General threats to water quality from domestic wastewater discharges in the Hill Country

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Revised Aug. 19, 2016 and Sept. 16, 2018

Preface

This presentation was developed to represent domestic wastewater discharges in the Texas Hill Country. The first 15 slides represent a summary of the presentation content and the remaining slides present details in support of the summary. Therefore, some of the information after slide number 15 is repeated in prior slides. A table of contents is provided on the next slide so that specific sections or issues can readily be viewed or skipped.

Because of the complexity and details involved in domestic wastewater discharge permitting in Texas, this presentation is not conclusive—a conclusive presentation would require much more detail than presented here. Generalities or simplifications are used where deemed to have minimal affect on comprehension and integrity of the material.

Basic information about water resources and water-quality are online at http://water.usgs.gov/edu/waterquality.html

Slide numbers are presented in lower right corner of each slide

Presentation organization

Introduction

Hill Country development and growth

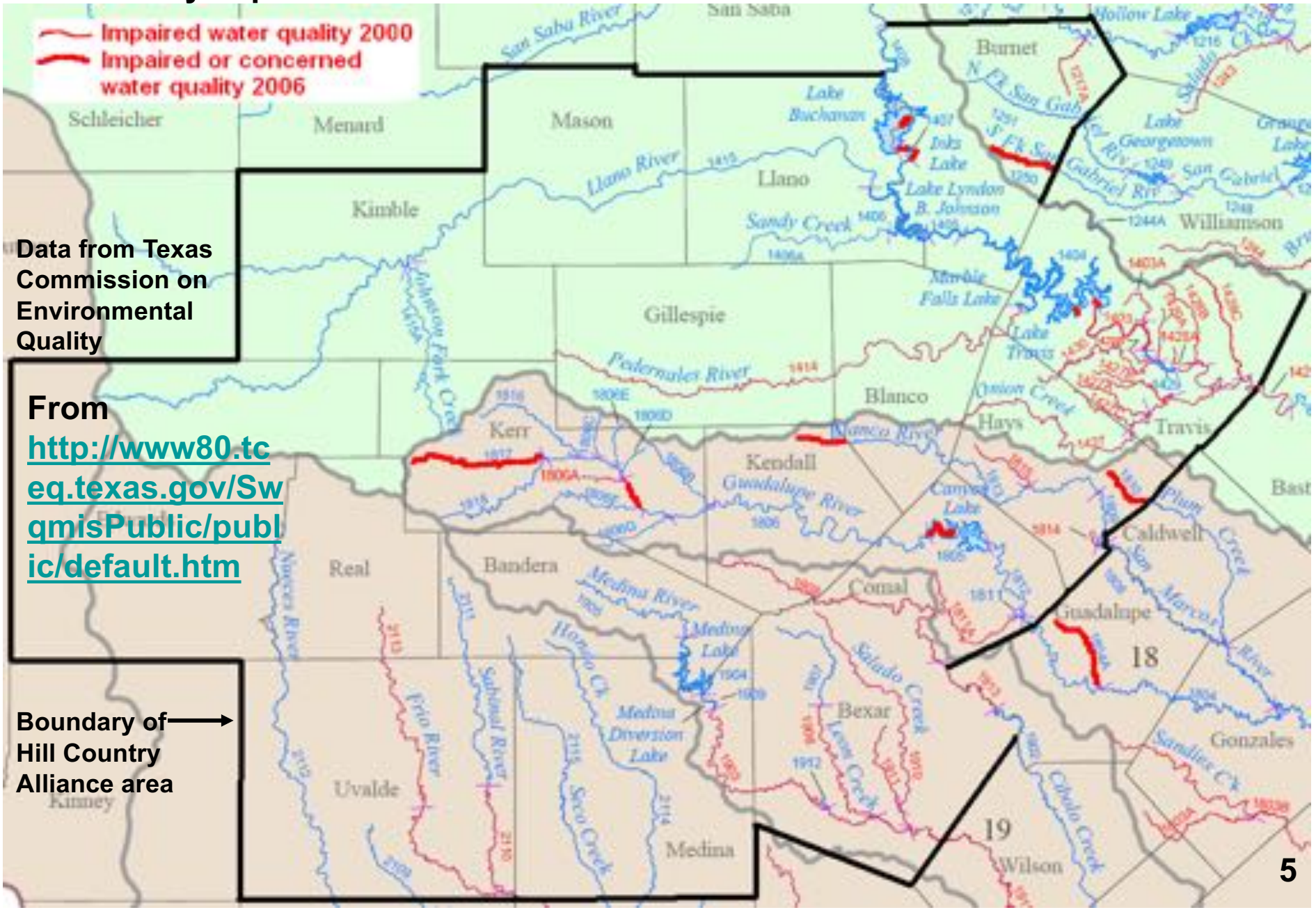
Urban development on the Texas Hill Country has been increasing over the past many years and is projected for additional increases in the future.

Current and projected population and water demands for the Hill Country are presented in a PowerPoint presentation entitled "Hill Country Water Issues" at

http://www.hillcountryalliance.org/HCA/Presentations

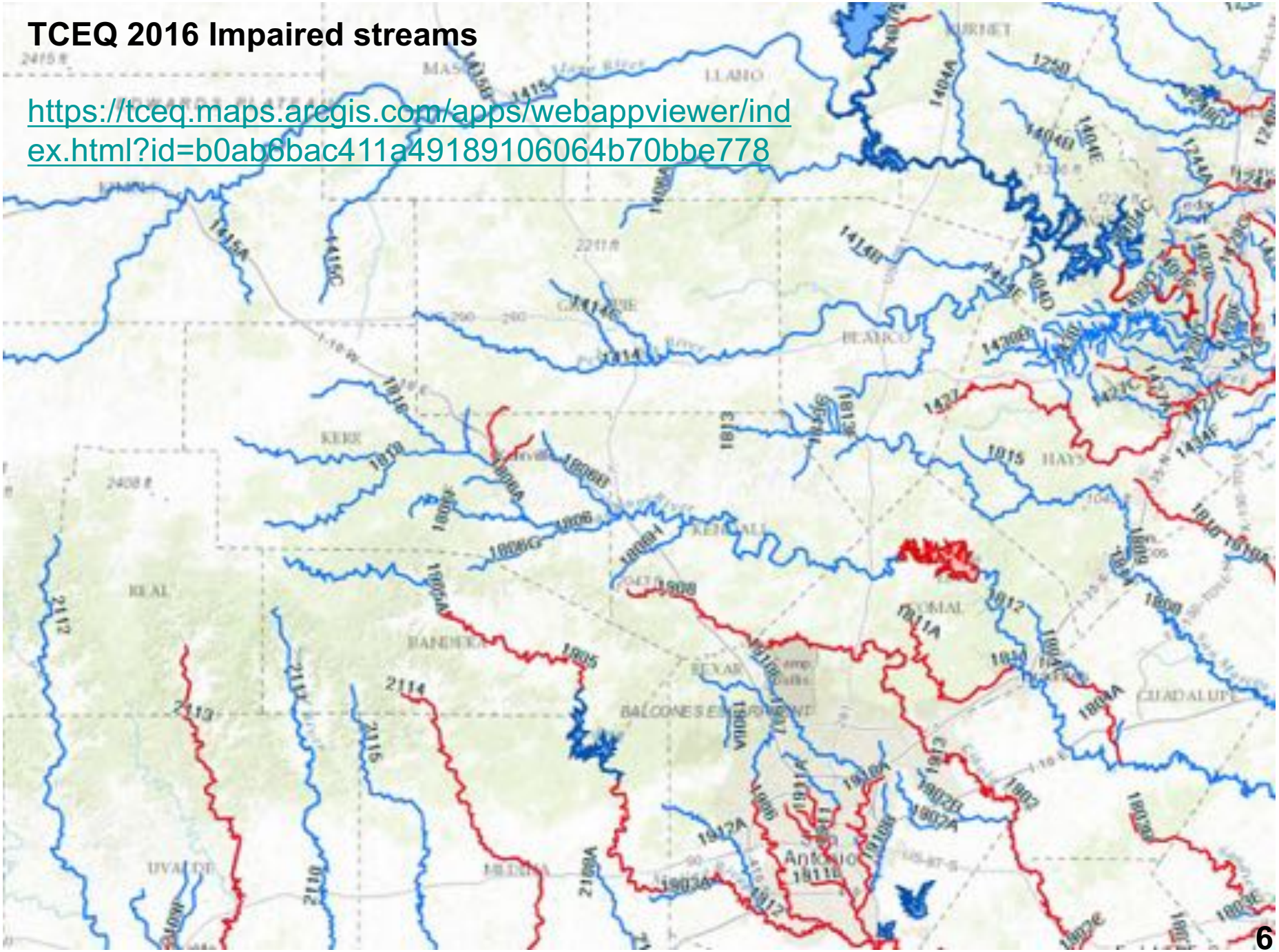
Domestic facilities that dispose of treated effluent by land application (surface irrigation, evaporation, drainfields or subsurface land application) are required to obtain a Texas Land Application Permit (TLAP) permit. Domestic facilities that dispose of treated effluent by discharge into waters in the state are required to obtain a Texas Pollutant Discharge Elimination System (TPDES) permit. These discharges typically are the least expensive method to dispose of domestic wastewater, however, as shown on the next slide, degradation of surface and groundwater quality often are caused by such discharges.

As of 2006, the water quality for many Hill Country stream reaches were already impaired from wastewater effluent and other contaminant sources



TCEQ 2016 Impaired streams

https://tceq.maps.arcgis.com/apps/webappviewer/index.html?id=b0ab6bac411a49189106064b70bbe778



Growing numbers of effluent wastewater discharge permits

Many of the wastewater discharge permits in the Hill Country produce large volumes of effluent. Of the 128 existing permits (as of 2016), 67 of the permits allow effluent discharge exceeding 1 million gallons per day.

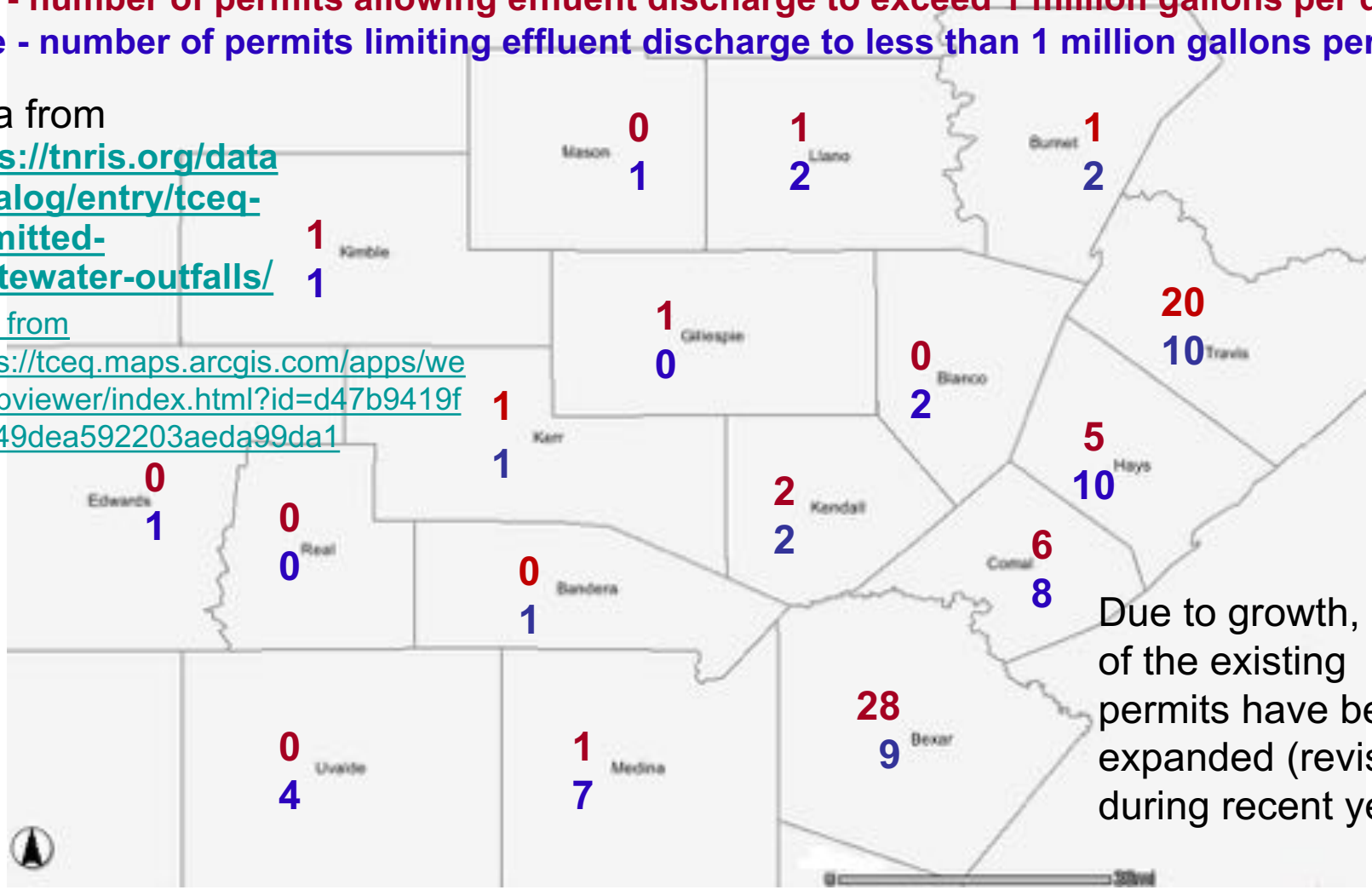
Explanation

Red - number of permits allowing effluent discharge to exceed 1 million gallons per day

Blue - number of permits limiting effluent discharge to less than 1 million gallons per day

Data from
https://tnris.org/data-catalog/entry/tceq-permitted-wastewater-outfalls/

And from
https://tceq.maps.arcgis.com/apps/webappviewer/index.html?id=d47b9419f42c49dea592203aeda99da1



Due to growth, most of the existing permits have been expanded (revised) during recent years

Criteria Summary for TCEQ wastewater permits

Applications for wastewater discharge permits specify a maximum and mean discharge rate (gallons per day) and require that discharges not exceed established maximum allowable concentrations (levels).

The permits generally address only four water-quality constituents– Carbonaceous Biolochemical Oxygen Demand (CBOD*), Total Suspended Solids (TSS), Ammonia Nitrogen (NH3), and Phosphorus (P). Minimum Dissolved Oxygen (DO) levels are established for permits in some areas. The units for all constituents are represented in milligrams per liter (mg/L).

Based on TCEQ identified vulnerability to contamination, the agency has established, for various geographic areas, maximum wastewater-quality limits for some or all of the five water-quality constituents.

Additionally, for some areas, the TCEQ has established maximum wastewater limits for various water sample durations—grab (instantaneous value), daily average, 7-day average, and 30-day average. However, as discussed later, for 7 Hill Country Counties, maximum limits exist only for 30-day average values.

Finally, TCEQ rules do not prohibit wastewater discharges into dry streams. Most Hill Country streams are dry most of the time, thus wastewater receiving streams often contain wastewater only.

Despite the permit criteria many Hill Country wastewater problems occur

***CBOD is a method defined test measured by the depletion of dissolved oxygen by biological organisms in a body of water in which the contribution from nitrogenous bacteria has been suppressed.**

The Hill Country is more vulnerable to wastewater contamination than the remainder of Texas

Wastewater permits typically are allocated to locations remote and upstream from "critical" water areas such as recharge zones, caves, reservoirs, or intakes for public water supplies. The permits are based on the premise that wastewater contaminants are effectively absorbed in receiving stream channels prior to the wastewater reaching any critical water areas. Such absorption is attributed to vegetation and soils in streambeds immediately downstream from wastewater discharges. Additionally, many if not most wastewater permit applications claim that much if not most contaminant levels (or at least nutrients—nitrogen and phosphorus) are substantially reduced by vegetation in channels immediately downstream from wastewater discharges. However, few in any permit applications document the existence of channel vegetation substantial enough for effective contaminant absorption.

Additionally, the effective absorption of contaminants in wastewater require receiving stream channels with: extensive vegetation and thick soils (to absorb wastewater contaminants); flat slopes (to cause slow stream velocities so that wastewater contaminants have maximum absorption time before arriving at downstream critical water areas); and, no caves or cavities (so that wastewater does not flow quickly and unfiltered to underlying aquifers).

However, compared to the remainder of Texas, the Hill Country has stream channels with: steep slopes; little if any vegetation or soils; and, extensive faults, caves, and springs. These conditions cause minimal if any absorption of wastewater contaminants. Maps (links below) present the physiography, soil characteristics, ecological conditions, and tectonics of Texas, and, substantiate the vulnerability of Hill Country streams.

http://www.beg.utexas.edu/UTopia/images/pagesizemaps/physiography.pdf
http://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=TX
https://www.epa.gov/eco-research/ecoregions
http://www.lib.utexas.edu/geo/pics/tectonic2.jpg

Because of the vulnerability of Hill Country streams, reservoirs and aquifers to wastewater contamination, this area should be afforded wastewater criteria that is stricter than the remainder of Texas and designed specifically for this region.

Water-quality criteria to protect Hill Country water

The EPA provide water quality criteria for many water uses http://www.epa.gov/waterscience/criteria/.

Protection criteria (maximum limits) for two of the wastewater-quality permit constituents (nitrogen and phosphorus) have been established. The EPA National Primary Drinking Water Regulations identify a maximum limit for nitrite nitrogen (NO2). Additionally the EPA and local studies have identified maximum limits for total nitrogen (N) and phosphorus (P) in order to protect biological species and prevent algae and eutrophication*. These protection criteria limits are presented herein and compared to permitted wastewater limits.

As shown in slide 7, permitted wastewater limits address NH3 but do not address NO2 or total N. However, ammonia nitrogen (NH3) is instable in a stream environment--much if not most or all NH3 readily becomes nitrite nitrogen (NO2) or nitrate nitrogen (NO3) in a stream environment. Total N represents the sum of organic N, NH3, NO2, and NO3.

The next 4 slides present:

1. **the maximum permitted wastewater limits for various areas within the Hill Country.**
2. **the stream background levels for the wastewater-quality constituents.**
3. **the protection criteria (maximum limits) as described in the previous paragraph**

The next slide presents the above information on a map, the following slide presents the information in a table, and the last 2 slides present a written summary.

*** Eutrophication is defined at http://www.wri.org/our-work/project/eutrophication-and-hypoxia/about-eutrophication**

3 click **Comparison of wastewater-quality criteria and protection criteria**

For wastewater, maximum 30-day average values in **red**, single grab sample value in **blue**

EPA Maximum limit for public water supply, NO2 = 1

no limits where dashed

Maximum limit to protect biological species, and prevent algae and eutrophication

EPA: total N = 0.25 P = 0.023

Texas: total N = 0.25 P = 0.05

NH3 – Ammonia N

CBOD-carbonaceous biochemical oxygen demand

Wastewater limits for other areas

CBOD	20	65
TSS	20	65
NH3	--	--
P	--	--
DO		2 (minimum)

Wastewater limits for 10 mile boundary (in red) around Lakes Buchanan and Travis

CBOD	10	35
TSS	15	60
NH3	--	--
P	--	--

Wastewater limits below apply only to areas in green

Distance from discharge location to Edwards aquifer

	0-5 miles	5-10 miles
CBOD	5	10
TSS	5	15
NH3	2	3
P	1	-- --

Note: No limit for grab samples

TCEQ defined Edwards aquifer contributing zone

No discharges allowed on the Edwards aquifer

Background water quality values for local streams

CBOD	<1
TSS	1-5
NH3	< 0.05
P	<0.05

0 miles 20

Comparison of wastewater-quality criteria and protection criteria

(--, no limits established)

Area	30-day average values CBOD	TSS	NH3	P	Single grab sample CBOD	TSS	NH3	P
Edwards aquifer	no discharges allowed				no discharges allowed			
Contributing zone, 0-5 miles from Edwards aquifer	5	5	2	1	no limits established			
Contributing zone, 5-10 miles from Edwards aquifer	10	15	3	--	no limits established			
10 mile boundary around Lakes Buchanan and Travis	10	15	--	--	35	60	--	--
Remainder of area	20	20	--	--	65	65	--	--
Natural background water quality for stream baseflow	< 1.0	1-5	<0.05	<0.05				
EPA Maximum level for public water supply	--	--	1.0*	--				
Maximum level to sustain biological species and prevent algae and eutrophication	--	--	0.25**	0.023 (EPA)				
	--	--	0.25**	0.05 (Texas studies)				

For areas other than the Edwards contributing zone, daily and 7-day average values also have been established

* Value for nitrite nitrogen (NO2)

** Value for total nitrogen (N)

Comparison of wastewater-quality criteria and protection criteria

Hill Country area presented in green

The Edwards aquifer (parts of Travis, Hays, Comal, Bexar, Medina, and Uvalde Counties)

Wastewater discharges are not allowed on the Edwards aquifer

TCEQ defined contributing zone within 0-5 miles of the Edwards aquifer in Travis, Hays, Comal, Bexar, Medina, and Uvalde Counties.

The strictest Hill Country wastewater quality limits exist in this area. However, the ammonia nitrogen limit (2.0) is 2 times higher than the value for EPA drinking water standards for nitrite nitrogen and 8 times higher than the nitrogen limit to protect the creek from eutrophication. Additionally, the phosphorus limit (1.0) is 43 times higher than the EPA limit to protect streams from eutrophication and 20 times higher than the Texas studies limit to protect streams from eutrophication.

TCEQ defined contributing zone within 5-10 miles of the Edwards aquifer in Travis, Hays, Comal, Bexar, Medina, and Uvalde Counties.

The ammonia nitrogen limit (3.0) is 3 times higher than the value for EPA drinking water standards for nitrite nitrogen and 12 times higher than the nitrogen limit to protect the creek from eutrophication. Additionally, no phosphorus limit exists in this area thus the area is subject to extremely large phosphorus values that could severely damage streams.

Finally, as described later in detail, for the contributing zone areas above, no wastewater quality limit is established for grab, daily, or 7-day average wastewater values. Therefore, wastewater quality for durations less than a month could be much greater than those established for average monthly values.

Comparison of wastewater-quality criteria and protection criteria (cont.)

Hill Country area presented in green

10 mile boundary around Lakes Buchanan and Travis

No limits for nitrogen or phosphorus exist for these areas

Remaining Hill Country area

No limits for nitrogen or phosphorus exist for these areas

Source rule for wastewater effluent water-quality criteria

Edwards aquifer contributing zone within 0-5 miles of the Edwards aquifer: Section 213.6 (c) (page 32-33) at https://www.tceq.texas.gov/assets/public/legal/rules/rules/pdflib/213a.pdf

Edwards aquifer contributing zone 5-10 miles from the Edwards aquifer: Section 213.6 (c) (2) (link above) states that limits shall follow those in set 2N in table 1, section 309 below.

Area adjacent to Highland Lakes : Section 311 requires wastewater discharges to water-supply reservoirs to follow set 2 in table 1, section 309 below.

Remaining area: Section 309.4, set 1 online at http://texreg.sos.state.tx.us/fids/200603307-1.html

Summary of major threats to water quality due to inconclusive rules

1. Wastewater quality limits are too lax.
2. Wastewater quality limits do not address many pollutants in wastewater.
3. In some areas, wastewater quality limits are not based on a complete set of time durations for wastewater samples. For example, 30-day average wastewater quality limits are identified but no limit for single grab samples, daily values, or 7-day average values).
4. TCEQ management of wastewater facilities is not as thorough and uncompromising as it should be.
5. Wastewater permits often are issued without complete identification of and consideration for local and downstream threats to water quality (i.e., wastewater can be discharged into dry streams).
6. TCEQ rules do not ban or limit phosphorus content in detergents.
7. Wastewater permits do not require monitoring of receiving surface or groundwater for contamination from the wastewater.
8. The Edwards aquifer contributing zone outside 10 miles from the aquifer has less strict wastewater-quality criteria than the area within 10 miles of the aquifer.

Additional information and details for items 1-6 and 8 above are presented in slides 19-32 and 34

Summary of recommendations to protect Hill Country water quality from wastewater discharges

Recommendation numbers 1-8 correspond to same threat numbers in previous slide

Major recommendations in black, specific recommendations in blue

1. **Decrease maximum allowable limits for wastewater quality. (slides 19-23).**
   a. **Wastewater quality limits should be lowered at least on-half for all Hill Country areas.**
2. **Add additional water-quality constituents for which wastewater quality limits are permitted.**
   a. **Identify, for all Hill Country areas, maximum levels for CBOD, TSS, NH3, P, DO, and TOC. (slide 24).**
3. **For all areas, establish maximum limits for grab, daily mean, and 7-day mean wastewater quality. The 30-day mean wastewater quality duration is too long to protect water quality for receiving waters and should be abolished. (slide 25)**

4.a. **Wastewater plants should not receive prior notice of inspections. (slides 26-28)**

b. **Time periods allowed for noncompliant operators to become compliant should be reduced to days rather than weeks.**

c. **Fines and penalties for noncompliance should be increased.**

d. **All violations, fines, and penalties should be made immediately available on the Internet.**

5. **Wastewater permit applications should include a thorough assessment of hydrologic and water quality conditions for wastewater receiving areas and potential threats to those areas from wastewater. (slides 29-31)**
   a. **For the receiving area of all wastewater permits, all water data and findings for surface and groundwater should be aggregated and a thorough analyses made to assure that the wastewater would not degrade the water quality for receiving waters. The report should include analyses for low-flow and long-term conditions, and, for compliance and worst case spill scenarios, the predicted water quality concentrations and loads for receiving waters (wells, streams, and reservoirs).**
   b. **Establish contingency permits for wastewater discharges so that such discharges occur only during designated minimal downstream streamflow discharge conditions.**
6. **Establish a limit (0.5% recommended) on phosphorus contents in detergents for Hill Country areas. (slide 32)**
7. **Require periodic water-quality monitoring of streams and aquifers in wastewater receiving areas for contamination from wastewater.**
8. **The entire contributing zone to the Edwards aquifer should be provided the same protection as that within 10 miles of the Edwards aquifer (slide 36)**
9. **Where feasible, decentralized wastewater treatment and reuse of wastewater should be encouraged and used. (slide 37, first reference)**

Background for TCEQ wastewater permits

Domestic developments that dispose of wastewater must obtain a TCEQ permit http://www.tceq.texas.gov/permitting/water_quality/wastewater/municipal/WQ_Domestic_Wastewater_Permits.html. Typical disposal includes land application or direct discharge to streams.

The permitting process for direct discharge is part of the TCEQ program permitting **Water quality permits for cities and other developed areas** http://www.tceq.texas.gov/permitting/wastewater/water-quality

The status of Water Quality Permit Applications (which include wastewater discharges) can be viewed at http://www.tceq.texas.gov/permitting/status/permit_data.html . These include existing and pending permits. This system also includes permits for industrial wastewater, industrial storm water, and municipal separate storm sewer systems.

A search for all information about Texas wastewater permits is online at http://www1.tceq.texas.gov/wqpaq/index.cfm?fuseaction=home.AdvanceSearchResult

and search regarding violations for such permits is online at https://www.tceq.texas.gov/compliance/enforcement/enforcement-reports/pending-enforcement-actions

Typically, land application is less threatening to water quality than direct discharge, however, the former method often is more expensive than the latter because land must be dedicated for irrigation. Therefore, most wastewater applications represent discharge to streams. Detailed information regarding wastewater irrigation systems and their effectiveness in reducing wastewater pollutants is presented on slides 37-38. Information regarding decentralized wastewater treatment systems and reuse of wastewater is presented on slide 37, first reference.

Background for TCEQ wastewater permits (cont.)

Chapter 30 (Texas Water Code) of the Texas Administrative Code covers rules to be enforced by the Texas Commission on Environmental Quality (http://www.tceq.texas.gov/rules/indxpdf.html)

Three chapters (below) are designed to protect the water quality for the Hill Country—wastewater rules are presented within each chapter

Section 213 in the Texas Water Code is designed to protect the water quality of the Edwards aquifer and streams contributing to the Edwards aquifer—they pertain to Travis, Hays, Comal, Bexar, Medina, and Uvalde within the Hill Country area (see map on slide 10)

Section 311 is designed to protect the water quality for Inks Lake, a 10-mile boundary on either side of Lake Buchanan and Lake Travis, and the Pedernales River within 15 miles of Lake Travis.

The water quality for the remaining area of the Hill Country are not protected by rules specific to this area. However, limits on wastewater permits for most of Texas, including the Hill Country but excluding the 2 other areas mentioned above, are identified by Section 309 of the Water Code. This section also includes rules for land irrigation of wastewater.

Details for major threats to water quality due to inconclusive rules

The following 14 slides present details for the 6 major threats identified in the Introduction slide and below:

Issue	slide numbers
1. Wastewater quality limits are lax	20-24
2. Permits do not address many pollutants in wastewater	25
3. Lack of time duration periods for analyses of wastewater samples	26
4. TCEQ management of wastewater facilities is not thorough	27-29
5. Lack of consideration for local characteristics and downstream threats	30-33
6. Rules do not ban or limit phosphorus content in detergents	34

1. Wastewater quality limits are lax
CBOD and TSS

Although National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations do not address CBOD or TSS, large concentrations of CBOD are associated with algal growth and lack of biological diversity and activity in streams.

Most of the Total Suspended Solids in wastewater is expected to be organic material rather than suspended sediment thus wastewater likely would cause an increase in suspended organic material in receiving streams and reservoirs—such increases likely would degrade water quality in receiving waters.

The EPA have developed water-quality criteria for many water uses—these are presented at http://www.epa.gov/waterscience/criteria/

1. Wastewater quality limits are lax (cont)

a. Ammonia nitrogen

Threat to public water supply

Ammonia Nitrogen limits

30-day average values

2 mg/L -- within 0-5 miles of Edwards aquifer recharge zone

3 mg/L – within 5-10 miles of Edwards aquifer recharge zone

No ammonia nitrogen limits for the remainder of the Hill Country

After discharge, ammonia nitrogen readily changes form to become nitrite nitrogten or nitrate nitrogen

Although no limits for ammonia nitrogen are established by National Primary Drinking Water Regulations (https://safewater.zendesk.com/hc/en-us/sections/202366648-Primary-Drinking-Water-Contaminants) a limit of 1 mg/l for nitrite nitrogen and 10 mg/l for nitrate nitrogen are imposed for public water systems. With addition of oxygen, the ammonia nitrogen in wastewater (2-3 mg/L) would change to states of nitrite and nitrate nitrogen as the wastewater was conveyed. Nitrite Nitrogen levels of 2-3 mg/L (converted from ammonia nitrogen) would exceed the limits from these regulations.

1. Wastewater quality limits are lax (cont)

a. Ammonia nitrogen

Threat to stream

Many studies have linked nitrogen in water to algal problems in streams. Nitrogen concentrations as low as 0.28 to 0.30 mg/l have been associated with nuisance growth of periphyton, a matrix of algae and heterotrophic microbes in water (https://www.epa.gov/nutrientpollution/problem). Also, nitrogen concentrations as low as 0.25 to 0.30 mg/l have been associated with plankton (tiny open-water plants, animals or bacteria) at eutrophic levels (same reference as above,).

Eutrophic conditions can readily be caused in streams and reservoirs by wastewater nitrogen—such conditions often cause reduction or depletion of biological species in such waters.

1. Wastewater quality limits are lax (cont)

b. Phosphorus

Threat to stream

Phosphorus limits

30-day average values

1 mg/L -- within 0-5 miles of Edwards aquifer recharge zone

No phosphorus limits for the remainder of the Hill Country

A study conducted by the Texas Institute for Applied Environmental Research shows that phosphorus levels as low as 0.05 mg/l have produced as much as one-half of the average algal biomass in the streams studies (Kiesling and others, 2001, p. 34, fig. 12, http://tiaer.tarleton.edu/pdf/TR0107.pdf)

and shows that phosphorus concentrations as low as 0.20 mg/l cause full maximum algae production in streams. (same reference as above, p. 37).

Detailed information regarding the water quality threat from phosphorus is presented in slide 32.

1. Wastewater quality limits are lax (cont)

c. Ammonia nitrogen and phosphorus

Threat to stream

Under section 303c of the Clean Water Act, the EPA recommends that States establish water-quality criteria, and provides background material and recommendations for limits of nutrients (nitrogen and phosphorus). Such information and data are presented for Region IV, which includes Texas http://www2.epa.gov/nutrient-policy-data/ecoregional-criteria-documents**.**

The State of Texas has not established nutrient criteria https://www.epa.gov/nutrient-policy-data/state-development-numeric-criteria-nitrogen-and-phosphorus-pollution **Water-quality data for streams in Subecoregion 30 within Region IV, which represents the Hill Country area, were used to present "Reference conditions" for nutrients in the subecoregion. Based on data for about 41 streams, 0.27 mg/l represents the 25 percentile for total nitrogen in streams in the subecoregion, and, based on about 50 streams, 0.008 mg/l represents the 25 percentile for total phosphorus. The data are available at** https://www.epa.gov/nutrient-policy-data/nitrogen-and-phosphorus-pollution-data-access-tool

These values are substantially lower than those for wastewater permits.

U.S Environmental Protection Agency recommendations for nutrient criteria for EcoRegion IV are 0.56 mg/l for total nitrogen and 0.023 mg/l for total phosphorus https://www.epa.gov/nutrient-policy-data/ecoregional-nutrient-criteria-rivers-streams**.**

2. Wastewater quality limits do not address many pollutants in wastewater.

Pharmaceuticals, hormones and other organic compounds

In many states and areas, wastewater limits are identified for total organic carbon (TOC)—Texas does not identify a wastewater limit for this constituent.

A recent study by the US Geological Survey shows that a broad range of chemicals found in residential wastewaters commonly occurs in mixtures at low concentrations downstream from wastewater discharge points. The chemicals include human and veterinary drugs (including antibiotics), natural and synthetic hormones, detergent metabolites, plasticizers, insecticides, and fire retardants.

One or more of these chemicals were found in 80 percent of the 139 streams sampled. Half of the streams, which are located throughout the Nation, contained 7 or more of these chemicals, and about one-third of the streams contained 10 or more of these chemicals (Buxton and Kolpin, 2002) http://toxics.usgs.gov/pubs/FS-027-02/index.html.

A summary of the above report entitled "Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams", published by the U.S. Geological Survey, presents the risks posed by a broad range of chemicals in wastewater effluent.

Much additional information regarding organic compounds in wastewater and water supplies is presented within references in slide 35.

3. Wastewater quality limits are not based on a complete set of time durations for wastewater samples

Wastewater quality rules for the counties containing the Edwards aquifer and TCEQ identified contributing zone (Travis, Hays, Comal, Bexar, Medina, and Uvalde Counties) identify maximum levels for time periods representing a 30-day average sample value. As an example, the maximum level permitted for wastewater discharge in the contributing zone within 5 miles of the Edwards aquifer is 2 mg/L for NH3 and 1 mg/L for P. However, theses maximum levels apply only to the average value for samples collected over a 30-day period.

This long time period allows the wastewater facility to discharge NH3 and P concentrations for shorter periods (i.e. a day or week) that are much greater than the designated 30-day average value—the permit criteria is met as long as the 30-day average value does not exceed that value.

However, the travel time from wastewater sites to the receiving streams and aquifers can represent hours or days—a duration much shorter than 30 days. Wastewater rules for other areas in the Hill Country and State identify maximum levels for grab samples, one day, and one week—such durations are needed for the 6 counties above in order to protect the receiving streams and aquifers from contamination.

4. Management of wastewater is not thorough

The TCEQ publishes an Annual Enforcement Report—the latest edition is 2016 online at http://www.tceq.texas.gov/enforcement/reports/AER/annenfreport.html--it identifies the number of: inspections (offsite and onsite), complaints, Enforcement (Notice of Violations, Notice of Enforcement, and Administrative orders), civil enforcements, and criminal charges for the 15 regulatory programs they manage—such programs include water, air, petroleum, and waste management. One of the 15 programs (water quality) includes domestic and industrial wastewater treatment plants, domestic and industrial storm water, and sludge use operations (beneficial use sites and transporters).

The 2015 report stated that 93% of waste facilities were compliant during inspection (page 1-8) but a footnote reports "Some minor violations may have been noted in the investigations; however, they were corrected within a reasonable period of time, and therefore did not require further enforcement" (page 1-8). When a violation is discovered, the responsible party typically receives a mailed "Notice of Violation (NOV)". If the violator does not become compliant, an Administrative Enforcement can be issued followed by civil enforcements and then criminal charges. A standard NOV is posted at http://www.tceq.texas.gov/assets/public/permitting/waterquality/attachments/municipal/a6d4~1.pdf The default time frame provided for permit compliance is 30 days.

TCEQ investigators send a document to a plant that is about to undergo a wastewater investigation, to "ensure availability of records needed to complete the process expeditiously". However, this provides time for the plant to ensure permit compliance in time for the inspection.

The TCEQ also has a voluntary environmental self audit program. Those who comply with the conditions of the Texas Environmental, Health, and Safety Audit Privilege Act may qualify for immunity from penalties if "swift" (not defined by TCEQ) compliance is achieved.

Unless specified otherwise, all references in slides 26-28 are within the Annual Enforcement Report at http://www.tceq.texas.gov/compliance/enforcement/reports/AER/annenfreport.html

4. Management of wastewater is not thorough (cont.)

The industry types with the highest percentage of administrative and civil judicial orders issued in FY 2015 were Gasoline Stations with Convenience Stores (18%), Water Supply and Irrigation Systems (17%), Sewage Treatment Facilities (8%), Solid Waste Landfills (3%), and Plumbing, Heating, and Air Conditioning Contractors (3%).

The Annual Enforcement Report presents the Statewide Inspection Compliance table below.

Table 1-2: Percent of Facilities Inspected by the TCEQ in Compliance (page 1-8)

YEAR	2010	2011	2012	2013	2014	2015
% of inspected air facilities in compliance	97	97	97	98	98	98
% of inspected water facilities in compliance	99	99	99	99	99	99
% of inspected waste facilities in compliance	92	93	90	89	95	93

The above table shows that waste treatment facilities have a relatively bad compliance record. Despite the fact that waste facilities receive advance notice of inspectors, about 5 -11% of the time (from 2010-2015) their plants are in noncompliance. Additionally, as the standard NOV indicates, they might be provided 30 days or more to become compliant. However, during this 30-day period, the wastewater plant could discharge a larger load of contaminants than during a full year of compliance discharges.

4. Management of wastewater is not thorough (cont.)

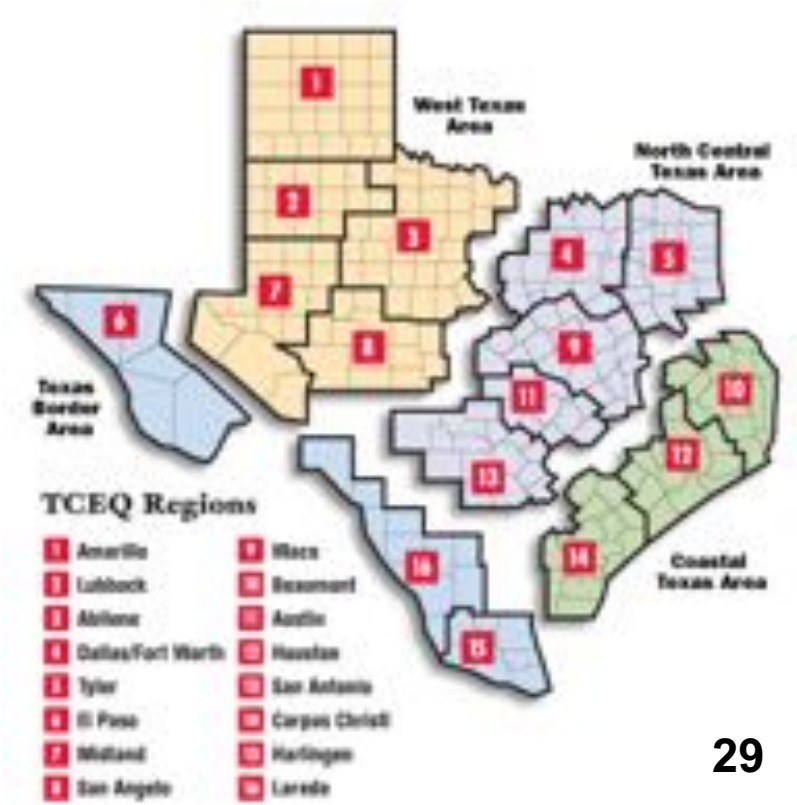
The Annual Enforcement Report does **not reveal any information about domestic wastewater discharge** permits, inspections, complaints, enforcement, etc. Information on this type of permit is buried within the water-quality program.

TCEQ Region 13 is comparable to the Hill Country. The 2015 Enforcement Report indicates that 1164 total inspections and 294 onsite inspections were made for the Water Quality program in Region 13 (tables T-1a and T-1b).

Additionally, for the Region 13 water-quality program in 2015, 87 complaints were filed and 82 NOVs were issued, which represents 28% of the number of on-site inspections. Additionally for region 13, one court order and no criminal convictions were issued for the water quality program in 2015.

24 Administrative orders were issued for water-quality permit violations within the 17 Hill Country counties during 2015. The assessed penalties ranged from $250 to $48,250. Most of the violations occurred in Bexar, Comal, and Travis counties.

http://www.tceq.texas.gov/compliance/enforcement/reports/AER/annenfreport.html



5. Wastewater permits often are issued without complete identification of and consideration for local characteristics and downstream threats to water quality

For example, several substantial databases contain background water quality characteristics for streams and reservoirs throughout Texas. However, these data are seldom presented by representatives as part of their application for wastewater permits. Summaries of these data for sites proximate to proposed wastewater sites can assist in identifying water quality degradation expected from proposed wastewater discharges.

Texas Commission on Environmental Quality

- **http://www80.tceq.texas.gov/SwqmisPublic/public/default.htm This map-based database represents water quality for stream segments throughout Texas. The stream segment number for each wastewater permit is presented in the TCEQ database for water quality permits (slide 16), thus the above database can be used to document background water quality conditions in the reach identified to receive a new wastewater permit.**
- **https://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html This database presents continuous monitoring of stream water quality by the TCEQ.**

US Geological Survey

- **http://maps.waterdata.usgs.gov/mapper/ All surface and groundwater quantity and quality data from the USGS is presented on this map-based product.**

5. Wastewater permits often are issued without complete identification of and consideration for local characteristics and downstream threats to water quality (cont.)

Representatives for wastewater permit applications often claim that wastewater nutrients (nitrogen and phosphorus) would be absorbed by vegetation in downstream channels. However, except during flood runoff, wastewater discharges are contained in the lowest parts of low-flow channels, typically less than a few feet wide.

Very few if any Hill Country channels contain substantial vegetation in low flow channels thus it is unlikely that wastewater nutrient levels would be reduced by receiving channels.

Additionally, TCEQ rules do not prohibit wastewater discharges into dry streams. Most Hill Country streams are dry most of the time, thus wastewater receiving streams often contain wastewater only.

The next slide presents photos of typical Hill Country streams and a stream affected by wastewater.

Little if any vegetation in typical low-flow channels of Hill Country streams

Algae from wastewater in Barton Creek

Large amounts of algae blanketed the South Fork of the San Gabriel River on May 8 outside of a Georgetown couple's home. The Texas Commission on Environmental Quality has determined the algae was caused by an unauthorized dumping of sludge by a city-operated wastewater treatment plant in Liberty Hill. July 18, 2018

https://www.mystatesman.com/news/local/report-sludge-dumped-into-river-wastewater-plant-caused-algae/lNYGS6ElAzyE3FqXev31WN/

6. TCEQ rules do not ban or limit phosphorus content in detergents

A large part of domestic wastewater is from washing machines which contain large concentrations of phosphorus from detergents. As shown earlier, even small levels of phosphorus can cause loss of biological species, algae and eutrophic conditions in streams and lakes.

Beginning in 1970, a large variety of detergent phosphate bans have been enacted by various states and communities. Some bands totally eliminated phosphorus in detergents, whereas other allow up to 0.5 % phosphorus (equivalent to 2 % phosphate) or even 2.2% phosphorus (9 % phosphate). Product performance is considered in establishing phosphorus limits.

Code for the City of Austin prohibits the use of detergents exceeding 0.5% phosphorus. However, the TCEQ does not ban or limit phosphorus content in detergents. Additionally, as shown in slides **10-11**, other than for the area within 0-5 miles of the Edwards aquifer recharge zone, wastewater permits for the Hill Country do not limit phosphorus in wastewater. Therefore, phosphorus in wastewater threatens streams throughout the Hill Country.

Scientific Study documents that Hill Country streams are contaminated by wastewater discharges

In 2005-06, the US Geological Survey, in cooperation with the TCEQ, evaluated nutrient and biological conditions in 15 small streams in parts of the Edwards Plateau of Central Texas (the Hill Country). Streams that did not receive wastewater effluent had relatively low nutrient concentrations and were classified as oligotrophic; (http://en.wikipedia.org/wiki/Oligotroph). Streams receiving wastewater effluent had relatively high nutrient concentrations and were classified as eutrophic.

The results from this study are published in a report entitled "Nutrient and Biological Conditions of Selected Small Streams in the Edwards Plateau, Central Texas, 2005-06, and Implications for Development of Nutrient Criteria"—the report is available on the Internet at http://pubs.er.usgs.gov/usgspubs/sir/sir20075195.

Results from the above study

Based on 16 samples for nutrients (6 from basins with wastewater discharges and 10 from basins without wastewater discharges), figure 4 of the report presents the following:

Median total nitrogen value for samples from non wastewater basins = 0.3 mg/L
Median total nitrogen value for samples from wastewater basins = 1.6 mg/L
Median total phosphorus value for samples from non wastewater basins = 0.006 mg/L
Median total phosphors value for samples from wastewater basins = 1.1 mg/L

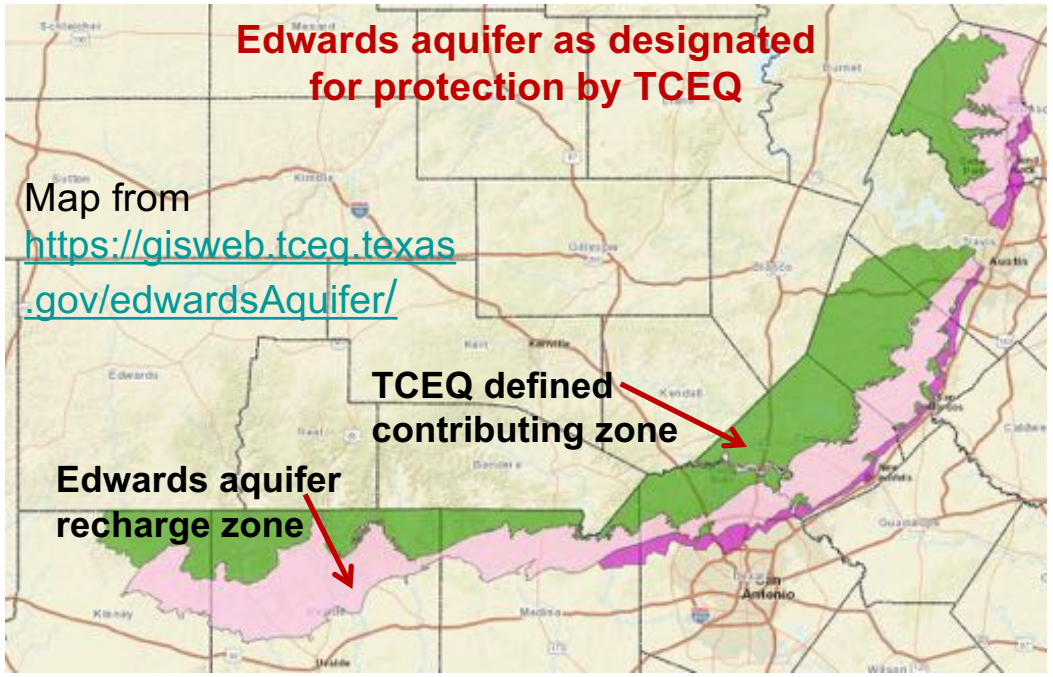
The values of total nitrogen and total phosphorus from the basins with wastewater discharges are greater than threshold values that could produce eutrophication (see slides 10 and 11). Additionally, for the samples, the median value for nitrite and nitrate nitrogen is 0.94 mg/L, a value that is comparable to the EPA maximum limit of 1 mg/L of nitrite nitrogen allowed for a public water supply (slides 10 and 11).

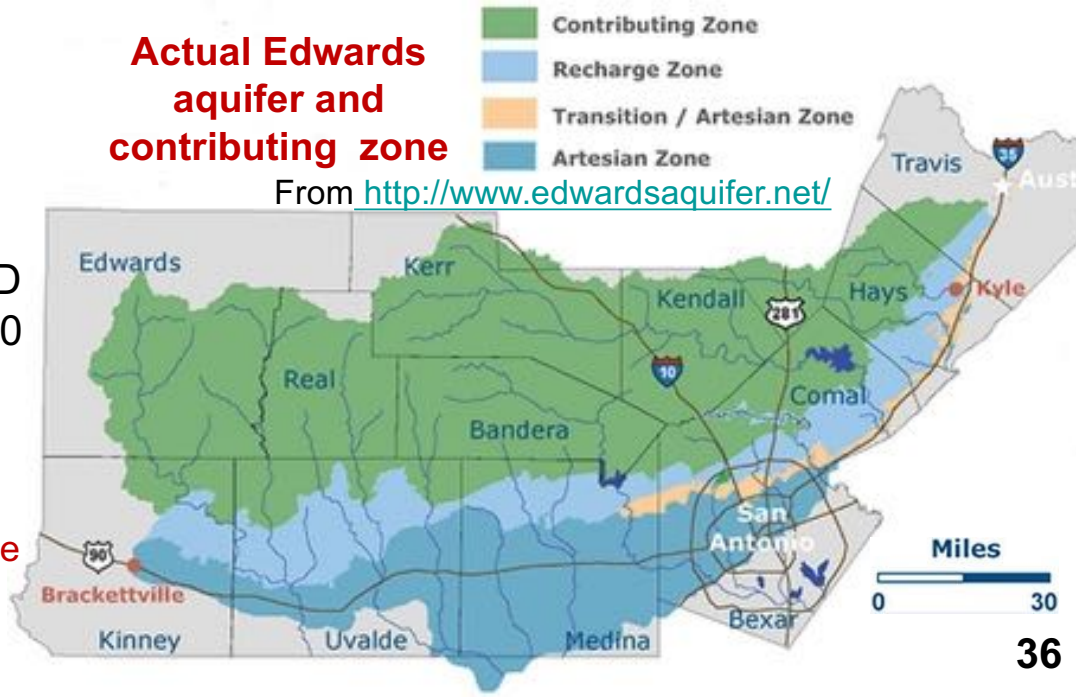
Wastewater quality criteria varies for Edwards aquifer contributing zone

Wastewater-quality criteria for the Edwards aquifer contributing area greater than 10 miles from the aquifer is less stringent than the criteria for the contributing area within 10 miles of the aquifer. However, most of the contributing area, that in Edwards, Real, Kerr, Bandera, and Kendall Counties, is outside the 10-mile distance.

Slides 11 and 12 present the wastewater criteria for that inside and outside the 5- and 10-mile distance from the Edwards aquifer. As shown, beyond 10 miles, no limit exists for NH3 and the limits for CBOD and TSS are greater than allowed within 10 miles.

In order to provide meaningful and reasonable protection for the Edwards aquifer, wastewater quality criteria should be the same throughout the contributing zone.





References for additional studies

Organic compounds in wastewater and water supplies

- **Occurrence of Selected Pharmaceutical and Organic Wastewater Compounds in Effluent and Water Samples from Municipal Wastewater and Drinking-Water Treatment Facilities in the Tar and Cape Fear River Basins, North Carolina, 2003-2005 http://pubs.er.usgs.gov/usgspubs/ofr/ofr20091046**
- **Water-Quality Data for Pharmaceuticals and Other Organic Wastewater Contaminants in Ground Water and in Untreated Drinking Water Sources in the United States, 2000-01 http://pubs.er.usgs.gov/usgspubs/ofr/ofr20081293**
- **Effect of On-Site Wastewater Disposal on Quality of Ground Water and Base Flow - A Pilot Study in Chester County, Southeastern Pennsylvania, 2005 http://pubs.er.usgs.gov/usgspubs/ofr/ofr20071253**
- **Occurrence of organic wastewater contaminants, pharmaceuticals, and personal care products in selected water supplies, Cape Cod, Massachusetts, June 2004 http://pubs.er.usgs.gov/usgspubs/ofr/ofr20051206**
- **Water-quality data for pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000 http://pubs.er.usgs.gov/usgspubs/ofr/ofr0294**
- **Occurrence of Organic Wastewater Compounds in Selected Surface-Water Supplies, Triangle Area of North Carolina, 2002-2005 http://pubs.er.usgs.gov/usgspubs/sir/sir20075054**
- **Organic compounds downstream from a treated-wastewater discharge near Dallas, Texas, March 1987 http://pubs.er.usgs.gov/usgspubs/wri/wri934194**

References for additional studies (cont.)

Water quality threat from phosphorus

- North Bosque River: A TMDL Project for Phosphorus
  https://www.tceq.texas.gov/waterquality/tmdl/06-bosque.html
- Effect of the restricted use of phosphate detergent and upgraded wastewater-treatment facilities of water quality in the Chattahoochee River near Atlanta, Georgia http://pubs.er.usgs.gov/usgspubs/ofr/ofr9499
- Review of Phosphorus Control Measures in the United States and Their Effects on Water Quality http://pubs.er.usgs.gov/usgspubs/wri/wri994007
- New Technologies Aim to Remove Excess Phosphorus
  http://twri.tamu.edu/newsletters/newwaves/nw-v16n3.pdf
- Nitrogen and Phosphorus in a Stretch of the Guadalupe River, Texas, with Five Main-Stream Impoundments
  http://www.springerlink.com/content/t2h511051312n772/
- Handbook of Detergents: Environmental impact
  http://books.google.com/books?id=WM0fiQuH7w0C&printsec=frontcover&source=gbs_v2_summary_r&cad=0#v=onepage&q=&f=false
- Phosphorus-free Fertilizer
  http://www.american-lawns.com/grasses/phosphorus.html

References for additional studies (cont.)

Decentralized systems and threats from wastewater systems

- A city of Austin report entitled "Wastewater disposal practices and change in development in the Barton Springs Zone" http://www.hillcountryalliance.org/uploads/HCA/WastewaterBartonSprings.pdf
- A report by Dr. Lauren Ross entitled "Land Applied Wastewater Effluent Impacts on the Edwards Aquifer" http://www.hillcountryalliance.org/uploads/HCA/EAWastewaterImpact.pdf
- US. Geological Survey website on toxic substances in wastewater https://toxics.usgs.gov/investigations/cec/wastewater_treatment.html
- Information by David Venhuizen about decentralized non potable reuse of wastewater http://www.venhuizen-ww.com/ and https://waterblogue.com/
- A report by Susan Parten entitled "Analysis of Existing Community-Sized Decentralized Wastewater Treatment Systems" http://www.ndwrcdp.org/documents/04-DEC-9/04DEC9RD_Research_Digest.pdf
- EPA interactive website presenting information on wastewater violations https://echo.epa.gov/facilities/facility-search/results
- KVUE TV report on "Should treated wastewater be dumped into Central Texas waterways?" https://www.kvue.com/article/news/should-treated-wastewater-be-dumped-into-central-texas-waterways/269-588834547 and
- KVUE TV report on threats from wastewater discharges https://www.kvue.com/article/news/investigations/defenders/the-dirty-truth-about-texas-water/269-342366238
- TCEQ webpage on existing and pending municipal wastewater permits https://www.tceq.texas.gov/permitting/wastewater/municipal/WQ_Domestic_Wastewater_Permits.html

References for additional studies (cont.)

Wastewater irrigation

Studies have shown that the long-term application of wastewater onto land can be done without damage to the environment. One such study "Impact of long-term application of wastewater" available at http://www.webpages.ttu.edu/cfedler/research/landapps/asae-2055.pdf presents such an example.

The EPA conducted 8 studies at 8 sites in 7 states, each entitled "Long-term effects of land application of domestic wastewater" and found no adverse impacts on the environment. An example of one of the reports (Vineland New Jersey) is at https://books.google.com/books?id=K22aKDQB42UC&printsec=frontcover&source=gbs_ViewAPI#v=onepage&q&f=false

The other studies were conducted in Camarillo, California; Dickinson, North Dakota; Hollister, California; Mesa, Arizona; Milton, Wisconsin; Roswell, New Mexico; and Tooele, Utah.

EPA National database of municipal wastewater treatment facilities

Database: https://www.epa.gov/npdes/status-nutrient-requirements-npdes-permitted-facilities

Presents, by State or territory: total number of facilities; number of facilities which have N or P limits; and, the number of facilities with required monitoring for N or P. The 4 databases represented by the boxes represent data for major facilities (> 1 mgd) and minor facilities (< 1 mgd).

- Based on the database, Texas has the most major such facilities with 489. PA is second with 291. 4420 such facilities exist Nationwide thus Tx has 11% of those in the Nation. Scroll down the link and click on the box "Majors with limits" to view this database.

- Tx also has the most minor facilities with at least 1323--the database description warns that not all minor facilities are included in this database.

- Additionally, the database shows that only 7% of Tx major facilities have imposed nitrogen (N) or phosphorus (P) limits--this compares with 34% for the entire U.S.

- Finally monitoring requirements for N or P are required for only 4% of major TX facilities--compared with 63% Nationwide.

- Tx has the most total such facilities and is at the bottom or near the bottom of the list for percent of facilities with N or P limits and for N or P monitoring.