Big Elm Creek Bacteria Loads and Needed Reductions

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Introductions

- Name
- Entity/Group – (agency, landowner, citizen, business owner, etc.)

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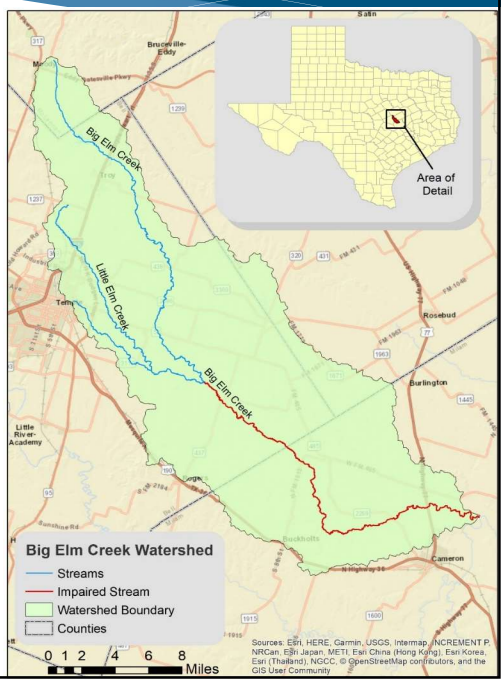
Agenda

- Previous Meeting Recap
  - Water Quality
  - Example WPP
- Reductions needed to meet water quality standards (Load Duration Curves)
- Potential sources of bacteria
- Identify areas with highest potential to impact water quality



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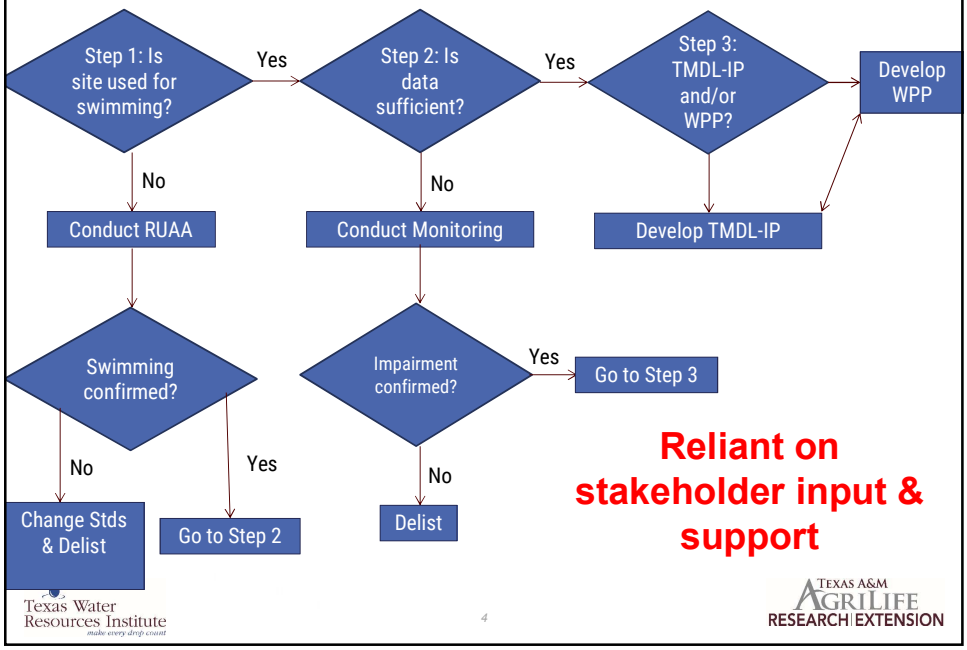
Approach to Address Water Quality Impairments



Reliant on stakeholder input & support

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Texas Surface Water Quality Standards Review

Some Examples:

Designated Use	Criteria	Parameter
Primary Contact Recreation	**126 MPN/100 mL (FW)** 35 MPN/100 mL (Marine)	***E. coli* Bacteria (FW)** Enterococci (Marine)
Secondary Contact Recreation 1	**630 MPN/100 mL (FW)** 175 MPN/100 mL (Marine)	***E. coli* Bacteria (FW)** Enterococci (Marine)
High Aquatic Life Use	5.0 mg/L Average 3.0 mg/L Minimum	Dissolved Oxygen
General Use	6.5 – 9.0	pH

Where do they come from?

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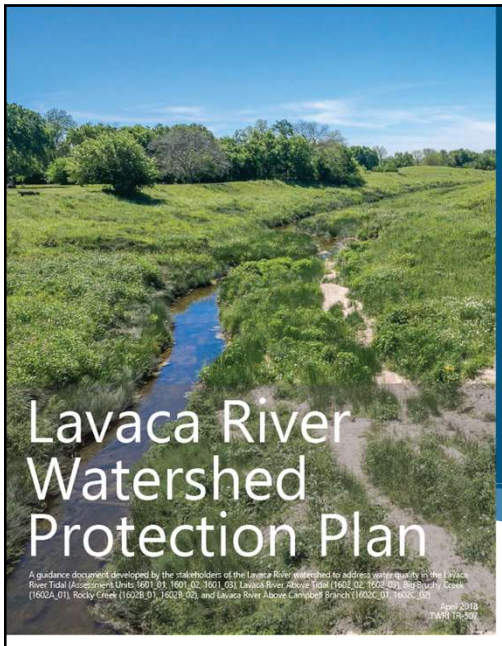

Example Watershed Protection Plan - Recap

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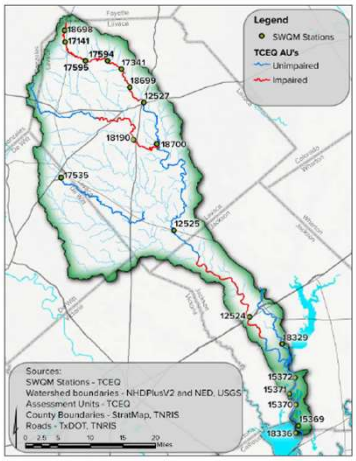
Example Watershed Based Plan



- Lavaca River Watershed Protection Plan
  - Problems: Excessive bacteria, low dissolved oxygen

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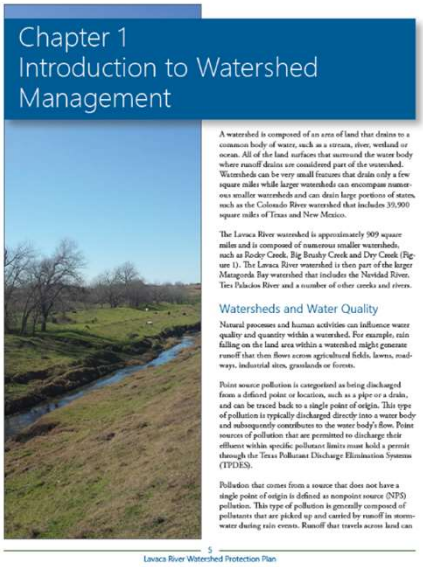
Chapter 1 – Introduction to Watershed Management

- Watersheds and Water Quality
- The Watershed Approach
- Watershed Protection Plan
- Adaptive Management
- Education and Outreach



Chapter 1
Introduction to Watershed Management

A watershed is composed of an area of land that drains to a common body of water, such as a stream, river, wetland or ocean. All of the land surfaces that surround the water body where runoff drains are considered part of the watershed. Watersheds can be very small features that drain only a few square miles while larger watersheds can encompass numerous smaller watersheds and can drain large portions of states, such as the Colorado River watershed that includes 39,900 square miles of Texas and New Mexico.

The Lavaca River watershed is approximately 909 square miles and is composed of numerous smaller watersheds, such as Rocky Creek, Big Brushy Creek and Dry Creek (Figure 1). The Lavaca River watershed is then part of the larger Matagorda Bay watershed that includes the Navidad River, Tres Palacios River and a number of other creeks and rivers.

Watersheds and Water Quality

Natural processes and human activities can influence water quality and quantity within a watershed. For example, rain falling on the land area within a watershed might generate runoff that then flows across agricultural fields, lawns, roadways, industrial sites, grasslands or forests.

Point source pollution is categorized as being discharged from a defined point or location, such as a pipe or a drain, and can be traced back to a single point of origin. This type of pollution is typically discharged directly into a water body and subsequently contributes to the water body's flow. Point sources of pollution that are permitted to discharge their effluent within specific pollutant limits must hold a permit through the Texas Pollutant Discharge Elimination Systems (TPDES).

Pollution that comes from a source that does not have a single point of origin is defined as nonpoint source (NPS) pollution. This type of pollution is generally composed of pollutants that are picked up and carried by runoff in stormwater during rain events. Runoff that travels across land can

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Lavaca River Watershed Protection Plan

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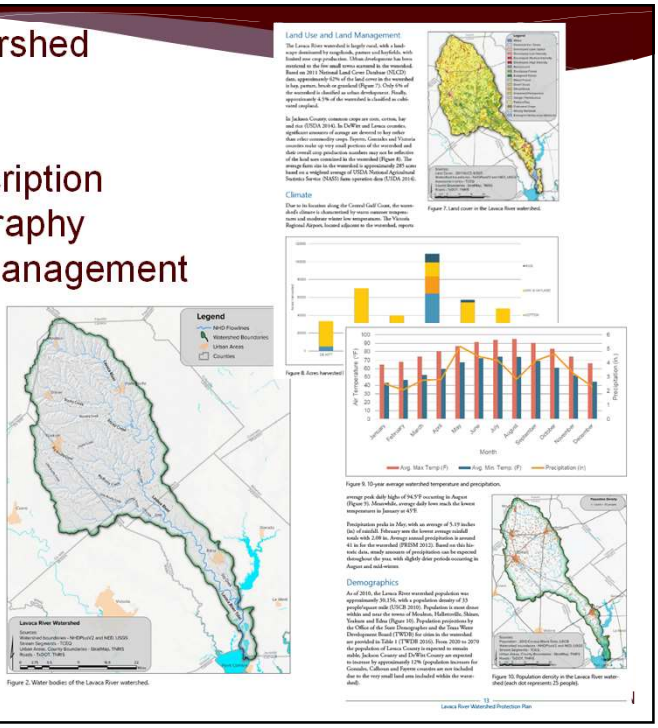
Chapter 2 – Watershed Description

- Watershed Description
- Soils and Topography
- Land Use and Management
- Climate
- Demographics



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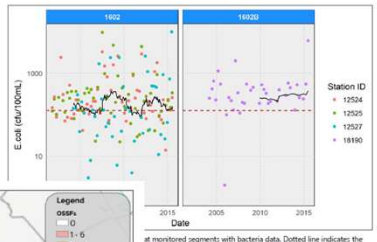
Chapter 3 – Water Quality

- Introduction
- Bacteria
- RUAA
- Dissolved Oxygen
- UAA
- Nutrients
- Flow
- Potential Sources of Water Quality Issues
- Water Quality Summary

Table 4. *2014 Texas Integrated Report* Assessment Results for stream segments in the Lavaca River watershed currently monitored for bacteria (TCEQ 2016).

AU	Description	Current Standard	Geomean	Supporting/Not Supporting
1602_02	Lavaca River Above Tidal – From the confluence of Beard Branch upstream to the upper end of segment at the confluence of Campbell Branch in Hallettsville.	126 cfu/100 mL *E. coli*	114.65	Fully Supporting
1602_03	Lavaca River Above Tidal – Lower portion of segment from confluence with NHD RC 12100101002463 south of Edna upstream to confluence with Beard Branch.	126 cfu/100 mL *E. coli*	294.94	Not Supporting
1602B_01	Rocky Creek – From confluence of Lavaca River upstream to confluence of Ponton Creek	126 cfu/100 mL *E. coli*	222.16	Not Supporting



at monitored segments with bacteria data. Dotted line indicates the
z indicates the mean value of previous 20 measurements.

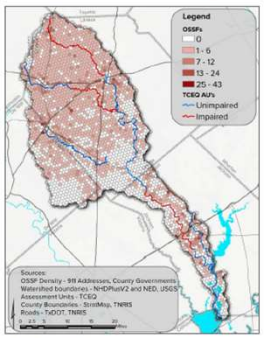


Figure 19. OSSF density.

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Chapter 4 – Pollutant Source Assessment

- Introduction
- Load Duration Curves
- Pollutant Source Load Estimates
- Load Reduction Summary

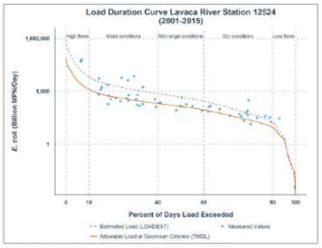

Figure 21. Load duration curve for Lavaca River SWQM Station 12524.

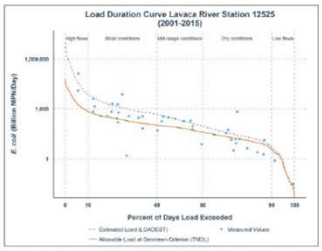

Figure 22. Load duration curve for Lavaca River SWQM Station 12525.

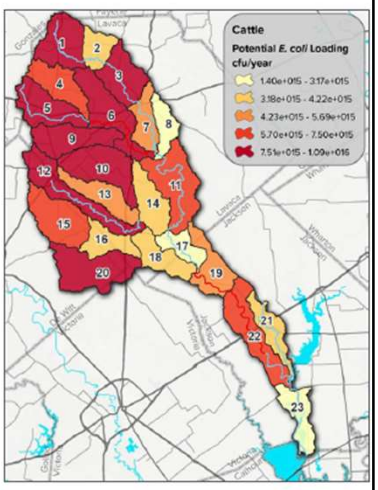

Figure 25. Potential annual bacteria loadings from cattle.

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Table 14. Management measure 1: Promote and implement Water Quality Management Plans or conservation plans.

Source: Cattle and Other Livestock			
Problem: Direct and indirect fecal bacteria loading due to livestock in streams, riparian degradation and overgrazing			
Objectives: • Work with producers to develop conservation plans and WQMPs that improve grazing practices and water quality. • Provide technical and financial support to producers. • Reduce fecal loadings attributed to livestock.			
Critical Areas: All properties with riparian habitat throughout the watershed and all properties in subwatersheds: 1, 3, 5, 6, 9, 10, 12 and 20			
Goal: Develop and implement conservation plans and WQMPs that minimize time spent by livestock in riparian areas and better use available grazing resource across the property.			
Description: Conservation plans and WQMPs will be developed with producers to implement BMPs that reduce water quality impacts from overgrazing, time spent by livestock in and near streams, and runoff from grazed lands. Practices will be identified and developed in consultation with NRCS, TSSWCB and local SWCDs as appropriate. Education programs and workshops will support and promote the adoption of these practices.			
Implementation Strategy			
Participation	**Recommendations**	**Period**	**Capital Costs**
TSSWCB, SWCDs	Develop funding to hire WQMP technician.	2019-2029	Estimated $75,000/yr
Producers, NRCS, TSSWCB, SWCDs	Develop, implement and provide financial assistance for 100 livestock conservation plans and WQMPs (including 30 in Rocky Creek subwatersheds).	2019-2029	$1,500,000 (est. $15,000/plan)
AgriLife Extension, TWRI	Deliver education and outreach programs and workshops (Lone Star Healthy Streams) to landowners.	2019, 2023, 2027	N/A
Estimated Load Reduction			
Prescribed management will reduce loadings associated with livestock by reducing runoff from pastures and rangeland as well as reducing direct deposition by livestock. Implementation of 100 WQMPs and conservation plans is estimated to reduce annual loads from livestock by 1.00×10^{15} cfu *E. coli*/yr in the Lavaca River. Of these 100 plans, at least 30 should be targeted toward the Rocky Creek watershed, which is estimated to reduce loads by 2.25×10^{14} cfu *E. coli*/yr.†			
Effectiveness	High – Decreasing the amount of time livestock spend in riparian areas and reducing runoff from pastures will directly reduce NPS contributions of bacteria in creeks.		
Certainty	Moderate – Landowners acknowledge the importance of good land stewardship practices and management plan objectives; however, financial incentives are often needed to promote the WQMP and conservation plan implementation.		
Commitment	Moderate – Landowners are willing to implement stewardship practices shown to improve productivity; however, because costs are often prohibitive, financial incentives are needed to increase implementation rates.		
Needs	High – Financial costs are a major barrier to implementation, education and outreach are also needed to demonstrate benefits to producers and their operations.		
Potential Funding Sources	Coastal Zone Management Program/Coastal Management Program (CZM program and CMP); EPA CWA §319(h) grant program; NRCS Environmental Quality Incentives Program (EQIP); Conservation Innovation Grants (CIG); Conservation Stewardship Program (CSP); Regional Conservation Partnership Program (RCPP)‡		

†Load reduction calculations described in Appendix B
‡Funding sources described in Section 7.4

Table 13. Available pasture and rangeland practices to improve water quality.

Practice	NRCS Code	Focus Area or Benefit
Brush management	314	Livestock, water quality, water quantity, wildlife
Fencing	382	Livestock, water quality
Filter strips	393	Livestock, water quality, wildlife
Grade stabilization structures	410	Water quality
Grazing land mechanical treatment	548	Livestock, water quality, wildlife
Heavy use area protection	562	Livestock, water quantity, water quality
Pond	378	Livestock, water quantity, water quality, wildlife
Prescribed burning	338	Livestock, water quality, wildlife
Prescribed grazing	528	Livestock, water quality, wildlife
Range/Pasture planting	550/512	Livestock, water quality, wildlife
Shade structure	N/A	Livestock, water quality, wildlife
Stream crossing	578	Livestock, water quality
Supplemental feed location	N/A	Livestock, water quality
Water well	642	Livestock, water quantity, wildlife
Watering facility	614	Livestock, water quantity

Chapter 5 – Watershed Protection Plan Implementation Strategies

- Introduction
- Management Measures

Chapter 6 – Education and Outreach

- Watershed Coordinator
- Public Meetings
- Future Stakeholder Engagement
- Education Programs (Extension programs)
- Public Meetings
- Newsletters and News Releases

Table 22. Watershed stakeholders that will need to be engaged throughout the implementation of the WPP.

Lavaca River WPP Stakeholders
Local residents, landowners, businesses
Local governments – Edna, Hallettsville, Moulton, Shiner, Yoakum, Jackson County, Lavaca County
State Agencies – TCEQ, TSSWCB, TPWD, AgriLife Extension
Federal Agencies – USDA NRCS
Regional Entities – LNRA staff and board members, SWCD boards

Future Stakeholder Engagement

Watershed stakeholders (Table 22) will be continually engaged throughout the entire process and following the transition of efforts from development to implementation of the WPP. The Watershed Coordinator will play a critical role in this transition by continuing to organize and host periodic public meetings and needed educational events in addition to seeking out and meeting with focused groups of stakeholders to find and secure implementation funds. The coordinator will also provide content to maintain and update the project website, track WPP implementation progress and participate in local events to promote watershed awareness and stewardship. News articles, newsletters and the project website will be primary tools used to communicate with watershed stakeholders on a regular basis and will be developed to update readers periodically on implementation progress, provide information on new implementation opportunities, inform them on available technical or financial assistance, and other items of interest related to the WPP effort.

Education Programs

Educational programming will be a critical part of the WPP implementation process. Multiple programs geared toward providing information on various sources of potential pollutants and feasible management strategies will be delivered in and near the Lavaca River watershed and advertised to watershed stakeholders. An approximate schedule for planned programming is provided in Chapter 8. This schedule will be used as a starting point, and efforts will be made to abide by this schedule as much as possible. As implementation and data collection continues, the adaptive management process will be used to modify this schedule and respective educational needs as appropriate.

Feral Hog Management Workshop

The Watershed Coordinator will coordinate with AgriLife Extension personnel to deliver periodic workshops focusing on feral hog management. This workshop will educate landowners on the negative impacts of feral hogs, effective control methods and resources to help them control these pests. Workshop frequency will be approximately every 3–5 years, unless there are significant changes in available means and methods to control feral hogs.

Lone Star Healthy Streams Workshop

The Watershed Coordinator will coordinate with AgriLife Extension personnel to deliver the Lone Star Healthy Streams curriculum. This program is geared toward expanding stakeholders' knowledge on how beef cattle producers can improve grazing lands to reduce NPS pollution. This statewide program promotes the adoption of BMPs that have been proven to effectively reduce bacterial contamination of streams. This program provides educational support for the development of conservation plans by illustrating the benefits of many practices available for inclusion in a conservation plan to program participants. This program will likely be delivered in the watershed once every 5 years or as needed.

OSSF Operation and Maintenance Workshop

Once OSSFs in the watershed and their owners have been identified, an OSSF rules, regulations, operation and maintenance training will be delivered in the watershed. This training will consist of education and outreach practices to promote the proper management of existing OSSFs and to garner support for efforts to further identify and address failing OSSFs through inspections and remedial actions. AgriLife Extension provides the needed expertise to deliver this training. Based on needs identified early during WPP planning, trainings will be scheduled for every third year. Additionally, an online training module that provides an overview of septic systems, how they operate and what maintenance is required to sustain proper functionality and extend system life will be made available to anyone interested through the partnership website. This training module was developed by the Guadalupe-Blanco River Authority in cooperation with AgriLife Extension and is currently available online at: www.gbra.org/septic.swf.

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Chapter 7 – Resources to Implement the WPP

- Introduction
- Technical Assistance
- Financial Sources

Table 23. Summary of potential sources of technical assistance.

Technical Assistance	
Management Measure	**Potential Sources**
MM1 : Promote and implement WQMPs or conservation plans	TSSWCB; local SWCDs; NRCS; AgriLife Extension
MM2: Promote technical and direct operational assistance to landowners for feral hog control	AgriLife Extension; TPWD; NRCS; TSSWCB
MM3: Identify and repair or replace failing on-site sewage systems	Lavaca County designated representative, Jackson County Office of Permitting; AgriLife Extension
MM4: Increase proper pet waste management	City public works departments; AgriLife Extension
MM5: Implement and expand urban and impervious surface stormwater runoff management	City public works departments; engineering firms; AgriLife Extension
MM6: Address inflow and infiltration	City public works departments; engineering firms, TCEQ
MM7: Reduce illicit dumping	AgriLife Extension; county law enforcement; TPWD game wardens

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Chapter 8 – Measuring Success

- Introduction
- Water Quality Targets
- Additional Data Collection Needs
- Data Review
- Interim Measurable Milestones
- Adaptive Management

Table 25. Lavaca River watershed management measures, responsible party, goals and estimated costs.

Management Measure	Responsible Party	Unit Cost	Implementation Goals (years after implementation begins)† 1	2	3	4	5	6	7	8	9	10	Total Cost
Livestock													
Hire WQMP field technician.	TSSWCB, SWCDs	$75,000/yr	1										
Develop 100 WQMPs/conservations plans.	TSSWCB, SWCDs, NRCS	$15,000	20		40		60		80		100		$1,500,000
Feral Hogs													
Install feral hog enclosures.	Landowners	$200	As many as possible										N/A
Feral hog removal	Landowners	N/A	15% reduction or > 2,439 hogs/yr										N/A
Develop and implement Wildlife Management Plans and Practices.	Landowners, TPWD, TSSWCB, NRCS	N/A	As many as possible										N/A
OSSFs													
Develop OSSF repair/replacement program.	Watershed Coordinator, counties, AgriLife Extension	N/A	1										N/A
Repair/replace faulty OSSFs.	Homeowner	$8,000			10		20		30		40		$320,000
Pet Waste													
Install and maintain pet waste stations.	Cities	$500 for stations plus $100/yr/station			2		3		4		5		$4,400
Develop educational and outreach materials.	Cities, AgriLife Extension, Watershed Coordinator	N/A	Develop and deliver annually										N/A
Urban Stormwater													
Identify and install potential stormwater BMP projects.	Cities	$4,000 to $45,000/acre treated	As many as possible										N/A
SSOs and Unauthorized Discharges													
Develop program to repair private connections contributing to I&I.	Cities, AgriLife Extension, property owners	N/A	1										N/A
Smoke testing and repair of faulty pipes and connections	Cities, contractors	$2,000-$2,500/mile; $3,000-$20,000/repair	As funding allows										N/A
Develop and deliver educational materials.	Cities, AgriLife Extension, TWRI	N/A	Develop and deliver annually										N/A

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Appendix A – Potential Load Reductions

Appendix B – Load Reduction Calculations

Appendix C – Elements of Successful Watershed Protection Plans (9 elements)

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Chapters 1 – 2

- Chapter 1 - Introduction
  - Watersheds
  - Types of Pollution
  - The Watershed Approach
  - Watershed Protection Plans
  - Adaptive Management
- Chapter 2 – Big Elm Creek Watershed Characterization
  - Description of the Watershed
  - Subwatersheds
  - Ecoregions
  - Land Use and Land Cover
  - Soils and Topography
  - Climate
  - Demographics
  - Potential Point Sources
  - Potential Nonpoint Sources
  - Other Water Sources

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Load Reduction Needs

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Load Duration Curve

- Visualizes streamflows and pollutant loads
- Helps assess under what conditions pollutant loads exceed water quality standards
- Can use to estimate the pollutant capacity of a stream and the reductions needed

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Needed Load Reduction

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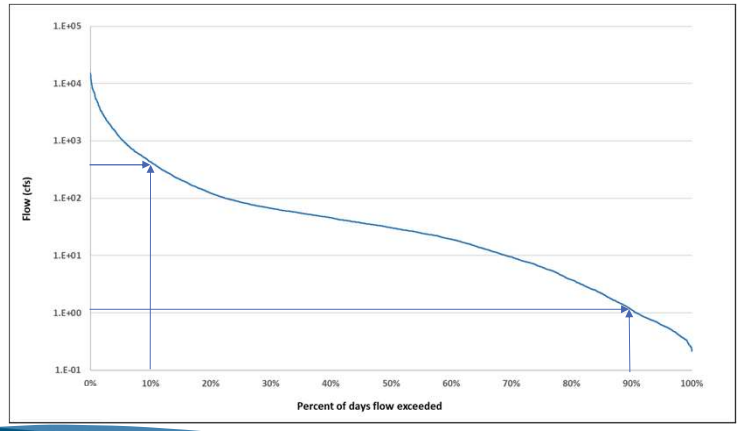
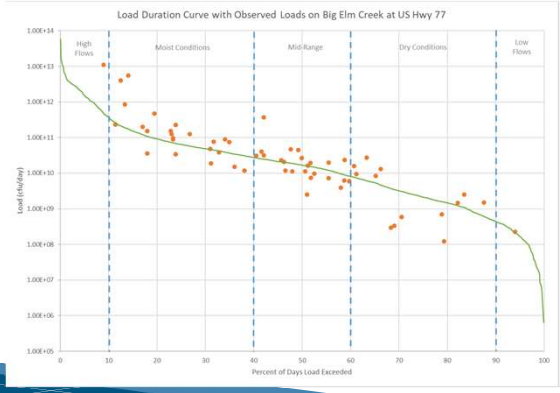
- Example:



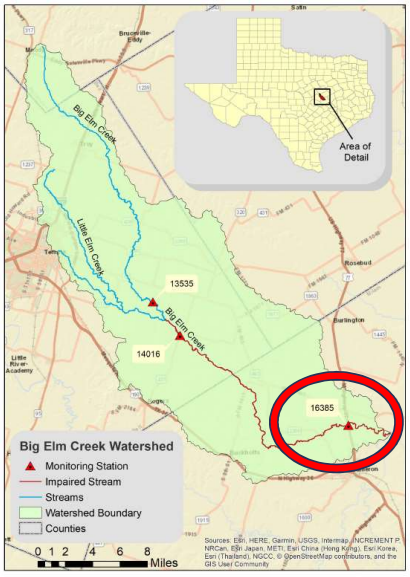
Needed Load Reduction

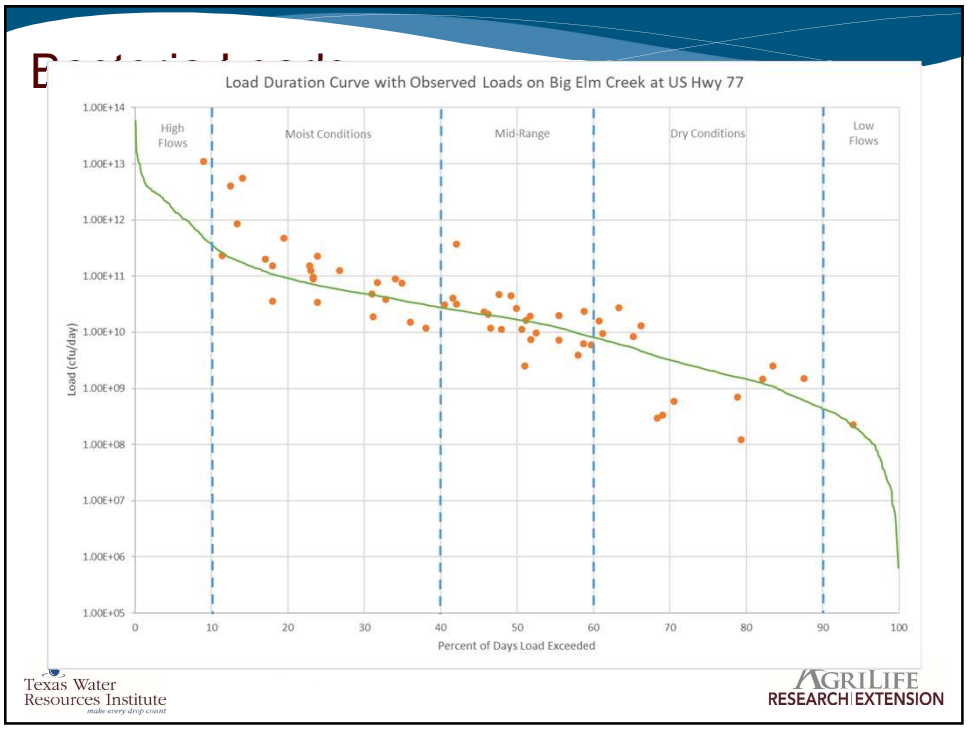
- Multiply allowable bacteria concentration (minus 10% margin of safety)
- Plot measured pollutant loads



TCEQ SWQM Station

- Only 1 active station in the watershed with long-term *E. coli* data (Station #16385, on US 77)





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Bacteria Loads

	High Flow Conditions	Moist Flow Conditions	Mid-Range Flow Conditions	Dry Flow Conditions	Low Flow Conditions
Days per year	36.5	109.5	73.0	109.5	36.5
Median Flow (cubic feet per second)	339.06	13.93	3.75	0.42	0.03
Existing Geomean Concentration (MPN/100 mL)	144.00	332.97	118.90	332.62	136.00
Allowable Daily Load (Billion MPN)	1045.2	42.94	11.6	1.3	0.11
Allowable Annual Load (Billion MPN)	381,497.82	15,671.53	4219.25	472.78	38.73
Existing Daily Load (Billion MPN)	1,194.51	113.46	10.91	3.42	0.12
Existing Annual Load (Billion MPN)	435,997.61	41,414.00	3,981.42	1,247.94	41.98
Annual Load Reduction Needed	54,499.79	24,742.46	N/A	775.15	3.25
Percent Reduction Needed	12.50%	62.16%	-5.97%	62.11%	7.74%

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Needed Load Reduction

	High Flow Conditions	Moist Flow Conditions	Mid-Range Flow Conditions	Dry Flow Conditions	Low Flow Conditions
Possible Sources	Overland flow, Sanitary Sewer Overflows, Resuspension				
	Failing or non-existent OSSFs				
			Direct deposition from wildlife, feral hogs, livestock, pets. Illegal dumping		
Total Annual Load (Billion MPN)	482,682.94				
Total Annual Load Reduction	401,900.11				
Total Percent Reduction (Billion MPN)	83.26				

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Big Elm Creek Watershed Potential Source Estimates

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Review of Potential Bacteria Sources

- Nonpoint Sources
  - Livestock
  - Wildlife/Feral Hogs
  - Septic Systems/OSSFs
  - Pets
- Point Sources
  - Wastewater plants
  - Sanitary Sewer Overflows

Focus for today

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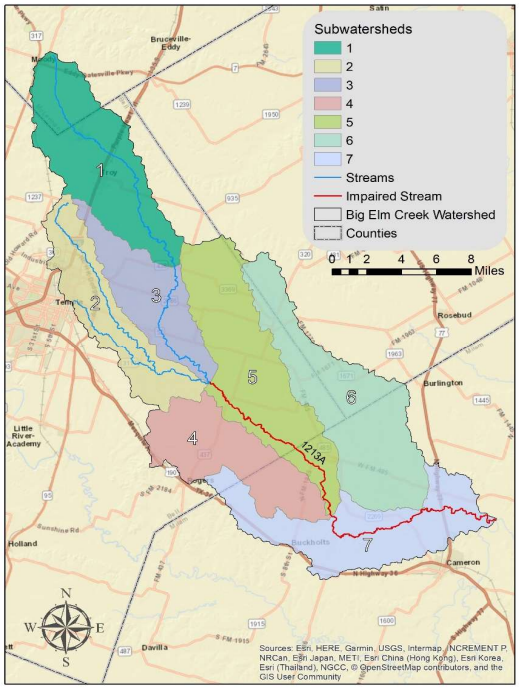

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Cattle Estimates

- Substantial difference between NASS and stocking rate estimation methods
- NASS based on county-wide data. Weighted by graze-able acres per watershed
- Do we want to use the NASS estimate or stocking rate estimate?
- If we use stocking rate estimate, is the 1 head/10 acres appropriate for unimproved range?
- What about 1 head/3 acres for pastures?
- Are these realistic stocking rates locally?

	NASS	Stocking Est
Cattle*	7,333	16,322
Horses	942	N/A
Goats	2,990	?
Sheep	168	?
Poultry	2,655	N/A

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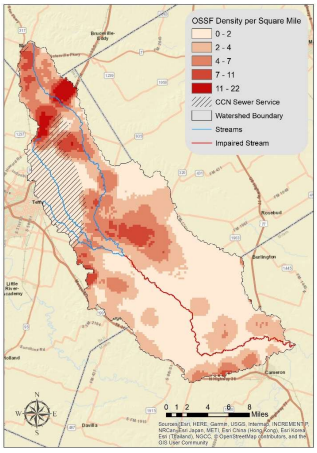
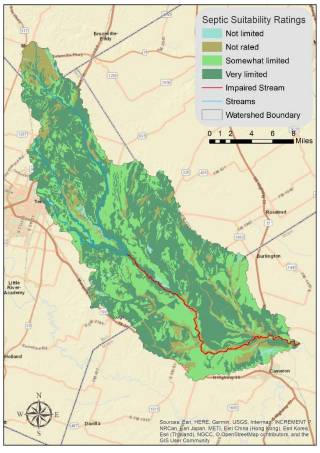
OSSF Estimates



Estimated OSSFs	Estimated Failure rate
2,439	8%



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Estimated Household Pets

Watershed	Estimated Number of Households	AVMA Estimated Dogs per Household	AVMA Estimated Cats per Household	Estimated Dog Population	Estimated Cat Population
Big Elm	8,407	0.584	0.638	4,910	5,364

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Estimated Wildlife

	Total	AU Conversion	AUs
Feral Hogs	5,695	0.125	712
Deer	7,103	0.112	795

Numbers developed for Deer from a density of 38.4 deer/1,000 acres provided by Texas Parks and Wildlife.
Numbers developed for Feral Hogs from a density of 33.3 acres per hog (Wagner and Moench, 2009).

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