

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

**By Raymond Slade, Jr,  
Certified Professional Hydrologist**

# Preface

**This presentation was developed to represent the Texas Hill Country only. The first 15 slides represent a summary of the presentation content and the remaining slides present details in support of the summary. 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 wastewater 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 of the material.**

A water-quality glossary is on the Internet at  
<http://www.wqa.org/glossary.cfm>

Slide numbers are presented in lower right corner of each slide

# Presentation organization

slide number

## Introduction

4-9

Hill Country development and growth

4-6

Criteria summary for TCEQ wastewater permits

7

Vulnerability of Hill Country to wastewater contamination

8

Water quality criteria to protect Hill Country water

9

Comparison of water quality limits for wastewater and protection criteria

10-13

Summary of major threats to water quality due to inconclusive TCEQ rules

14

Summary of recommendations to protect water from wastewater

15

Background for TCEQ wastewater permits

16-17

Details for major threats to water quality due to inconclusive TCEQ rules

18

Wastewater quality limits are lax

19-23

Permits do not address many pollutants in wastewater

24

Lack of time duration periods for analyses of wastewater quality samples

25

TCEQ management of wastewater facilities is not thorough

26-28

Lack of consideration for local characteristics and downstream threats

29-31

Rules do not ban or limit phosphorus content in detergents

32

Hill Country study documents water quality degradation due to wastewater

33

References for additional studies

34-37

Organic compounds in wastewater and water supplies

34

Water quality threat from phosphorus

35

Irrigation and decentralized wastewater systems

36-37

# **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>**

**Many of the developments dispose of their wastewater through direct discharges in streams—permits for such discharges are obtained through the Texas Commission on Environmental Quality (TCEQ). These discharges typically are the least expensive method to dispose of 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

Impaired water quality 2000  
Impaired or concerned water quality 2006

Data from Texas Commission on Environmental Quality  
[http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305\\_303.html](http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html)

Boundary of Hill Country Alliance area

5

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

Impaired water quality 2000  
Impaired or concerned water quality 2006

Data from Texas Commission on Environmental Quality  
[http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305\\_303.html](http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html)

Boundary of Hill Country Alliance area

5

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

Impaired water quality 2000  
Impaired or concerned water quality 2006

Data from Texas Commission on Environmental Quality  
[http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305\\_303.html](http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html)

Boundary of Hill Country Alliance area

5

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

Impaired water quality 2000  
Impaired or concerned water quality 2006

Data from Texas Commission on Environmental Quality  
[http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305\\_303.html](http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html)

Boundary of Hill Country Alliance area

5

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

Impaired water quality 2000  
Impaired or concerned water quality 2006

Data from Texas Commission on Environmental Quality  
[http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305\\_303.html](http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html)

Boundary of Hill Country Alliance area

5



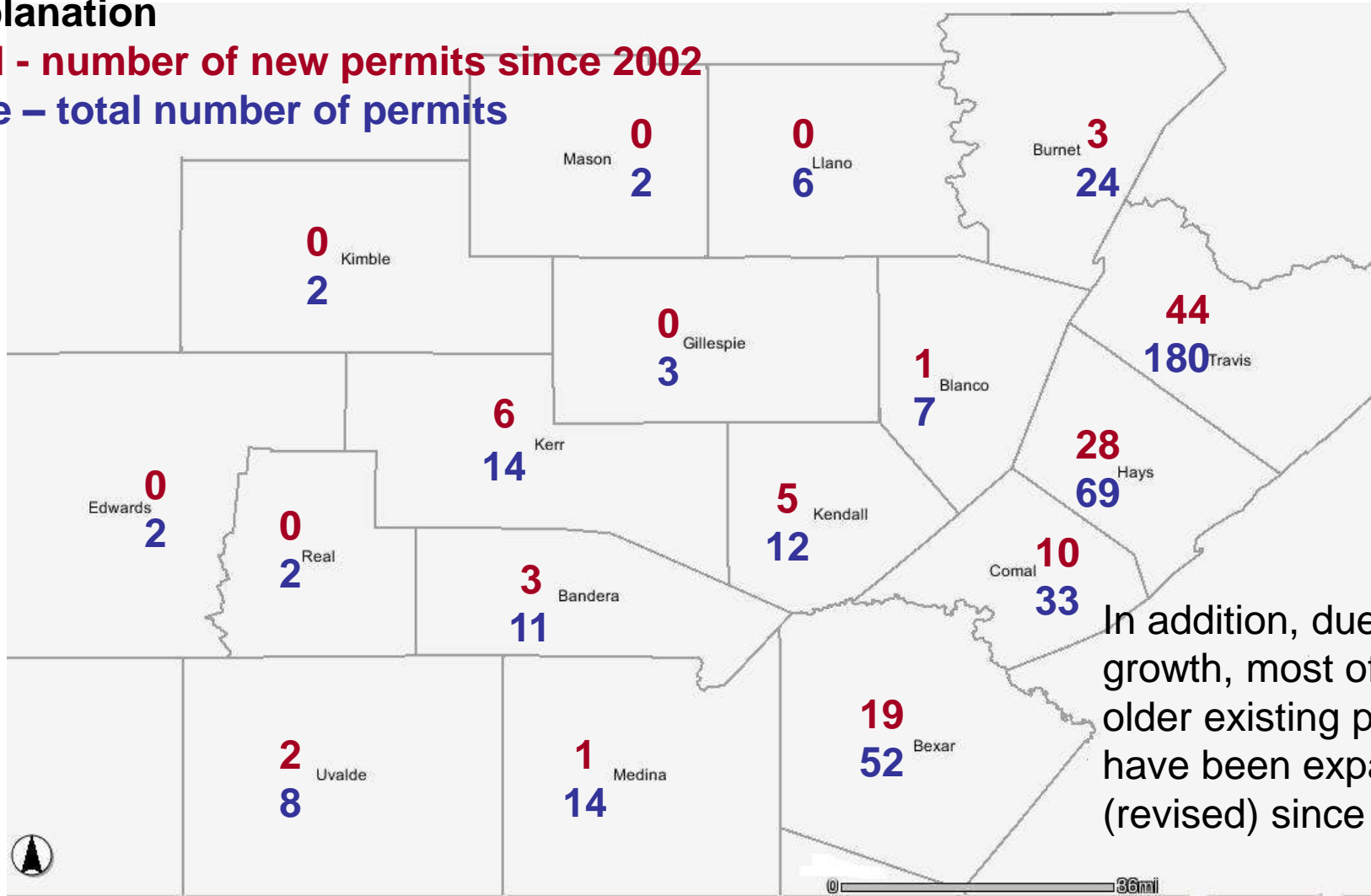
# Growing numbers of municipal wastewater permits

Many of the existing wastewater permits in the Hill Country have been issued in the past few years. Of **441** existing permits (as of August 5, 2009), **82** have been issued since 2002. The map below shows, by county, the number of new permits since 2002 and total number of permits.

## Explanation

**Red** - number of new permits since 2002

**blue** – total number of permits



# Criteria Summary for TCEQ wastewater permits

Applications for wastewater discharge permits generally specify a maximum and mean discharge rate (gallons per day) and typically request that discharges be permitted for the maximum allowable concentrations (levels) for wastewater quality established for such permits.

The permits generally address only four water quality constituents—Carbonaceous Biological Oxygen Demand (**CBOD**), Total Suspended Solids (**TSS**), Ammonia Nitrogen (**NH<sub>3</sub>**), 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 of the five 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 as reported at <http://hillcountrywater.org/SewageTreatment.htm>

# 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 by 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 caves and springs](#). These conditions cause minimal if any absorption of wastewater contaminants. Maps (links below) showing the physiography, soil characteristics, ecological conditions, and tectonics of Texas substantiate the vulnerability of Hill Country streams.

<http://www.beg.utexas.edu/UTopia/images/pagesizemaps/physiography.pdf>

[ftp://ftp-fc.sc.egov.usda.gov/TX/soils/tx\\_gsm\\_map.pdf](ftp://ftp-fc.sc.egov.usda.gov/TX/soils/tx_gsm_map.pdf)

[http://www.epa.gov/wed/pages/ecoregions/tx\\_eco.htm](http://www.epa.gov/wed/pages/ecoregions/tx_eco.htm)

<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 (NO<sub>2</sub>). 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 as a comparison to the permitted wastewater limits.

As shown in slide 7, wastewater limits address NH<sub>3</sub> but do not address NO<sub>2</sub> or total N. However, ammonia nitrogen (NH<sub>3</sub>) is instable in a stream environment--much if not most or all NH<sub>3</sub> readily becomes nitrite nitrogen (NO<sub>2</sub>) or nitrate nitrogen (NO<sub>3</sub>) in a stream environment. Total N represents the sum of organic N, NH<sub>3</sub>, NO<sub>2</sub>, and NO<sub>3</sub>.

**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://toxics.usgs.gov/definitions/eutrophication.html>

# Comparison of water quality limits for wastewater and protection criteria

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

no limits where dashed

**EPA Maximum limit for public water supply, NO<sub>2</sub> = 1**

**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**

## Wastewater limits for other areas

CBOD	20	65
TSS	20	65
NH <sub>3</sub>	--	--
P	--	--
DO		2 (minimum)

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
NH <sub>3</sub>	2	3
P	1	--

**Note: No limit for grab samples**

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

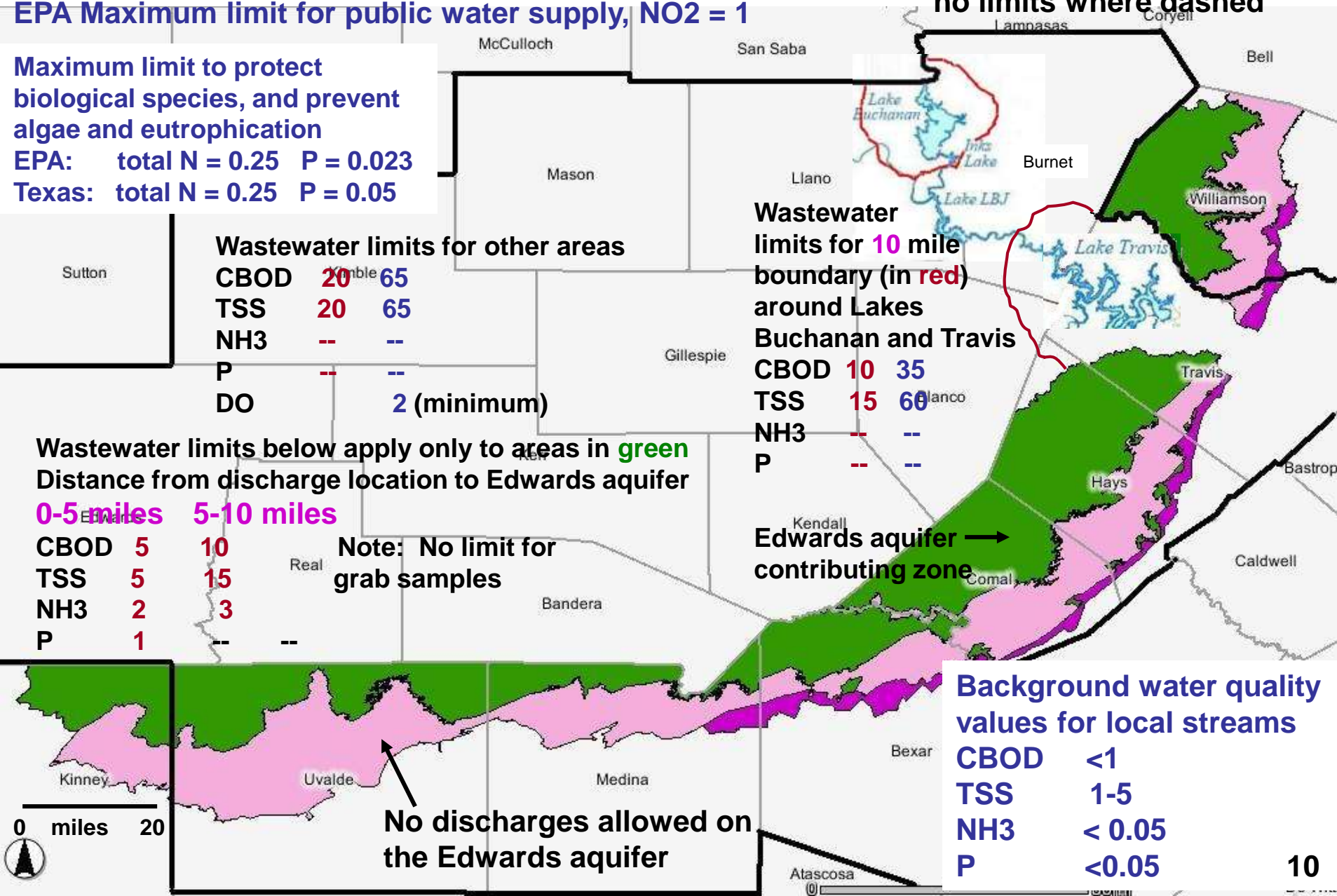
CBOD	10	35
TSS	15	60
NH <sub>3</sub>	--	--
P	--	--

**Edwards aquifer contributing zone**

**Background water quality values for local streams**

CBOD	<1
TSS	1-5
NH <sub>3</sub>	< 0.05
P	<0.05

**No discharges allowed on the Edwards aquifer**



# Comparison of water quality limits for wastewater and protection criteria (--, no limits established)

Area	30-day average values				Single grab sample			
	CBOD	TSS	NH3	P	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 all but the Edwards and contributing areas, daily and 7-day average values also have been established

\* Value for nitrite nitrogen (NO<sub>2</sub>)

\*\* Value for total nitrogen (N)

# Summary of comparison of wastewater and protection criteria limits

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. Additionally, the phosphorus limit (**1.0**) is **43 times** higher than the EPA limit to protect streams and **20 times** higher than the Texas studies limit to protect streams.

**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. Additionally, no phosphorus limit exists in this area thus the area is subject to extremely large phosphorus values that could severely damage streams.

Additionally, as described later in detail, for the contributing zone areas above, **no wastewater limit** is established for grab, daily, or 7-day average wastewater values.

# Summary of comparison of wastewater and protection criteria limits (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**



# **Summary of major threats to water quality due to inconclusive TCEQ rules**

- 1. Wastewater quality limits are too lax.**
- 2. Wastewater quality limits do not address many pollutants in wastewater.**
- 3. Wastewater quality limits are not based on a complete set of time durations for wastewater samples in some areas (i.e., 30-day average wastewater quality limit is identified but single grab samples and daily maximum values are not identified).**
- 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.**

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

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

Recommendation numbers 1-7 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, NH<sub>3</sub>, 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. **Where feasible, decentralized wastewater treatment and reuse of wastewater should be encouraged and used. (slide 36, first reference)**

# Background for TCEQ wastewater permits

Domestic developments that dispose of wastewater must obtain a TCEQ permit [http://www.tceq.state.tx.us/permitting/water\\_quality/wastewater/municipal/WQ\\_Domestic\\_Wastewater\\_Permits.html](http://www.tceq.state.tx.us/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](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.

Typically, land application is less threatening to water quality than direct discharge, however, the former method often is more expensive 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 **36-37**. Information regarding decentralized wastewater treatment systems and reuse of wastewater is presented on slide **36**, 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.state.tx.us/rules/indxpdf.html>)

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

Chapter 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)

Chapter 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 Chapter 309 of the Water Code. This chapter also includes rules for land irrigation of wastewater.

# Details for major threats to water quality due to inconclusive TCEQ 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	19-23
2. Permits do not address many pollutants in wastewater	24
3. Lack of time duration periods for analyses of wastewater samples	25
4. TCEQ management of wastewater facilities is not thorough	26-28
5. Lack of consideration for local characteristics and downstream threats	29-31
6. Rules do not ban or limit phosphorus content in detergents	32



# **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 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/>**

**A water-quality glossary is on the Internet at <http://www.wqa.org/glossary.cfm>**

# 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 or nitrate nitrogen**

Although no limits for ammonia nitrogen are established by National Primary Drinking Water Regulations (<http://www.epa.gov/safewater/mcl.html#mcls>) 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 (<http://www.epa.gov/waterscience/criteria/nutrient/guidance/rivers/rivers-streams-full.pdf>, p. 101). 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**, p. 101).

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>.

Water-quality data for streams in Subcoregion 30 within Region IV, which represents the Hill Country area, were used to present “Reference conditions” for nutrients in the subcoregion. Based on data for about 41 streams, 0.27 mg/l represents the 25 percentile for total nitrogen in streams in the subcoregion, and, based on about 50 streams, 0.008 mg/l represents the 25 percentile for total phosphorus (same reference as above, p. 19).

These values are substantially lower than those for wastewater permits.

U.S Environmental Protection Agency recommendations for nutrient criteria for Region IV are 0.56 mg/l for total nitrogen and 0.023 mg/l for total phosphorus [http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/2007\\_09\\_27\\_criteria\\_nutrient\\_ecoregions\\_sumtable.pdf](http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/2007_09_27_criteria_nutrient_ecoregions_sumtable.pdf).



## **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 34.**

### **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 **NH<sub>3</sub>** and **1** mg/L for **P**. However, these 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 **NH<sub>3</sub>** and **P** concentrations for shorter periods (i.e. a day or week) that are much higher than the designated 30-day 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](http://www.tceq.state.tx.us/compliance/enforcement/reports/AER/annenfreport.html)—the latest edition is 2008 as of August 2009 (<http://www.tceq.state.tx.us/compliance/enforcement/reports/AER/annenfreport.html>)--it identifies the number of: inspections (offsite and onsite), notice of permit violations, administrative enforcements, 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 wastewater direct discharge.

When a violation is discovered, the responsible party typically receives a mailed “Notice of Violation (NOV)”. TCEQ claims that most offences are “corrected within a reasonable period of time, and therefore did not require further enforcement” (page 1-11, above reference). If the violator does not become compliant, an administrative enforcement can be issued followed by civil enforcements (these represent Enforcement Orders) and then criminal charges. A standard NOV is posted at <http://www.tceq.state.tx.us/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.state.tx.us/compliance/enforcement/reports/AER/annenfreport.html>

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

TCEQ also can investigate through complaints--the number of investigated complaints has decreased the last 3 years.

The largest percentage of the enforcement orders issued by the TCEQ were for the water program (45%) and **Sewerage systems** was the industry with the highest number of orders issued. Of the regulated entities that were issued civil and administrative orders, the highest percentage of industry types with previous orders issued included gasoline service stations and **sewerage systems**.

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

Table 1-4: Percent of Facilities Inspected by the TCEQ in Compliance (page 1-11)

YEAR	2003	2004	2005	2006	2007	2008
% of inspected air facilities in compliance	98.9	98.0	97.3	97.1	96.4	94.7
% of inspected water facilities in compliance	99.6	99.0	98.9	99.0	99.0	99.3
% of inspected waste facilities in compliance	98.2	86.5	90.2	89.6	95.5	93.7

The above table shows that waste facilities have the worst compliance record. Despite the fact that wastewater operators have advance notice when inspectors are coming, about 5 -14% of the time 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.

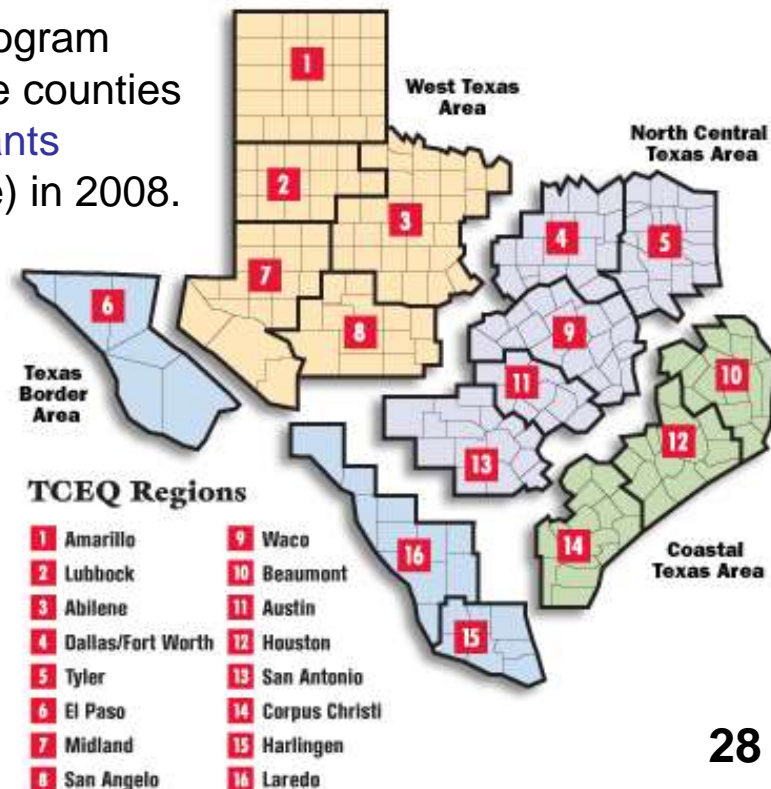
## 4. Management of wastewater is not thorough (cont.)

The Annual Enforcement Report does **not reveal how many:** wastewater permits exist; wastewater inspections were made; NOVs, administrative orders, civil enforcements, or criminal charges) were made for wastewater. It does reveal, by **regulatory program**, how many inspections, NOVs, and Enforcement Orders were made by TCEQ region (see map). One of those **regulatory programs** is **Water Quality**, which includes domestic **wastewater** discharge, industrial wastewater, industrial storm water, and municipal separate storm sewer systems—most of these permits represent wastewater. TCEQ Region 13 is comparable to the Hill Country. The 2008 Enforcement Report indicates that 1228 total inspections and **240 onsite inspections** were made for the **Water Quality** program in Region 13 (tables 1a and 1b).

About **240 active permits** exist in the Water Quality Program database <http://www1.tceq.texas.gov/wqpaq/> for the counties in Region 13, thus most if not all of the **wastewater plants probably received one inspection** (with advance notice) in 2008.

Additionally, for this Region and Program, **107 NOVs** were issued, which represents **45%** of the number of **on-site inspections**.

The Report does not reveal the number of Enforcement Orders by Region or Program, but does list the permit holders names for all administrative orders, civil enforcements, and criminal charges. (see appendices in the Enforcement Report at <http://www.tceq.state.tx.us/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://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305\\_303.html](http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html) This 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.
- [http://www.tceq.texas.gov/waterquality/monitoring/swqm\\_realtime.html](http://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, 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**



## 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 permit up to 0.5 % phosphorus (equivalent to 2 % phosphate) or even 2.2% phosphorus (9 % phosphate). Product performance is considered in establishing phosphorus.

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.**

**<http://toxics.usgs.gov/definitions/eutrophication.html>**

**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>.**

# 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  
<http://www.tceq.state.tx.us/implementation/water/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=gbv\\_v2\\_summary\\_r&cad=0#v=onepage&q=&f=false](http://books.google.com/books?id=WM0fiQuH7w0C&printsec=frontcover&source=gbv_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.)

## Wastewater Irrigation and Decentralized wastewater systems

- Decentralized wastewater systems <http://www.venhuizen-ww.com/>
- Landscape Irrigation (TCEQ)  
[http://www.tceq.state.tx.us/nav/compliance/land\\_irrigate.html](http://www.tceq.state.tx.us/nav/compliance/land_irrigate.html)
- Landscape Irrigation Program: Implementation  
[http://www.tceq.state.tx.us/comm\\_exec/forms\\_pubs/pubs/rg/rg-466.html](http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/rg/rg-466.html)
- Evaluation of onsite wastewater research  
<http://www.tceq.texas.gov/licensing/ossf/researchgrants.html>
- Evaluation of Land Application Systems: Technical Bulletin (EPA)  
<http://yosemite.epa.gov/water/owrcCatalog.nsf/e673c95b11602f2385256ae1007279fe/5930cb358762d6ac85256b060072385b!OpenDocument>
- Fate of Organic Pollutants in a Wastewater Land Treatment System Using Lagoon Impoundment and Spray Irrigation  
<http://yosemite.epa.gov/water/owrcCatalog.nsf/e673c95b11602f2385256ae1007279fe/94dbe8c742a2737f85256b06007238f5!OpenDocument>
- Cost-Effective Comparison of Land Application and Advanced Wastewater Treatment  
<http://yosemite.epa.gov/water/owrcCatalog.nsf/e673c95b11602f2385256ae1007279fe/a3e9b3b89925a31b85256b060072333d!OpenDocument>

# References for additional studies (cont.)

## Wastewater Irrigation and Decentralized wastewater systems (cont.)

- Long-term affects of slow-rate land application of municipal wastewater

<http://nepis.epa.gov/Exe/ZyNET.exe/2000TN8P.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1981+Thru+1985&Docs=&Query=&Time=&EndTime=&SearchMethod=3&TocRestrict=n&Toc=&TocEntry=&QField=pubnumber%5E%22600S781152%22&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=pubnumber&IntQFieldOp=1&ExtQFieldOp=1&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C81thru85%5CTxt%5C00000005%5C2000TN8P.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=10&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x>

The above report investigated 50 pollutants at 6 municipal irrigation sites and concluded that soils and vegetation effectively reduced pollutant concentrations. All sites received wastewater irrigation for at least 10 years.