Aransas and Poesta Creeks and flows 34.9 miles to a point just upstream of US 77. The Aransas River Tidal (Segment 2003) begins at this point and flows 28.3 miles to Copano Bay.

The drainage area for the impaired AU of Poesta Creek (AU 2004B_02) is 52.3 square miles and located entirely within Bee County. The drainage area for the impaired AU of Aransas River Above Tidal (AU 2004_02) includes the drainage area for Poesta Creek and is 314.4 square miles.

The 2014 Integrated Report (TCEQ, 2015a) provides the following segment and AU descriptions for the water bodies considered in this document:

- Segment 2004 (Aransas River Above Tidal) - From a point 1.6 kilometers (1.0 mile) upstream of US 77 in Refugio/San Patricio County to the confluence of Poesta Creek and Aransas Creek in Bee County
    - 2004_02 – From the confluence with Papalote Creek to the upstream end of segment at the confluence with Aransas Creek and Poesta Creek
- Segment 2004B (Poesta Creek) - From the confluence with the Aransas River to the headwaters of the stream about 7.5 km upstream of FM 673
    - 2004B_02 –From the confluence with Talpacate Creek to the headwaters of the stream approximately 7.5 km upstream of FM 673

Monthly normal air temperature data from the Beeville Chase Station USW00012925 weather station (NOAA, 2016) indicate the daily mean air temperature from 1981-2010 was 73.0°F. Minimum average daily temperature reached a low of 46.3°F in January. Maximum average daily temperature reached a peak of 97.4°F in July (Figure 4).

Monthly normal precipitation data, also from the Beeville Chase Station USW00012925 weather station (NOAA, 2016), indicate Beeville's mean annual rainfall from 1981-2010 was 31.96 inches (NOAA, 2016). Rainfall normally peaks in September (4.76 inches) with lowest totals occurring in December (1.55 inches) (Figure 4). Average annual precipitation values across the study area from the PRISM Climate Group at Oregon State (2012) indicate average annual rainfall ranges from 29 to 33 inches per year across the watershed, with a clear east to west decreasing gradient (Figure 5).

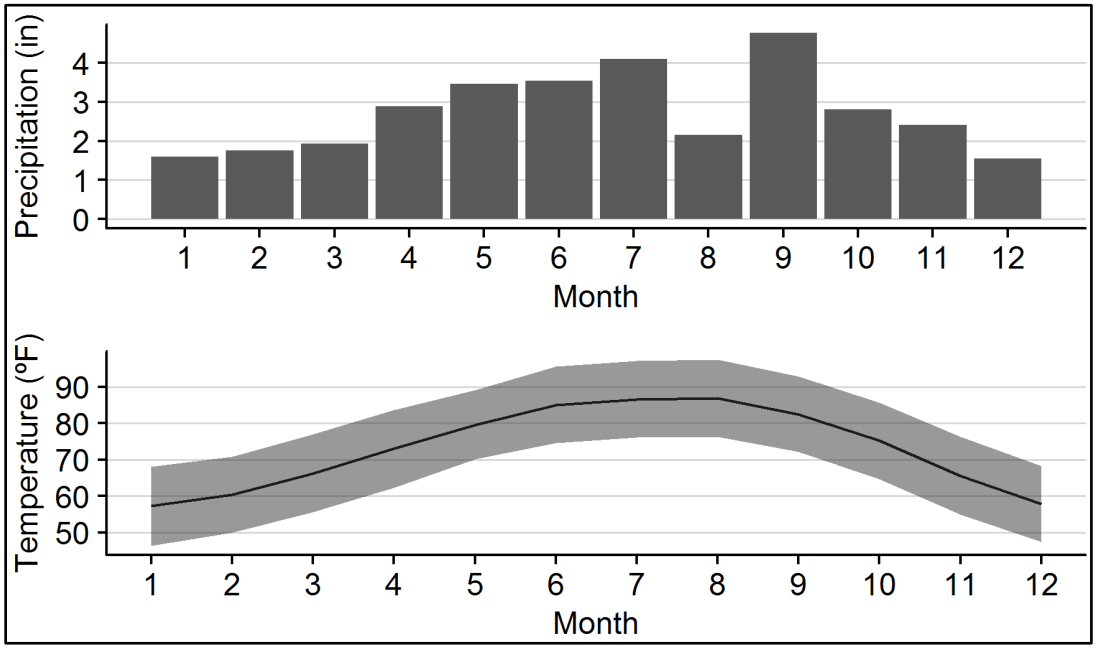

Figure 4. Beeville normal monthly precipitation by month and normal average, maximum, and minimum air temperature by month from 1981-2010
Source: (NOAA, 2016)

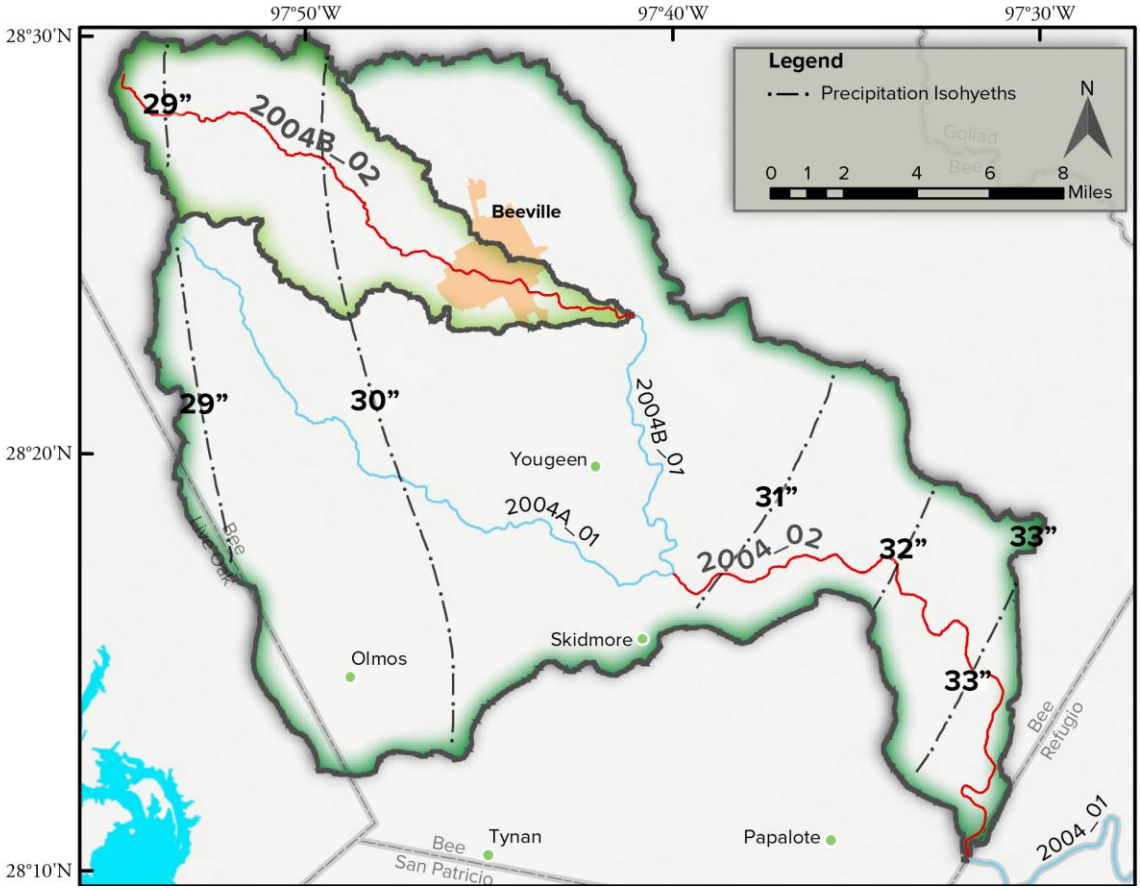

Figure 5. Average annual rainfall (inches) across the study area from 1981-2010
Source: PRISM Climate Group at Oregon State University (2012)

Land use and land cover for the study area (Figure 6) was obtained from the 2011 National Land Cover Database (NLCD) (USGS, 2015). The total Aransas River Above Tidal (AU 2004_02) watershed area is 201,226.6 acres and predominately composed of Pasture/Hay (32.5 percent) and Shrub/Scrub (30.7 percent) (Table 3). The Poesta Creek (AU 2004B_02) watershed, located within the Aransas River Above Tidal watershed, is 33,441.7 acres. The majority of land cover in the Poesta Creek watershed is also Shrub/Scrub (42.3 percent) and Pasture/Hay (32.8 percent). Urban development comprises less than 8 percent of the Aransas River Above Tidal watershed and nearly 15 percent of the Poesta Creek watershed.

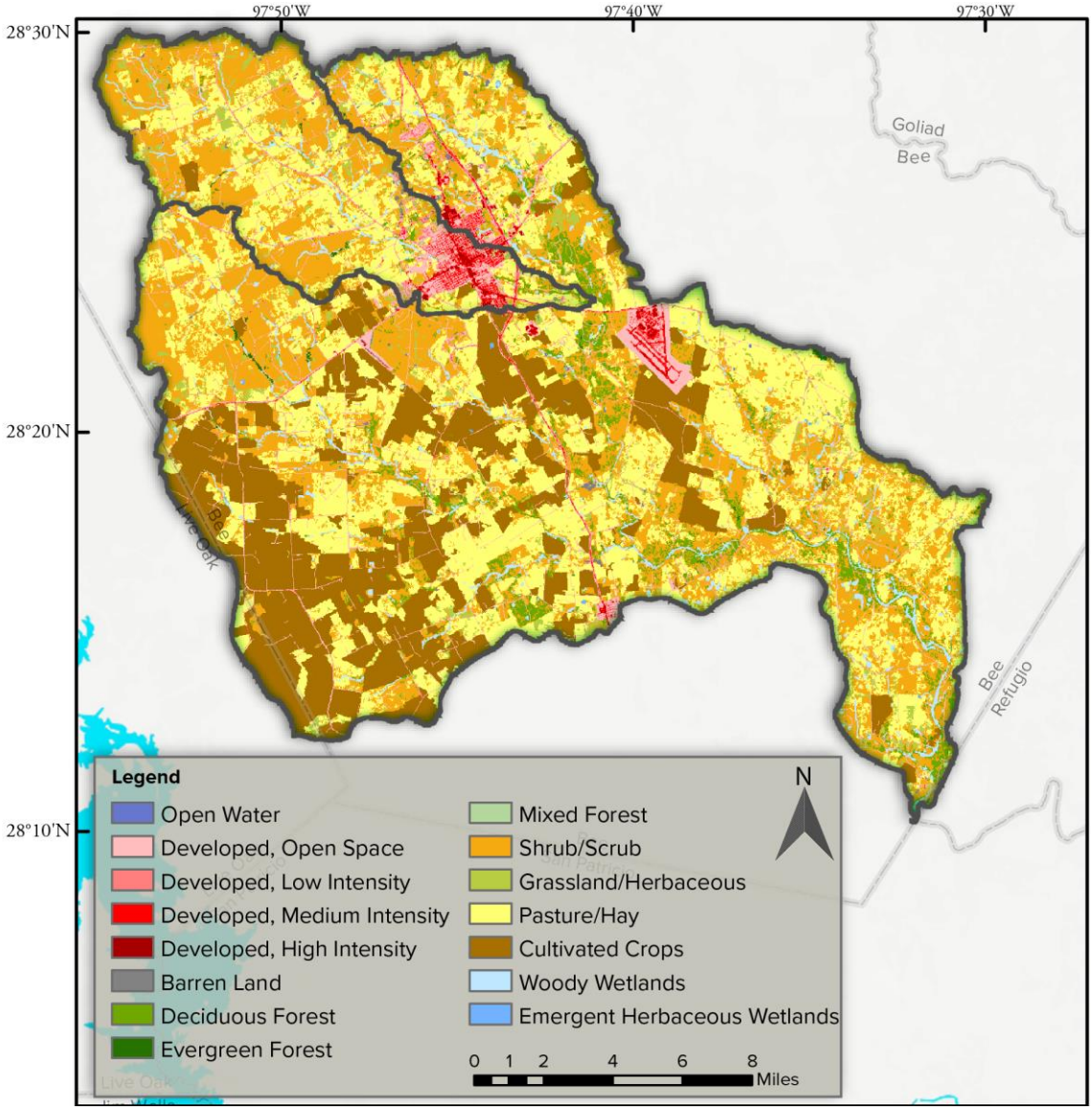

Figure 6. Land use/land cover across the study area
Source: (USGS, 2015)

Table 3. Land use/land cover for the study area
Source: (USGS, 2015)

Land Use/Land Cover	Aransas River Above Tidal (2004_02)		Poesta Creek (2004B_02)	
	Acres	Percent of Total	Acres	Percent of Total
Open Water	33.4	<0.1%	-	-
Developed, Open Space	9,891.4	4.9%	2,361.6	7.1%
Developed, Low Intensity	3,695.5	1.8%	1,430.0	4.3%
Developed, Medium Intensity	1,747.4	0.9%	772.6	2.3%
Developed, High Intensity	473.3	0.2%	218.8	0.7%
Barren Land	452.8	0.2%	166.4	0.5%
Deciduous Forest	7,763.6	3.9%	393.2	1.2%
Evergreen Forest	252.0	0.1%	45.4	0.1%
Mixed Forest	71.2	<0.1%	3.3	<0.1%
Shrub/Scrub	61,769.2	30.7%	14,145.4	42.3%
Grassland/Herbaceous	6,171.7	3.1%	1,585.5	4.7%
Pasture/Hay	65,329.3	32.5%	10,955.4	32.8%
Cultivated Crops	37,717.7	18.7%	432.8	1.3%
Woody Wetlands	5,752.0	2.9%	924.5	2.8%
Emergent Herbaceous Wetlands	106.1	0.1%	6.9	<0.1%
Total	**201,226.6**	**100%**	**33,441.7**	**100%**

Endpoint Identification

The endpoint for the TMDL is to maintain the concentration of *E. coli* below the geometric mean criterion of 126 MPN/100mL. This endpoint was applied to both AUs addressed by this TMDL. This endpoint is identical to the geometric mean criterion for primary contact recreation in the 2010 TSWQS (TCEQ, 2010).

Source Analysis

Regulated Sources

Permitted sources are regulated under the Texas Pollutant Discharge Elimination System (TPDES) and the National Pollutant Discharge Elimination System (NPDES) programs. Wastewater treatment facility (WWTF) outfalls and stormwater discharges from industries and construction sites represent the regulated sources in the project watershed.

Domestic and Industrial Wastewater Treatment Facilities

Three facilities in the project watershed treat domestic wastewater (Figure 7). The City of Beeville Moore Street WWTF (TPDES permit number 10124-002) discharges directly into the impaired Poesta Creek (AU 2004B_02). The Chase Field WWTF (TPDES permit number 10124-004) operated by the City of Beeville discharges into the mainstem of the impaired Aransas River Above Tidal (AU 2004_02) slightly downstream of USGS streamflow gage 08189700. The Skidmore Water Supply Corporation (WSC; TPDES permit number 14112-001) discharges into an unnamed tributary that flows into the impaired Aransas River Above Tidal (AU 2004_02). Table 4 summarizes final permitted discharges and recent

discharges obtained from the EPA (2017) Enforcement and Compliance History Online (ECHO) website. Permitted discharges in the watershed range from 0.131 to 3.0 million gallons per day (MGD).

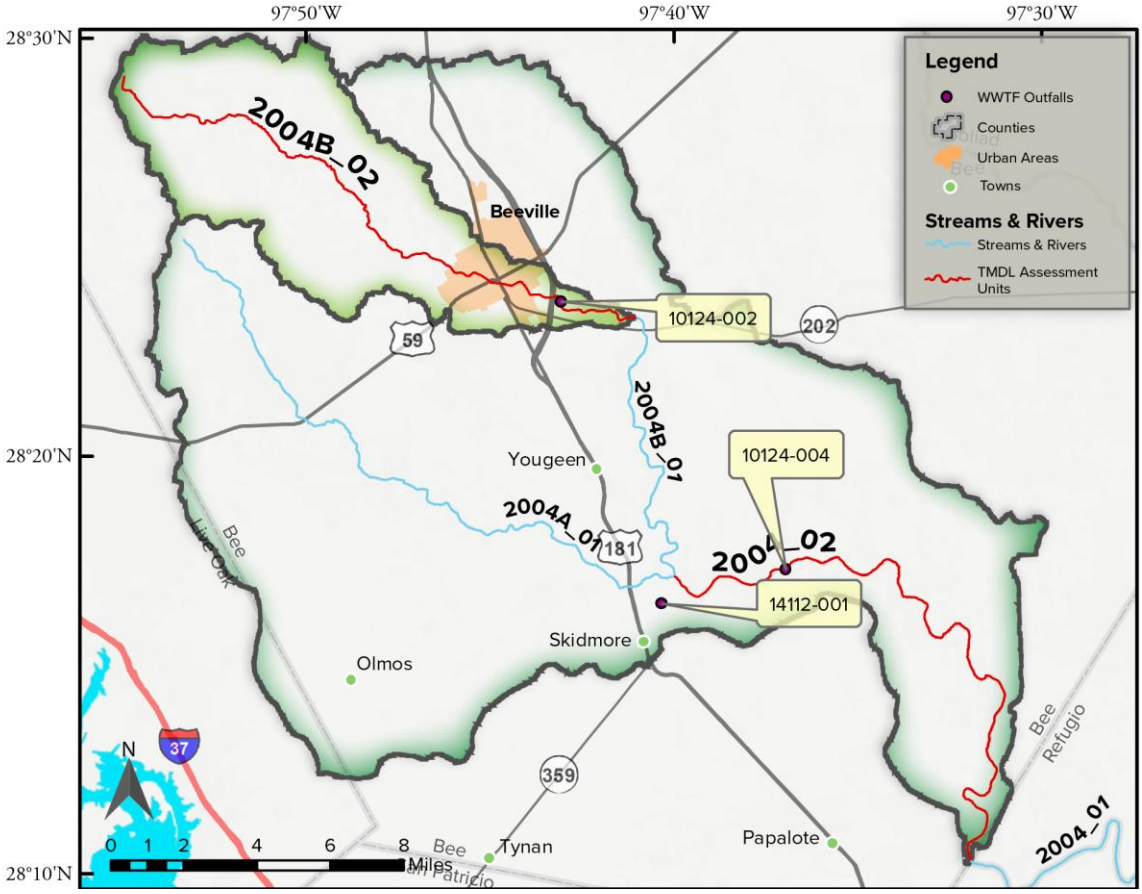

Figure 7. WWTF outfall locations across the project watershed.

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) are unauthorized discharges that must be addressed by the responsible party. The TCEQ Region 14 office maintains a database of SSO data reported by municipalities (personal communication with TCEQ Region 14 on January 11, 2017). These SSO data typically contain estimates of the total gallons spilled, responsible entity, and a general location of the spill. Table 5 provides a summary of SSOs that occurred within the project AUs from August 2009 through December 2016. Fifteen separate incidents reported by two facilities occurred in the project watershed during this timeframe.

Table 4. Permitted WWTFs in the project watersheds
Source: Individual TPDES Permits

TPDES Permit Number	NPDES Permit Number	Facility	AU	TMDL Receiving Waters	Final Permitted Discharge (MGD)	Average Discharge (MGD)[1]
10124-002	TX0047007	City of Beeville - Moore Street WWTF	2004B_02	Poesta Creek	3.0	2.03
10124-004	TX0113859	City of Beeville - Chase Field WWTF	2004_02	Aransas River Above Tidal	2.5	0.43
14112-001	TX0119407	Skidmore WSC WWTF	2004_02	Aransas River Above Tidal	0.131	0.05

[1] Average discharge from January 2009 through October 2016

Table 5. Summary of SSO incidents reported in project watersheds from August 2009 through December 2016
Source: Personal communication TCEQ Region 14 (Jan 11, 2017)

AU	Number of Incidents[1]	Mean Volume (gallons)	Median Volume (gallons)	Minimum Volume (gallons)	Maximum Volume (gallons)	Total Volume (gallons)
2004_02	15	25,221.429	10,000	350	93,750	353,100
2004B_02	11	24,310.000	9,000	350	93,750	243,100

[1] Total number of reported incidents. One incident reported that an unknown volume was discharged during the event. Therefore, the number of incidents used to calculate statistics included in the table are 14 and 10 for AU 2004_02 and 2004B_02 respectively.

TPDES-Regulated Stormwater

TPDES general permits cover stormwater discharges from Phase II urbanized areas, industrial facilities, and construction sites over one acre. A review of active stormwater general permits in the project watershed resulted in eight active industrial site permits (Stormwater Multi-Sector General Permit for Industrial Facilities, TXR050000; six of those permits occurred in the 2004B_02 Poesta Creek watershed), as of January 20, 2017 (TCEQ, 2017) (Table 6). The project watershed contains no municipal separate storm sewer system (MS4) permits. The acreage associated with active industrial stormwater general permits was estimated by importing location information into a Geographic Information System and measuring the estimated disturbed area from available aerial imagery. Construction permits (Stormwater General Permit for Construction Activities, TXR150000) were summarized by average daily acreage for permits issued over the entire available period of record (January 2003 through May 2016). Over that time period, twenty construction permits were issued in the Aransas River Above Tidal (AU 2004_02) watershed, seven of which were in the Poesta Creek (AU 2004B_02) watershed.

Table 6. Summary of land area covered by stormwater permits in project watersheds as of January 20, 2017

Source: TCEQ Central Registry (TCEQ, 2017)

AU	Industrial General Permits (number)	Industrial General Permits (acres / % of watershed)	Construction Permits (number)	Construction Permits (average acres / % of watershed)	Total Area of Permits (acres / % of watershed)
2004_02	8	46.3 / 0.023%	20	104.9 / 0.052%	151.2 / 0.075%
2004B_02	6	27.9 / 0.083%	7	20.5 / 0.062%	48.4 / 0.145%

Unregulated Sources

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

Wildlife and Unmanaged Animal Contributions

E. coli 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 the potential for bacteria contributions from wildlife. Riparian corridors of streams and rivers naturally attract wildlife. With direct access to the stream channel, direct deposition of wildlife waste can be a concentrated source of bacteria loading to a water body. Wildlife also deposit fecal bacteria onto land surfaces, where rainfall runoff may wash bacteria into nearby streams.

For deer, Texas Parks and Wildlife Department (TPWD) biologists provided estimates for deer management units in Bee County, including deer management units 8E, 9, and 11. Based on estimates from 2011 through 2016, an average of one whitetail deer per 34.5 acres of habitat was calculated across the watershed. This density was applied to land classified in the 2011 NLCD as pasture/hay, cultivated crops, shrub/scrub, grassland/herbaceous, deciduous forest, evergreen forest, mixed forest, woody wetlands, and emergent herbaceous wetlands (TWRI, 2009) (Table 7).

For feral hogs, an estimate of one hog per 33.3 acres was applied to land classified in the 2011 NLCD as pasture/hay, cultivated crops, shrub/scrub, grassland/herbaceous, deciduous forest, evergreen forest, mixed forest, woody wetlands, and emergent herbaceous wetlands (TWRI, 2009) (Table 7).

Table 7. Estimated deer and feral hog populations in project watershed

Sources: Estimates derived from previous watershed studies (TWRI, 2009) and communication with TPWD staff.

AU	Deer	Feral Hogs
2004_02	5,360	5,554
2004B_02	826	856

Domesticated Animals

The estimated livestock numbers in Table 8 are provided to demonstrate that livestock are a potential source of bacteria in the project watersheds. Livestock counts were estimated using county level data available from the 2012 Census of Agriculture (USDA, 2014). These numbers, however, are not used to develop an allocation of allowable bacteria loading to livestock.

Table 8. Livestock estimates for project watersheds

Source: Estimates derived from USDA Census of Agriculture (USDA, 2014)

AU	Cattle and Calves	Hogs	Chickens	Goats and Sheep	Horses
2004_02	10,472	26	604	749	491
2004B_02	1,643	4	96	118	77

Fecal matter 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 9 summarizes the estimated number of dogs and cats for each AU of the TMDL addendum watersheds. Pet population estimates were calculated as the estimated number of dogs (0.584) and cats (0.638) per household (AVMA, 2012). The actual contribution and significance of fecal coliform loads reaching the water bodies of the impaired watersheds is unknown.

Table 9. Estimated households and pet populations

Sources: Estimates derived from United States Census Bureau (USCB) Census Blocks (USCB, 2010) and American Veterinary Medical Association (AVMA) pet estimates (AVMA, 2012)

AU	Estimated Number of Households	Estimated Dog Population	Estimated Cat Population
2004_02	8,748	5,109	5,581
2004B_02	4,884	2,852	3,116

Onsite Sewage Facilities

Estimates of the number of OSSFs in the project watershed were determined using 2010 Census block data. OSSFs were estimated to be households that were outside of city boundaries and Certificate of Convenience and Necessity (CCN) areas. Table 10 and Figure 8 show the total estimated OSSFs in the project watersheds.

Table 10. OSSF estimate for the project watersheds

Source: Estimates derived from Census Blocks (USCB, 2010) and CCNs (Public Utility Commission of Texas, 2017).

AU	Estimated OSSFs
2004_02	2,545
2004B_02	763

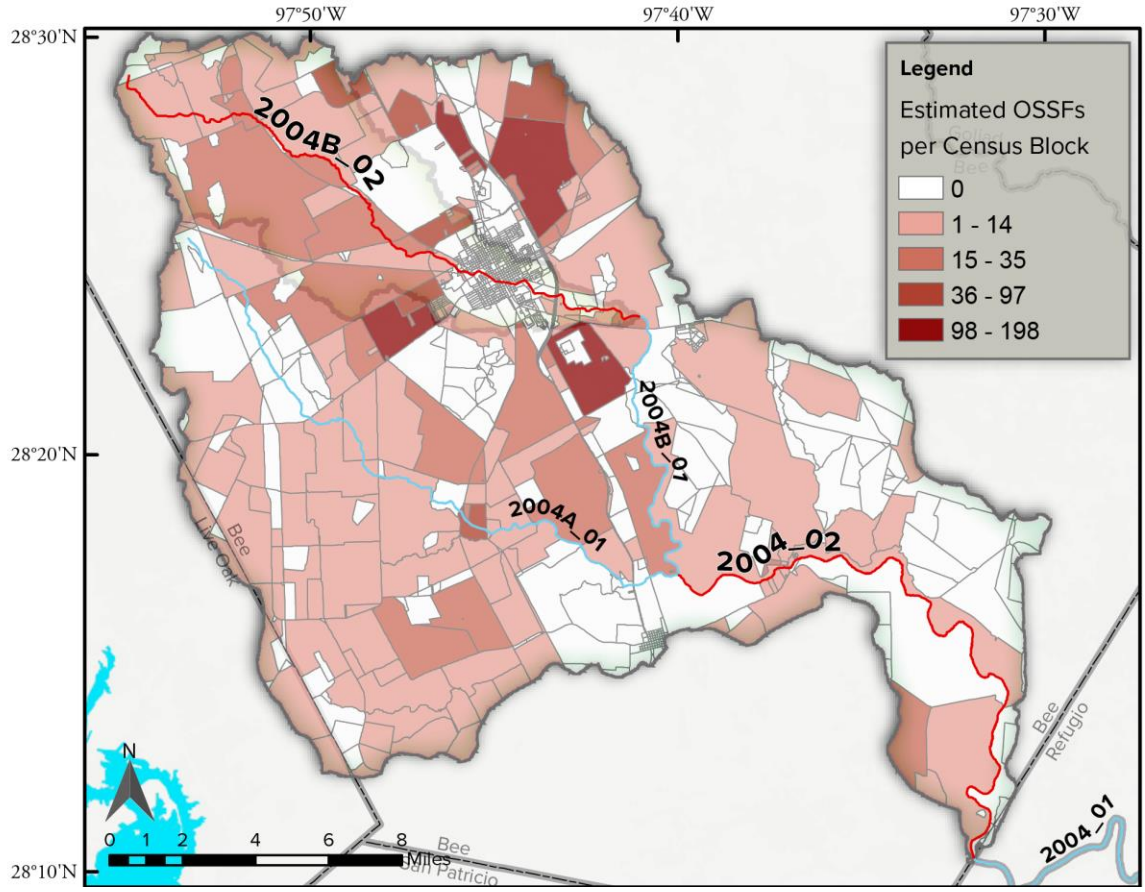

Figure 8. OSSF estimates for the project watersheds

Sources: Estimates derived from Census Blocks (USCB, 2010) and CCNs (Public Utility Commission of Texas, 2017).

Linkage Analysis

Load duration curves (LDCs) were 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 and the landscape as regulated and non-regulated sources. Further, this one-to-one relationship was also inherently assumed when using LDCs to define the TMDL pollutant load allocation. That is, the allocation of pollutant loads was based on apportioning the loadings based on flows assigned to WWTFs, a fractional proportioning of the remaining flow based on the area of the watershed under stormwater regulation, and assigning the remaining portion to the non-regulated stormwater. The Technical Support Document (Schramm, 2017) provides details about the analyses, tools, and their applications.

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 TMDLs covered by this report incorporate an explicit MOS by setting a target for indicator bacteria loads that is 5 percent lower than the geometric mean criterion.

Pollutant Load Allocation

The TMDL component for the two impaired AUs covered in this report are derived using the median flow within the high flow regime (or 5 percent flow) of the LDC developed for the outlet of each AU watershed.

Based on the LDCs to be used in the pollutant load allocation process with historical *E. coli* data added to the graphs (Figures 9 and 10), the following broad linkage statements can be made. For the Aransas River Above Tidal (AU 2004_02) watershed, *E. coli* loading exceedances occur frequently at high flows and are generally below or near the loading criterion at mid-range and low flows. However, elevated loadings occur under all flow conditions for the Poesta Creek (AU 2004B_02) watershed.

Regulated stormwater comprises a minor portion of both watersheds. Therefore, non-regulated stormwater likely contributes to the majority of high flow-related loadings in both watersheds. Elevated loadings in Poesta Creek (AU 2004B_02) at low and median flow conditions cannot be attributed exclusively to WWTFs due to the WWTF outfall location occurring downstream of the SWQM sampling station. Therefore, other sources of bacteria loadings under lower flow conditions in the absence of overland flow contributions (i.e., without stormwater contribution) are most likely to contribute bacteria directly to the water. These sources may include direct deposition of fecal material from sources such as wildlife, feral hogs, and livestock. However, the actual contributions of bacteria loadings directly attributable from these sources cannot be determined using LDCs.

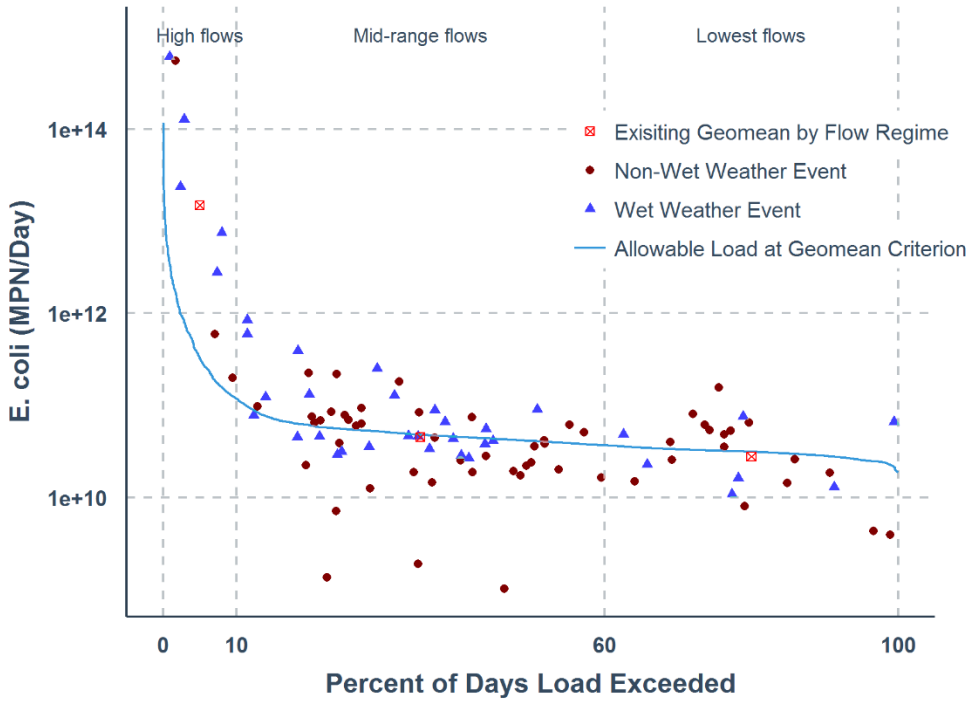

Figure 9. Load Duration Curve for Aransas River Above Tidal (AU 2004_02).

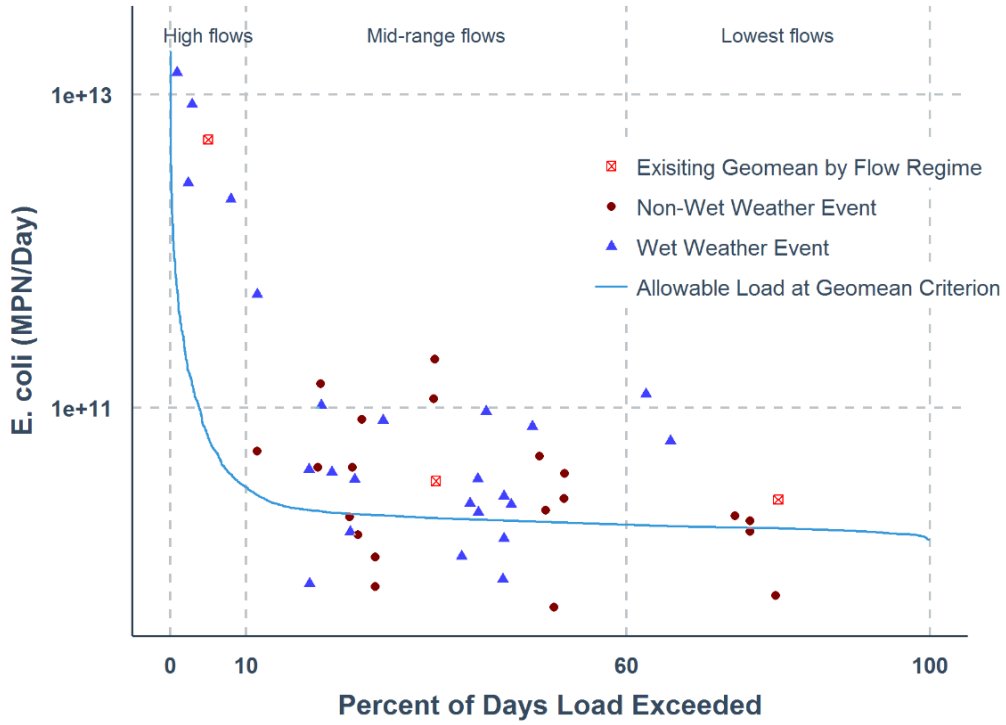

Figure 10. Load Duration Curve for Poesta Creek (AU 2004B_02).

Wasteload Allocation

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

WWTFs

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 and reduced to account for the required MOS. The *E. coli* primary contact recreation geometric mean criterion of 126 MPN/100mL is used as the WWTF target. Table 11 presents the wasteload allocations for each individual WWTF located in the project watersheds.

Table 11. Summary of WLAs for WWTFs in the project watersheds

TPDES / NPDES Permit	Facility	AU	Final Permitted Discharge (MGD)	*E. coli* WLA_{WWTF} (Billion MPN/day)
10124-002 / TX0047007	City of Beeville – Moore Street WWTF	2004B_02[1]	3.0	13.593
2004B_02 Total WLA_{WWTF}			3.0	13.593
10124-004 / TX0113859	City of Beeville – Chase Field WWTF	2004_02	2.5	11.328
14112-001 / TX0119407	Skidmore WSC WWTF	2004_02	0.131	0.594
2004_02 Total WLA_{WWTF}			5.631	25.515

[1] The total WLA_{WWTF} for AU 2004_02 includes WWTFs in AU 2004B_02

Regulated Stormwater

Stormwater discharges from MS4, industrial, and construction sites are also considered permitted or regulated point sources. Therefore, the WLA calculations must also include an allocation for permitted stormwater discharges (WLA_{SW}). A simplified approach for estimating the WLA for these areas was used in the development of these TMDLs due to the limited amount of data available, the complexities associated with simulating rainfall runoff, and the variability of stormwater loading. The percentage of land area included in each watershed that is under the jurisdiction of stormwater permits is used to estimate the amount of overall runoff load that should be allocated as the permitted stormwater contribution in the WLA_{SW} component of the TMDL.

Load Allocation

The load allocation (LA) component of the TMDL corresponds to runoff from unregulated sources. It is calculated by subtracting the sum of the WLA_{WWTF}, WLA_{SW}, MOS, and future growth (FG) allocations from the total TMDL allocation.

Future Growth

The 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. The assimilative capacity of streams

increases as the amount of flow increases. Increases in flow allow for additional indicator bacteria loads if the concentration are at or below the contact recreation standard.

Three domestic WWTFs are located in the project watersheds. To account for the FG component of the impaired AUs, the loadings from all WWTFS are included in the FG computation, which is based on the WLA_{WWTF} formula. The FG equation contains an additional term to account for project population growth within the WWTF service areas between 2010 and 2070, based on data obtained from the Texas Water Development Board (TWDB) 2017 State Water Plan (TWDB, 2017).

The three-tiered antidegradation policy in the TSWQS prohibits an increase in loading that would cause or contribute to degradation of an existing use. The antidegradation policy applies to both point and nonpoint source pollutant discharges. In general, antidegradation procedures establish a process for reviewing individual proposed actions to determine if the activity will degrade water quality. The TMDLs in this document will result in protection of existing designated uses and conform to Texas's antidegradation policy.

TMDL Calculations

Table 12 summarizes the TMDL calculations for the project watersheds. Each of the TMDLs was calculated based on median flow in the 0-10 percentile range (5 percent exceedance, high flow regime) for flow exceedance from the LDC developed for the outlet of each AU. Allocations are based on the current geometric mean criterion for *E. coli* of 126 MPN/100mL for each component of the TMDL.

The final TMDL allocations (Table 13) needed to comply with the requirements of 40 Code of Federal Regulations (CFR) § 103.7 include the FG component within the WLA_{WWTF}. The WLA_{WWTF} for each AU includes the sum of the WWTF allocations for that AU and all upstream AUs. Similarly, the WLA_{SW} for each AU includes the sum of all regulated stormwater areas of that AU and upstream AUs. The LA component of the final TMDL allocations is comprised of the sum of loadings arising from within each AU and all upstream AUs that are associated with unregulated sources.

In the event that the criterion changes due to a change in the designated recreational use, Appendix A provides guidance for recalculating the allocations in Table 13.

Table 12. TMDL allocation summary for project watersheds

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

AU	TMDL	MOS	WLA_{WWTF}	WLA_{SW}	LA	FG
2004_02	319.170	15.959	25.515	0.206	274.505	2.985
2004B_02	63.891	3.195	13.593	0.066	45.447	1.590

Table 13. Final TMDL allocations for project watersheds

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

AU	TMDL	WLA_{WWTF}[1]	WLA_{SW}	LA	MOS
2004_02	319.170	28.500	0.206	274.505	15.959
2004B_02	63.891	15.183	0.066	45.447	3.195

[1] WLA_{WWTF} includes the future potential allocation to wastewater treatment facilities

Seasonal Variation

Federal regulations in 40 CFR §130.7(c)(1) require that TMDLs account for seasonal variation in watershed conditions and pollutant loading. Analysis of the seasonal differences in indicator bacteria concentrations were assessed by comparing *E. coli* concentrations collected in warmer months (May-September) against those collected during cooler months (November-March). The months of April and October were considered transitional between the 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 Wilcoxon Rank Sum test was chosen for its ability to handle non-normal data without requiring data transformation. The test was considered significant at the α=0.05 level.

The Wilcoxon Rank Sum test did not detect a significant difference in seasonal *E. coli* measurements in the Aransas River Above Tidal (AU 2004_02) (W=709.5, p=0.357, Figure 11a). A significant difference was detected in seasonal *E. coli* measurements for Poesta Creek (AU 2004B_02) (W=228.5, p<0.001, Figure 11b), indicating that higher *E. coli* concentrations typically occur during the warm season.

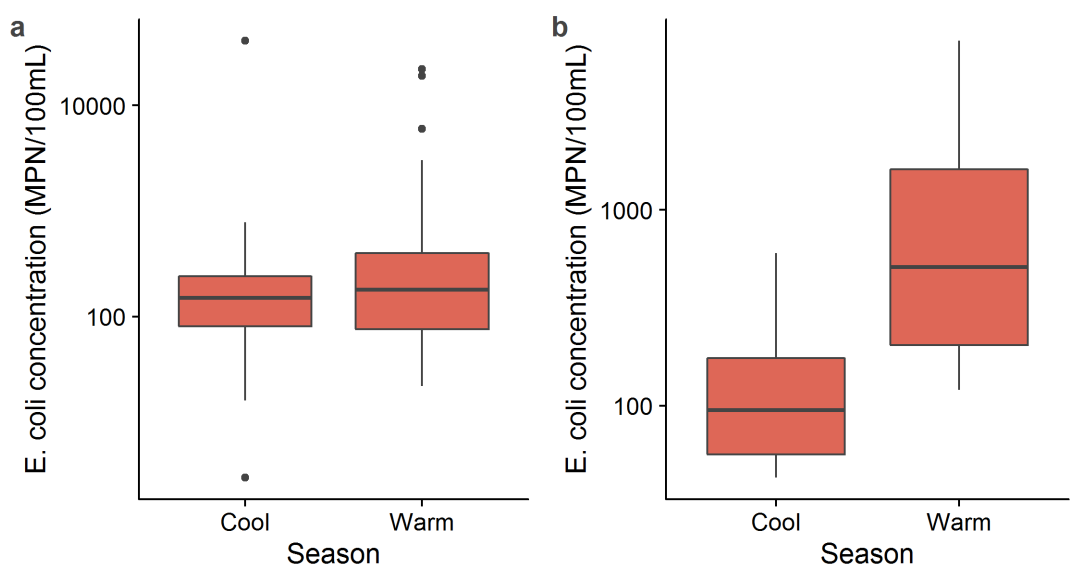

Figure 11. Distribution of *E. coli* concentrations by season in (a) Aransas River Above Tidal (AU 2004_02) and (b) Poesta Creek (AU 2004B_02).

Public Participation

The TCEQ maintains an inclusive public participation process. From the inception of the TMDL study, the TCEQ 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.

Regular stakeholder meetings have been held and TCEQ solicited stakeholder comments at each project milestone. As a contractor to TCEQ, the Texas Water Resources Institute (TWRI) provided technical support and presentations at stakeholder meetings. Ten meetings were held in the project watershed between January 2012 and August 2013 to keep the public aware of the original TMDL and to engage public participation in development of the Implementation Plan (I-Plan).

Stakeholders were consulted on the addendum to these TMDLs through a public meeting on August 10, 2017, where the results of the study were presented by the TWRI project manager. This is an ongoing process, so notice of the public comment period for this addendum will be sent to the stakeholders and posted on the TCEQ's TMDL program online News page at <www.tceq.texas.gov/waterquality/tmdl/tmdlnews.html>, and the document will be posted at <www.tceq.texas.gov/permitting/wqmp/WQmanagement_updates.html>.

The technical support document for these TMDL additions (Schramm, 2017) was posted on the TMDL project page at: <www.tceq.texas.gov/assets/public/waterquality/tmdl/76copano/76-aransas-poesta-tsd.pdf > on August 3, 2017. The public will have an opportunity to comment on this addendum during a 30-day WQMP update public comment period (November 10 through December 12, 2017).

TCEQ accepted public comments on the original TMDLs and I-Plan during the period October 23, 2015 through November 23, 2015. Two comments were submitted, and neither of them referred directly to the AUs in this TMDL addendum.

Implementation and Reasonable Assurance

The two segments and AUs covered by this addendum are within the existing bacteria TMDL watersheds of the Mission and Aransas Rivers, which drain to Copano Bay. These watersheds are within the area covered by the I-Plan developed with the assistance of local stakeholders. The I-Plan (TCEQ, 2016b) was approved by the TCEQ on May 25, 2016. It outlines an adaptive management approach in which measures are periodically assessed 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.

References

AVMA [American Veterinary Medical Association] (2012*). In: U.S. Pet Ownership & Demographics Sourcebook (2012 Edition).* Retrieved Jan 9, 2017, from www.avma.org/KB/Resources/Statistics/Pages/Market-research-statistics-US-pet-ownership.aspx

EPA [United States Environmental Protection Agency] (2017). *Enforcement and Compliance History Online* [ECHO].Retrieved Jan 10, 2017, from <http://echo.epa.gov/echo/>

NOAA [National Oceanic and Atmospheric Administration] (2016). *Station 12925, Beeville Chase NAAS, TX US. Monthly Normals.* Retrieved Sept 21 2016, from <www.ncdc.noaa.gov/cdo-web/datasets/NORMAL_MLY/stations/GHCND:USW00012925/detail>

PRISM (Parameter-elevation Regressions on Independent Slopes Model) Climate Group at Oregon State University. (2012). *PRISM Products Matrix*. Retrieved Jan 3, 2017, from PRISM Climate Group: <www.prism.oregonstate.edu/normals/>

Public Utility Commission of Texas (2017). *CCN Mapping Information*. PUC CCN Water and Sewer GIS Data Retrieved Jan 10, 2017, from <www.puc.texas.gov/industry/water/utilities/gis.aspx >

Schramm, M. 2017. *Technical Support Document for Total Maximum Daily Loads for Indicator Bacteria in Aransas River Above Tidal and Poesta Creek Segments 2004 and 2004B*. Texas Water Resources Institute, Texas A&M University, College Station, TX. Available online at: <www.tceq.texas.gov/assets/public/waterquality/tmdl/76copano/76-aransas-poesta-tsd.pdf>.

TCEQ [Texas Commission on Environmental Quality] (2010). Texas Surface Water Quality Standards, 2010 Rule Amendment, 30 TAC 307. Retrieved Jan 9, 2017, from <www.tceq.texas.gov/assets/public/waterquality/standards/TSWQS2010/TSWQS2010_rule.pdf >

TCEQ [Texas Commission on Environmental Quality] (2012). *TCEQ Surface Water Quality Monitoring Stations.* Retrieved Jan 3, 2017, from <www.tceq.texas.gov/gis/download-tceq-gis-data/>

TCEQ [Texas Commission on Environmental Quality] (2015a). *2014 Texas Integrated Report for Sections 305(b) and 303(d).* (Approved by EPA on November 19, 2015). Retrieved Jan 9, 2017, from <www.tceq.texas.gov/waterquality/assessment/14twqi/14txir>

TCEQ [Texas Commission on Environmental Quality] (2015b) *TCEQ 2014 Assessment Units.* Retrieved Jan 3, 2017, from <www.tceq.texas.gov/gis/download-tceq-gis-data/>

TCEQ [Texas Commission on Environmental Quality] (2016a). *Two Total Maximum Daily Loads for Indicator Bacteria in the Tidal Segments of the Mission and Aransas Rivers.* (Adopted May 25, 2016) <www.tceq.texas.gov/assets/public/waterquality/tmdl/76copano/76A-MissionAransasTMDL-adopted.pdf>

TCEQ [Texas Commission on Environmental Quality] (2016b). *Implementation Plan for Two Total Maximum Daily Loads for Indicator Bacteria in the Tidal Segments of the Mission and Aransas Rivers.* (Approved May 25, 2016) <www.tceq.texas.gov/assets/public/waterquality/tmdl/76copano/76A-MissionAransasI-Plan-Approved.pdf>

TCEQ [Texas Commission on Environmental Quality] (2017). *TCEQ Information Resources Division Central Registry.* Retrieved Jan 20, 2017, from <http://www15.tceq.texas.gov/crpub/>

TWDB [Texas Water Development Board] (2017) *Regional Water Plan Population & Water Demand Projections.* Retrieved Jan 3, 2017, from <www.twdb.texas.gov/waterplanning/data/projections/2017/ popproj.asp>

TWRI [Texas Water Resources Institute] (2009). *Education Program for Improved Water Quality in Copano Bay Task Two Report*. TR-347. Retrieved Jan 9, 2017, from <http://twri.tamu.edu/reports/2009/tr347.pdf>

USCB [United States Census Bureau] (2010). *2010 TIGER/Line Shapefiles.* Retrieved Jan 3, 2017, from <www.census.gov/geo/maps-data/data/tiger-line.html>

USDA [United States Department of Agriculture] (2014). 2012 *Census of Agriculture.* Retrieved Jan 9, 2017, from <www.agcensus.usda.gov/Publications/2012/>

USGS [United States Geological Survey] (2011). *GAGES-II: Geospatial Attributes of Gages for Evaluating Streamflow.* Retrieved Dec 6, 2016, from <https://water.usgs.gov/GIS/dsdl/gagesII_9322_point_shapefile.zip>

USGS [United States Geological Survey] (2015). *Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database (NLCD 2011).* Retrieved May 3, 2016, from <www.mrlc.gov/nlcd2011.php>

Appendix A

Equations for Calculating TMDL Allocations for Contact Recreation Standard Changes

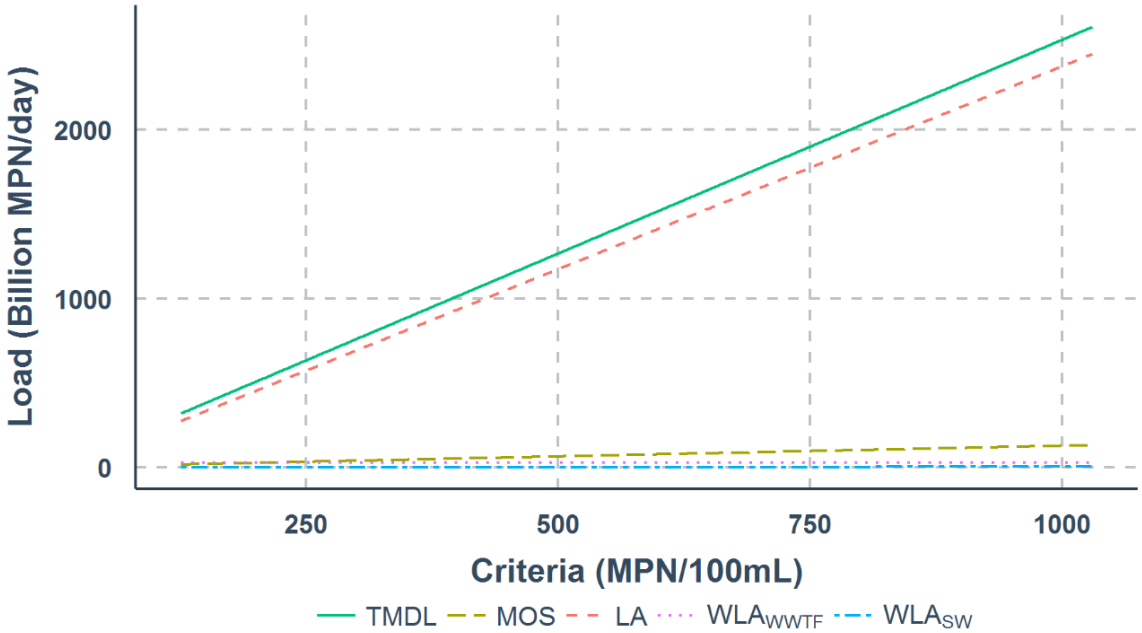

Figure A-1. *E. coli* allocation loads for Aransas River Above Tidal (AU 2004_02) as a function of water quality criteria

Equations for calculating new TMDL and allocations (in billion MPN/day *E. coli*) for Aransas River Above Tidal (AU 2004_02):

$$TMDL = 2.533095 \times Std$$
$$MOS = 0.1266547 \times Std$$
$$LA = 2.404635 \times Std - 28.478676$$
$$WLA_{WWTF} = 28.50005$$
$$WLA_{SW} = 0.00180483 \times Std - 0.02137504$$

Where:

Std = Revised Water Quality Standard
MOS = Margin of Safety
LA = Total load allocation (non-permitted source contributions)
WLA_{WWTF} = Wasteload allocation (permitted WWTF + future growth) [Note: WWTF load held at existing primary contact (126 MPN/100mL) criteria]
WLA_{SW} = Wasteload allocation (permitted stormwater)

Table A-1. Summary of allocation loads for Aransas River Above Tidal (AU 2004_02) at selected revised water quality standards

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

Std (MPN/100mL)	TMDL	MOS	LA	WLA_{WWTF}[1]	WLA_{SW}
126	319.170	15.959	274.505	28.50005	0.206
630	1595.850	79.792	1486.441	28.50005	1.116
1030	2609.087	130.454	2448.295	28.50005	1.838

[1] WLA_{WWTF} includes the future potential allocation to wastewater treatment facilities and held at the primary contact (126 MPN/100mL) criteria

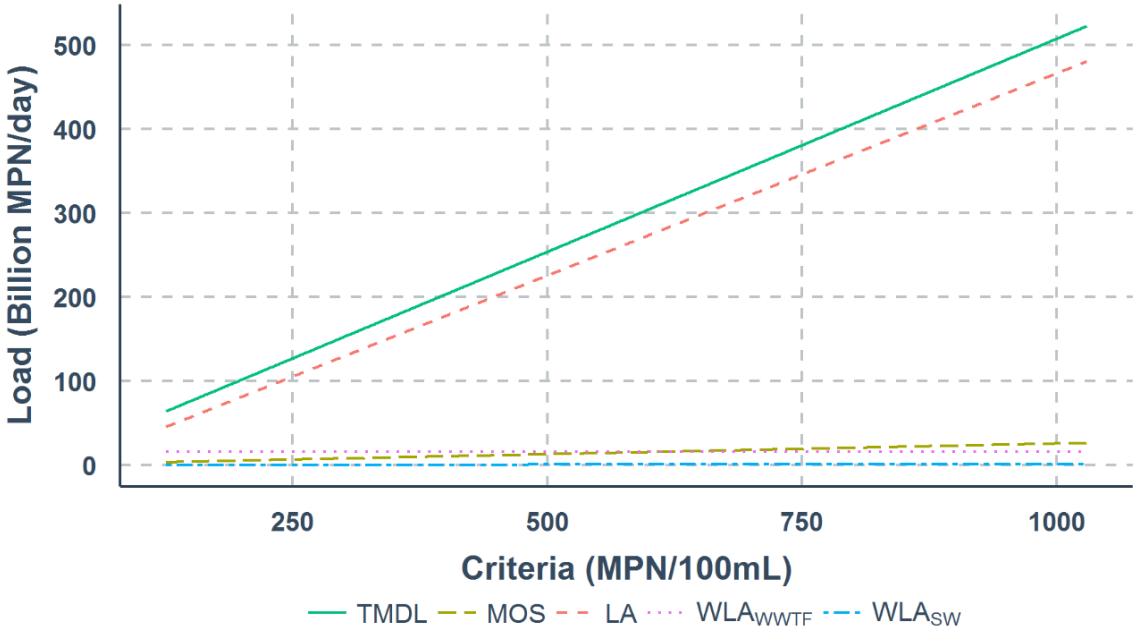

Figure A-2. *E. coli* allocation loads for Poesta Creek (AU 2004B_02) as a function of water quality criteria

Equations for calculating new TMDL and allocations (in billion MPN/day *E. coli*) for Poesta Creek (AU 2004B_02):

$$TMDL = 0.5070740 \times Std$$
$$MOS = 0.02535370 \times Std$$
$$LA = 0.4810218 \times Std - 15.1618148$$
$$WLA_{WWTF} = 15.18383$$
$$WLA_{SW} = 0.00069849 \times Std - 0.02202$$

Where:

Std = Revised Water Quality Standard
MOS = Margin of Safety
LA = Total load allocation (non-permitted source contributions)
WLA_{WWTF} = Wasteload allocation (permitted WWTF + future growth) [Note: WWTF load held at existing primary contact (126 MPN/100mL) criteria]
WLA_{SW} = Wasteload allocation (permitted stormwater)

Table A-2. Summary of allocation loads for Poesta Creek (AU 2004B_02) at selected revised water quality standards
All loads expressed as billion MPN/day *E. coli*

Std (MPN/100mL)	TMDL	MOS	LA	WLA_{WWTF}[1]	WLA_{SW}
126	63.891	3.195	45.447	15.18383	0.066
630	319.457	15.973	287.882	15.18383	0.418
1030	522.286	26.114	480.291	15.18383	0.697

[1] WLA_{WWTF} includes the future potential allocation to wastewater treatment facilities and held at the primary contact (126 MPN/100mL) criteria