Oso Creek and Oso Bay Data Report

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Introduction

Water Body Location: Oso Creek begins near west Corpus Christi, roughly three miles northeast of Robstown in northern Nueces County and runs for 28 miles to the confluence at Oso Bay in Corpus Christi.[i] The Oso Creek (Segment 2485A) and Oso Bay (Segment 2485) watershed drains approximately 235 mi^2.[ii]

Water Body Description: Oso Bay receives freshwater inflow from Oso Creek, which is primarily fed by permitted discharges, and saltwater from Corpus Christi Bay. Economic activities in and around the bay include oil and gas refining and production, agriculture, manufacturing, and tourism.[iii]

Texas Stream Team: Texas Stream Team is a volunteer based water quality monitoring program. In alignment with Texas Stream Team's core mission, monitors collect surface water quality data that may be used in decision-making processes to promote and protect a healthy and safe environment for people and aquatic inhabitants. Citizen monitoring occurs at set monitoring sites roughly the same time of day once a month. Citizen monitoring data provides a valuable resource of information supplementing professional data collection efforts where resources are limited. The data may be used by professionals to identify water quality trends, target additional data collection, identify pollution events, identify sources and causes of pollution, and show effectiveness of management measures towards improving water quality.

Texas Stream Team volunteer data, however, is not used by the state to assess whether water bodies are meeting the designated surface water quality standards. The primary reason for this is that Texas Stream Team volunteers use different methods than the professional water quality monitoring community. Different methods are utilized by Texas Stream Team due to higher equipment costs, training requirements, and stringent laboratory procedures that are required of the professional community. The Texas Stream Team methods have been chosen because of relative ease of performing the methods in the field, while providing reliable results at low costs. As a result, Texas Stream Team data does not have the same accuracy or precision as professional data and is therefore not directly comparable. However, Texas Stream Team data are valuable records often collected in portions of water body that professionals are not able to monitor or monitor as frequently. This long-term data set is available to and may be considered by the surface water quality professional community to facilitate management and protection of Texas' water resources. For additional information about water quality monitoring methods and procedures, see:

- Texas Stream Volunteer Water Quality Monitoring Manual
- Texas Commission on Environmental Quality (TCEQ) Surface Water Quality Monitoring Procedures for professional monitors

Information collected by Texas Stream Team volunteers is covered under a TCEQ approved quality assurance project plan (QAPP) to ensure a standard set of methods of known

quality are used. All data used in data reports are screened by the Texas Stream Team for completeness, precision and accuracy where applicable, and scrutinized with data quality objective and data validation techniques.

The purpose of this report is to provide analysis of data collected by Texas Stream Team volunteers. The data presented in this report should be considered in conjunction with other relevant water quality reports prepared by the following programs in order to provide a holistic view of water quality in this water body:

- Texas Surface Water Quality Standards;
- Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d) (or Texas Integrated Report; formerly the Texas Water Quality Inventory and 303(d) List);
- Texas Clean Rivers Program partners' reports such as Basin Summary Reports and Highlight Reports;
- TCEQ surface water quality special studies;
- TCEQ Total Maximum Daily Load reports;
- TCEQ and Texas State Soil and Water Conservation Board Nonpoint Source Program funded reports, including Watershed Protection Plans.

Questions about this report should be directed to the Texas Stream Team at (512) 245-1346.

Water Quality Terminology

The following paragraphs under this section provide general information about types of data collected by Texas Stream Team volunteers, along with the importance of these parameters for aquatic and human health.

Conductivity

Conductivity is measured to determine the amount of dissolved solids in the water. Conductivity is a measure of the ability of water to conduct electricity. The more dissolved solids a body of water has, such as inorganic salts (Ex. magnesium, calcium, chloride, and sulfate), the more electricity it conducts, or the more conductive it is. Conductivity is measured in microSiemens per centimeter (µS/cm). To determine total dissolved solids (TDS) in water, the Texas Surface Water Quality Monitoring Procedures call for a conversion of specific conductance by 65%.Sources of TDS can include agricultural runoff, domestic runoff, discharges from wastewater treatment plants, groundwater inflows, or naturally saline conditions resulting from the local geology and arid climate.

High concentrations of salt can inhibit water absorption and limit root growth for vegetation, lead to an abundance of more drought tolerant plants, and cause dehydration of fish and amphibians.

Bacteria

Pathogens are microorganisms, such as bacteria, viruses, and protozoans, that can cause illness in humans. Pathogens can be transmitted by drinking or swimming in water containing fecal waste of warm-blooded animals, primarily through ingestion. The EPA has determined *E. coli* bacteria to be the best indicator of the degree of pathogens in a water body. The TCEQ uses Enterococci to monitor surface water quality, instead of E. *coli* bacteria in waters under tidal influence such as Oso Creek and Oso Bay because Enterococci are less affected by salt water. Water bodies naturally contain bacteria. *E. coli* and Enterococci levels are therefore monitored to determine if there is a significant risk to human health in relation to contact recreation. Citizen monitors are not able to perform tests for Enterococci because there is no practical method available. Sources of bacteria may include livestock, pets, failing septic systems and wastewater treatment plants, or wildlife around the water body.

Data Analysis

Oso Creek

David Boylan, the citizen monitoring coordinator of the Lindheimer Master Naturalists, collected data at three sites on Oso Creek from October 2008 to February 2010, and a group of students from Texas A&M Corpus Christi collected data at three sites on the discharge flow from the Oso Wastewater Treatment Plant near Oso Bay from February 2009 to April 2009. Samples on Oso Creek were collected by Texas A&M Corpus Christi students, and one was the result of a citizen water quality monitor training. Only *E. coli* and conductivity data were collected at Oso Creek, and only *E. coli* data were collected at Oso Bay.

Oso Creek is on the Texas 2010 303(d) List of Impaired Water Bodies because 182/244 (75%) Enterococci samples collected from 12/1/2001 to 11/30/2008 were over the standard of 89 cfu/100mL, and the geomean (an average) was 248.1 cfu/100mL, well over the geomean standard of 35 cfu/100mL.

Texas Stream Team data do not show a significant concern for elevated levels of *E.coli* in Oso Creek. Only 2 of 68 *E. coli* samples collected between October 2008 and November 2009 were over the single sample standard of 394 cfu/100 mL. The two values over the standard were observed on the same day, 11/11/2008, at collection sites at FM 665 and FM 763. Eighteen samples were over the geomean standard, which is used here only as a reference point, as these are single samples. The geomean for all three sites is 70.7 cfu/100mL, well below the geomean standard of 126 cfu/100mL.

It is possible the difference in citizen water quality *E. coli* data and professional Enterococci data is observed because E. *coli* grows at an attenuated rate in the presence of high concentrations of salt. High concentractions of salt would be observed at these sites during high tide because Oso Creek is under tidal influence from Oso Bay. The average conductivity of 3,114 µS/cm indicates the likelihood that these samples were collected at high tide. While this data does not directly inform on the impairment, E. *coli* monitoring is useful, nonetheless, as a method of problem identification.

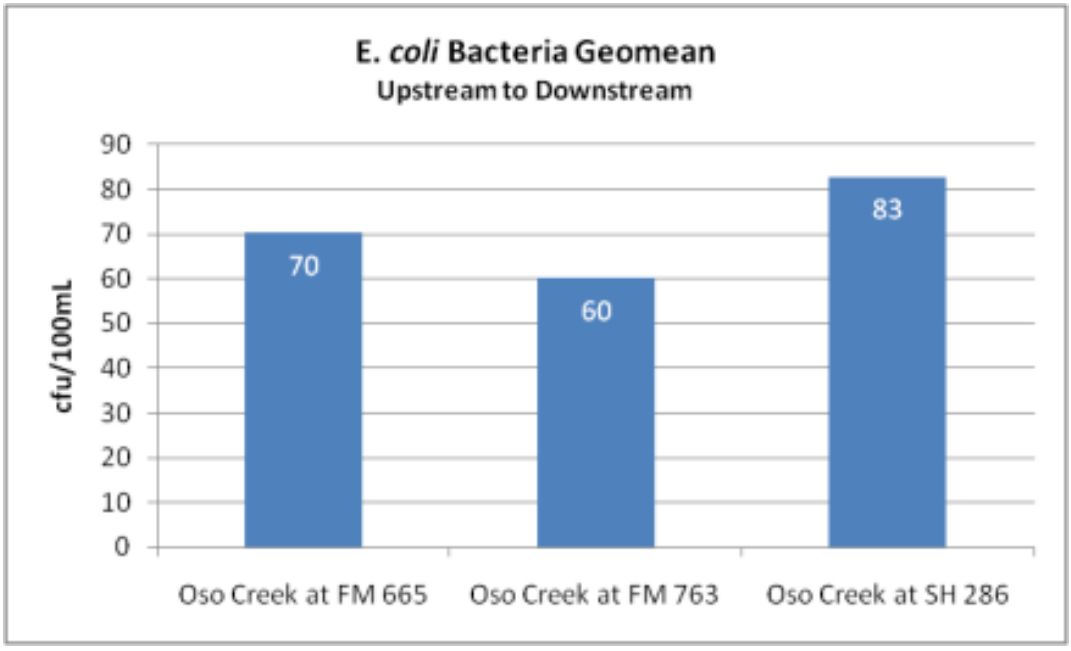
Conductivity values were highly variable, which is to be expected for a water body where fresh water from upstream mixes with salt water from downstream.

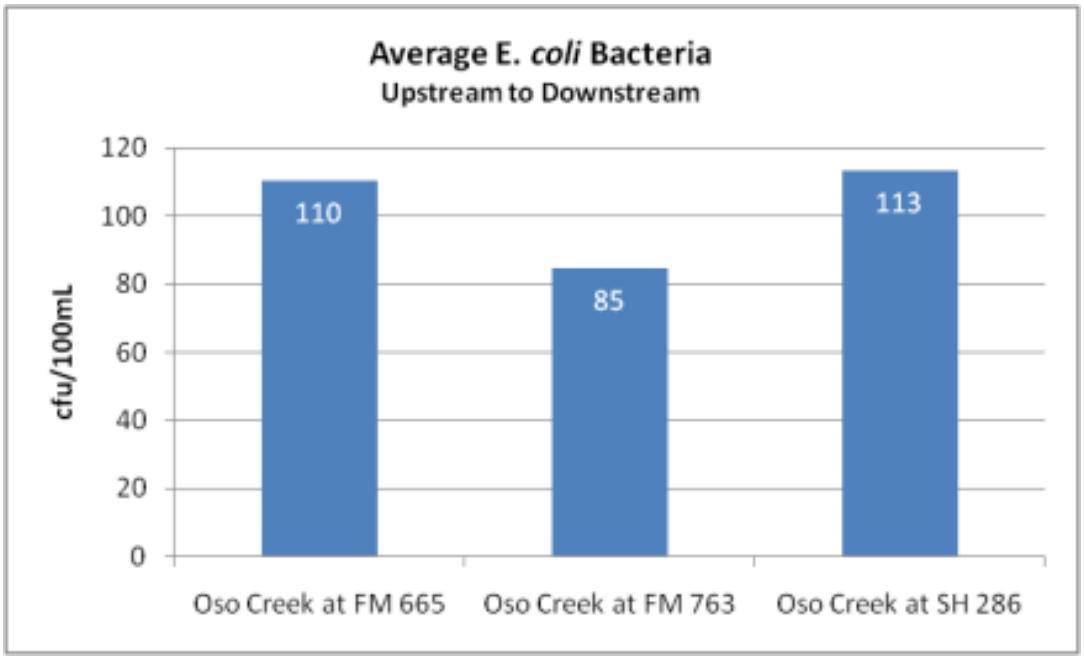
Oso Creek Descriptive Statistics Table

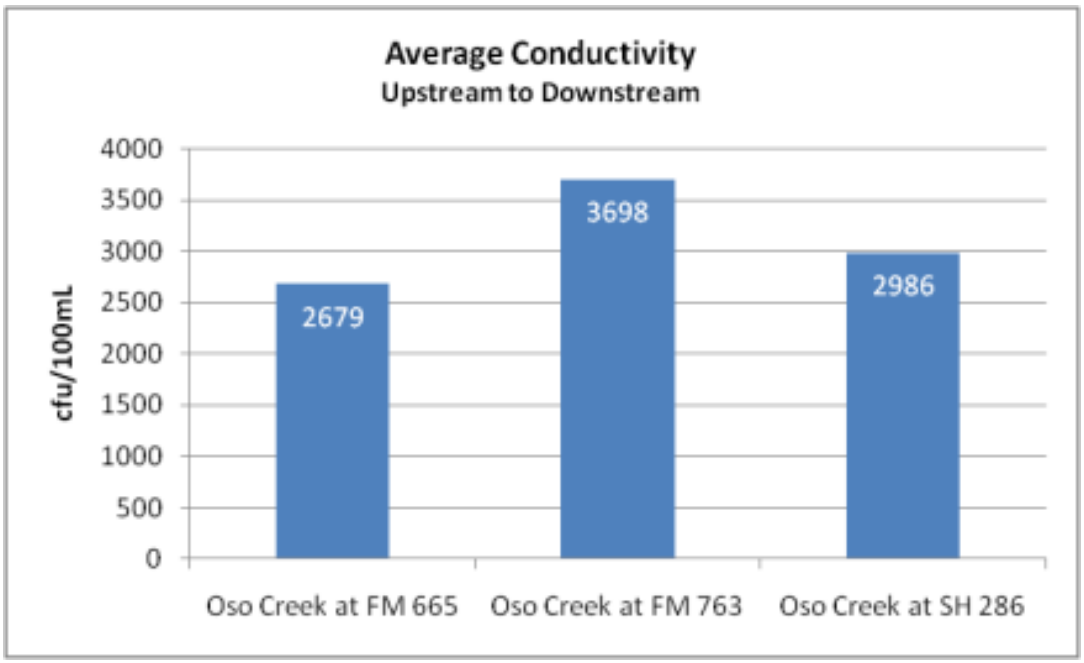
Oso Creek						
Parameter	**#**	**% Complete**	**Min**	**Avg**	**Max**	**Std Dev**
E. *coli* Bacteria	68	97	33	103	533	105
Conductivity	38	54	400	3114	5800	1234
Sample Time	67	96	11:00 AM	12:18 PM	2:35 PM	0:39

The *E. coli* single sample averages for each site spanned from 85 to 113 cfu/100mL with the highest average at SH 286. The E. *coli* geomean spanned from 60 to 83 cfu/100mL with the highest geomean at SH 286 as well. The difference in these values is not large enough to determine a significant trend between sites. Average conductivity spanned from 2,679 to 3,698 µS/cm with the highest average at FM 763. The graphs below show the average value for all three sites because the data were collected at sites within 7 miles of each other within an hour.

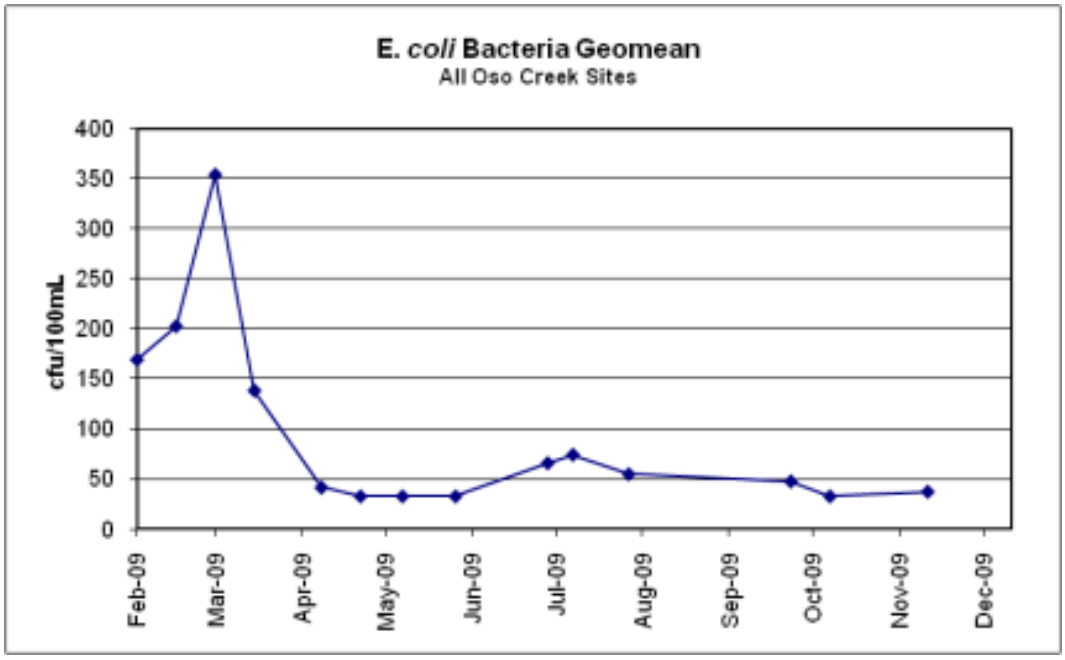
Upstream to Downstream Trends

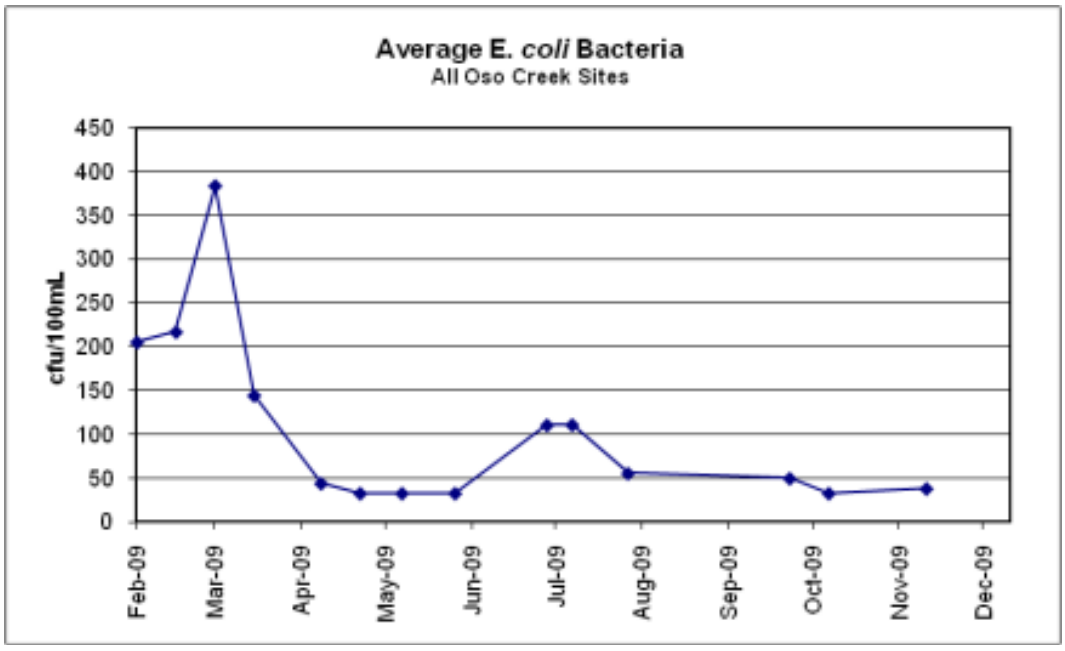


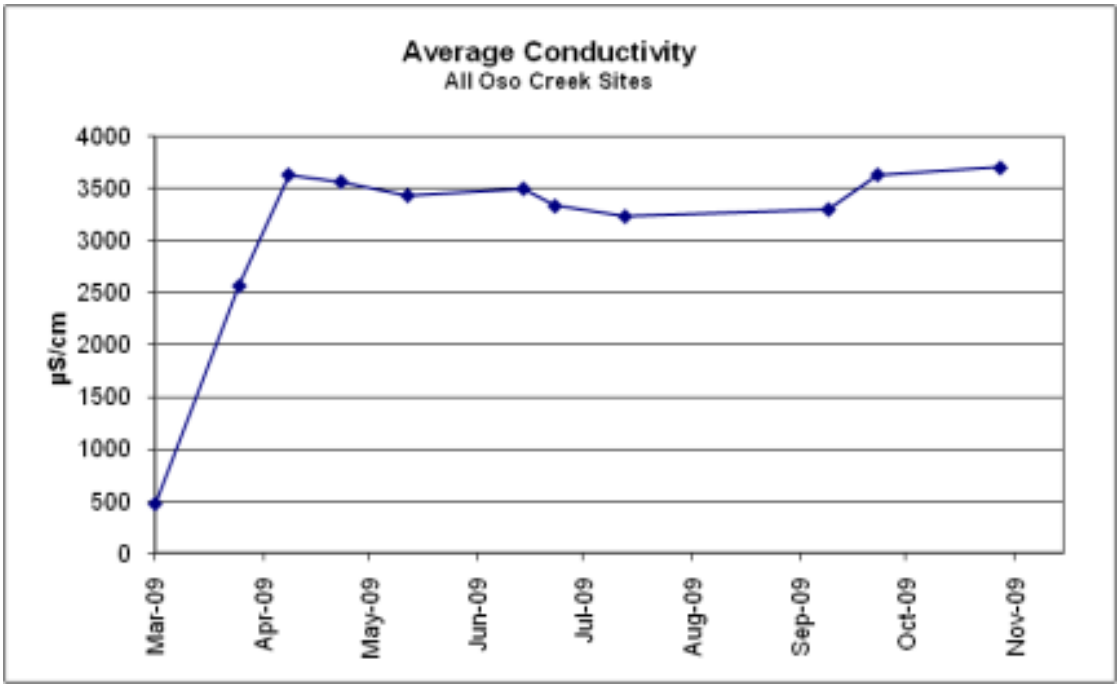

Average E. coli Bacteria
Upstream to Downstream
cfu/100mL
120
100
80
60
40
20
0
110
85
113
Oso Creek at FM 665
Oso Creek at FM 763
Oso Creek at SH 286


Average Conductivity
Upstream to Downstream
cfu/100mL
4000
3500
3000
2500
2000
1500
1000
500
0
2679
3698
2986
Oso Creek at FM 665
Oso Creek at FM 763
Oso Creek at SH 286

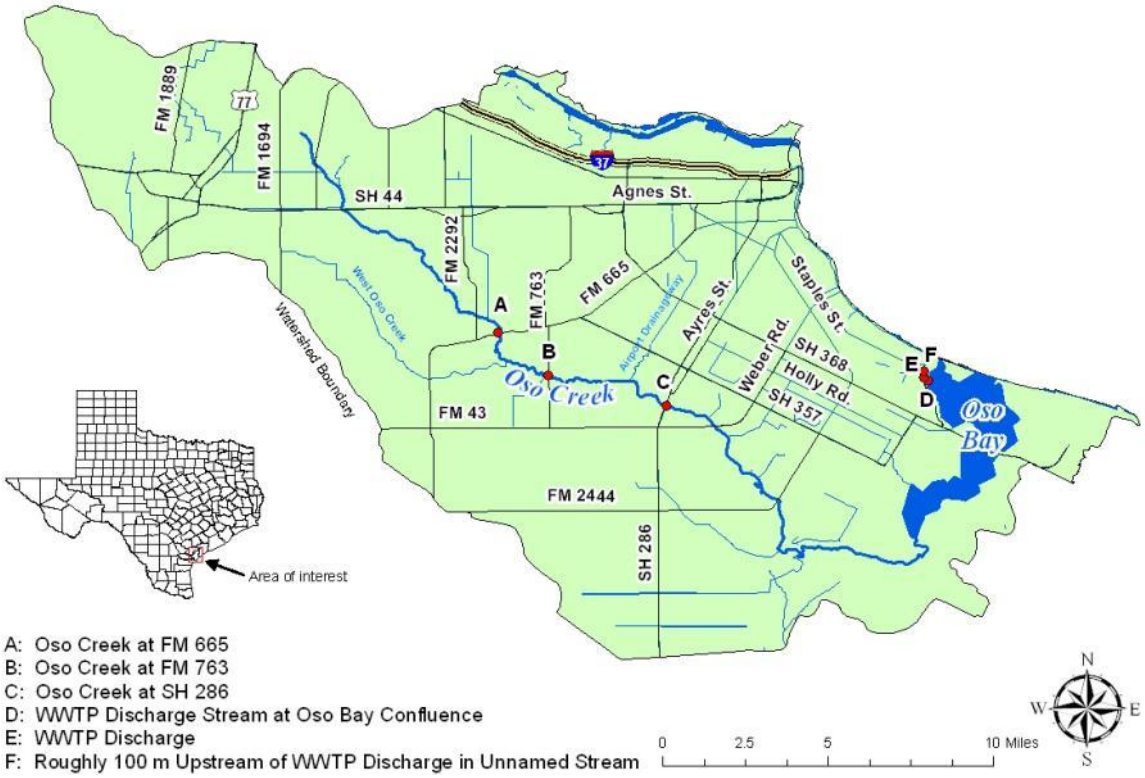
Trends Over Time



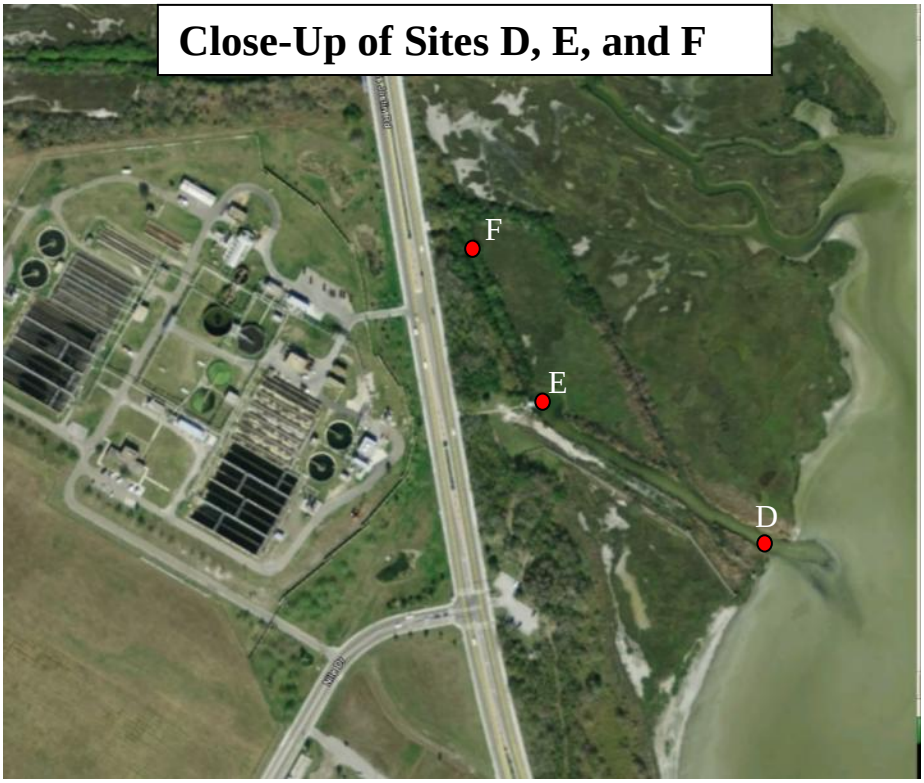



Average Conductivity
All Oso Creek Sites
µS/cm
4000
3500
3000
2500
2000
1500
1000
500
0
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09

Oso Creek/Oso Bay
Citizen Water Quality Monitor Site Locations



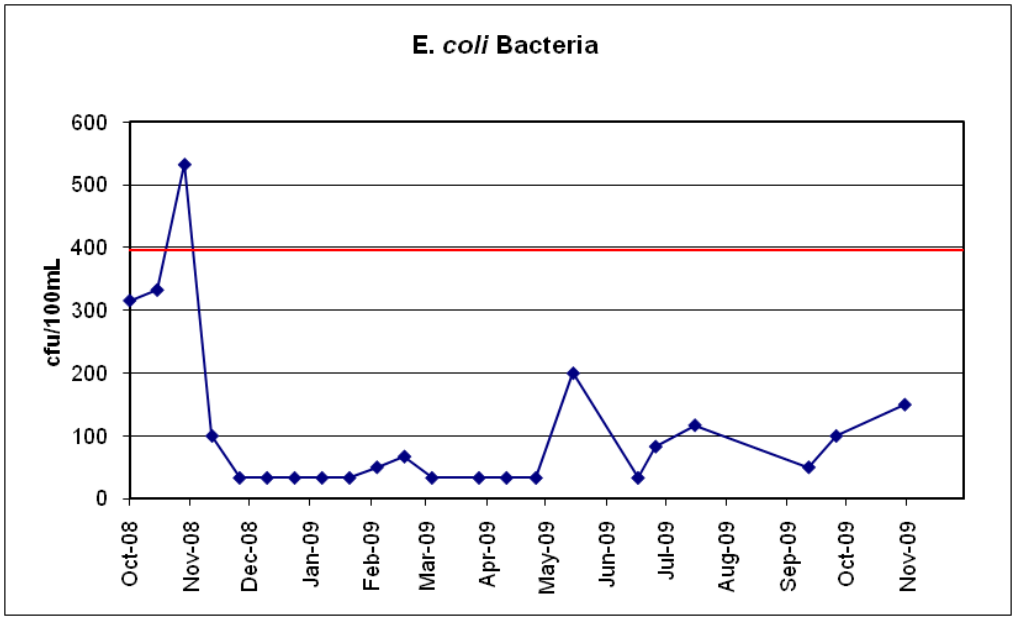
A: Oso Creek at FM 665
B: Oso Creek at FM 763
C: Oso Creek at SH 286
D: WWTP Discharge Stream at Oso Bay Confluence
E: WWTP Discharge
F: Roughly 100 m Upstream of WWTP Discharge in Unnamed Stream

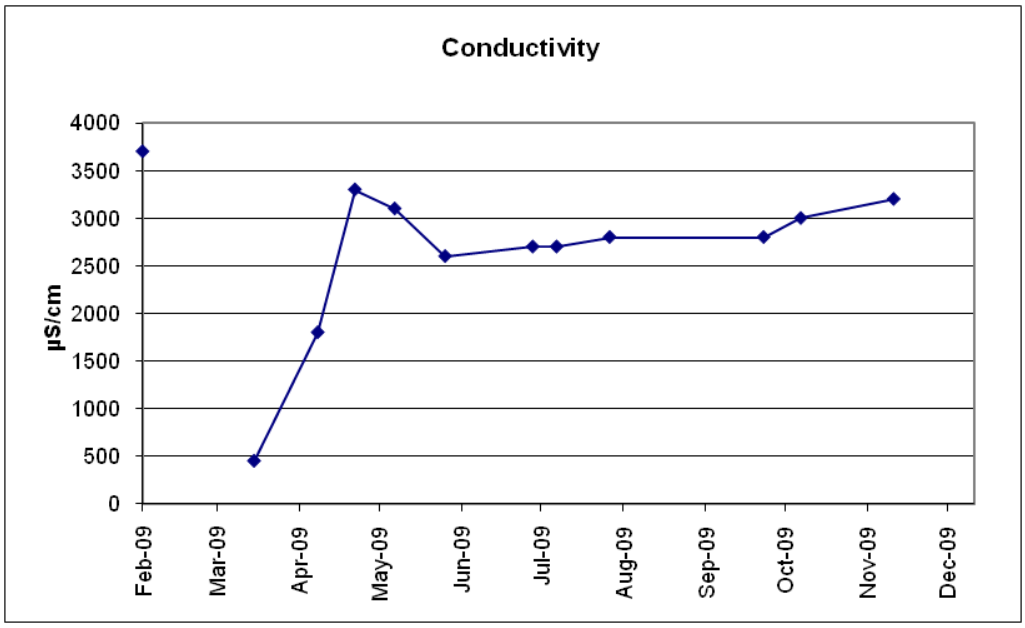


Site by Site Analyses

Site A: Oso Creek at FM 665

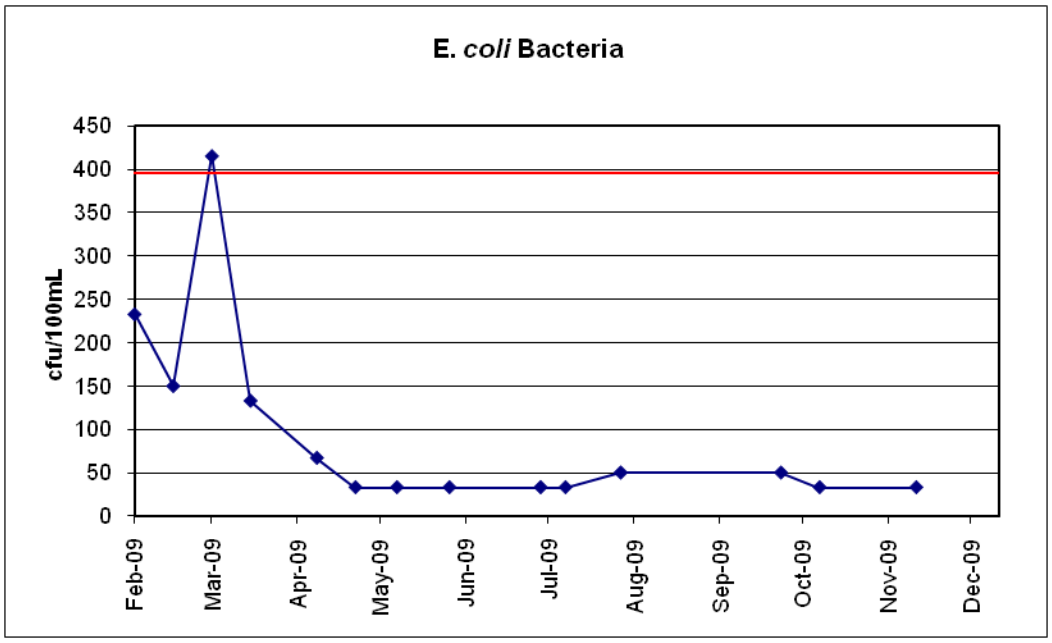
Site A: Oso Creek at FM 665						
Parameter	**#**	**% Complete**	**Min**	**Avg**	**Max**	**Std Dev**
E. *coli* Bacteria	22	100	33	110	533	129
Conductivity	12	55	450	2679	3700	840
Sample Time	22	100	11:00 AM	11:56 AM	12:20 PM	0:25

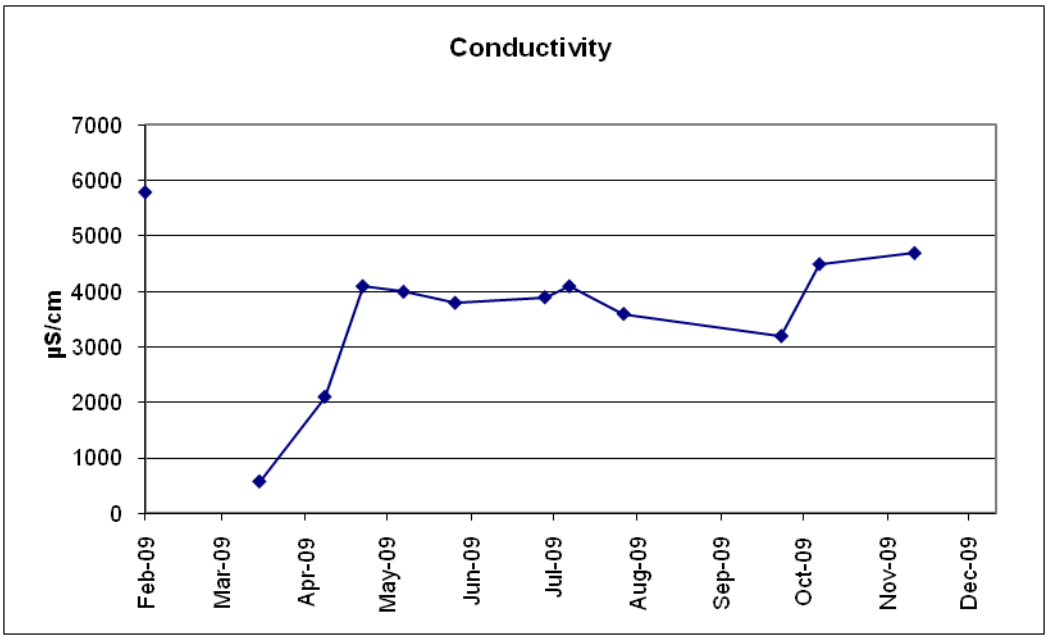




Site B: Oso Creek at FM 763

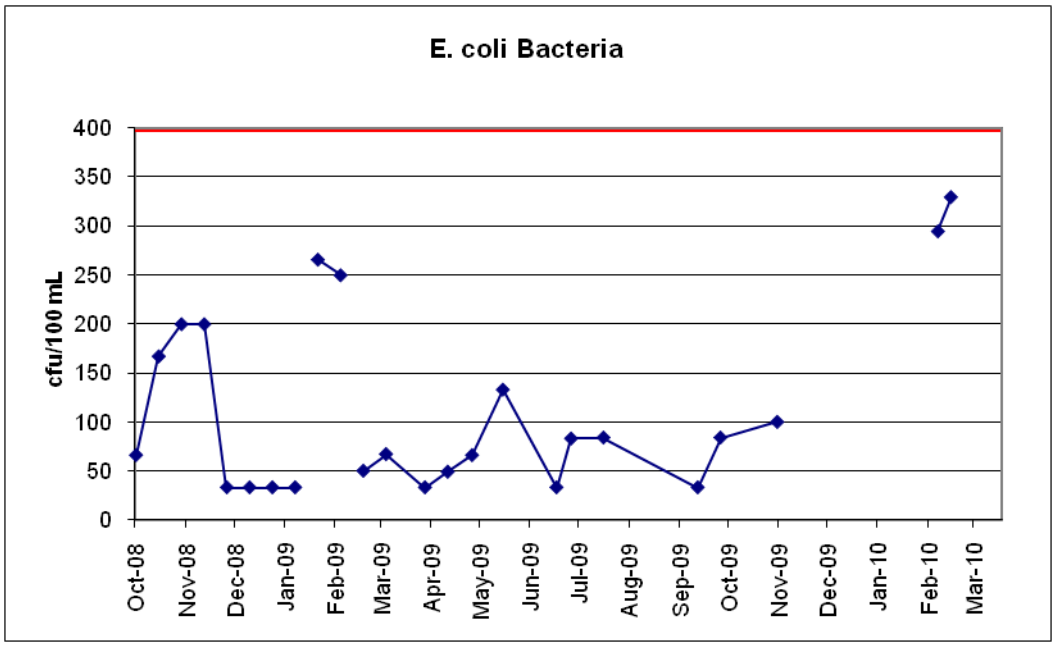
Site B: Oso Creek at FM 763						
Parameter	**#**	**% Complete**	**Min**	**Avg**	**Max**	**Std Dev**
E. *coli* Bacteria	22	100	33	85	416	91
Conductivity	12	55	570	3698	5800	1319
Sample Time	22	100	11:10 AM	12:10 PM	12:40 PM	0:27

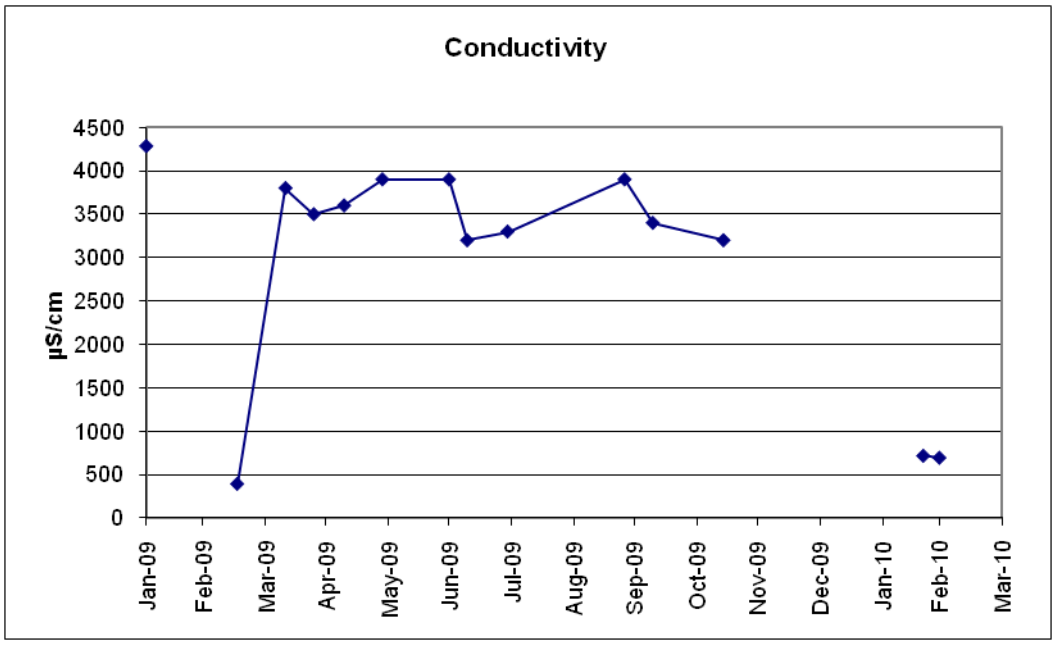




Site C: Oso Creek at SH 286

Site C: Oso Creek at SH 286						
Parameter	**#**	**% Complete**	**Min**	**Avg**	**Max**	**Std Dev**
E. *coli* Bacteria	24	92	33	113	330	94
Conductivity	14	54	400	2986	4282	1327
Sample Time	28	108	11:20 AM	12:43 PM	2:35 PM	0:45





Oso Bay

Oso Bay has been on the Texas 303(d) List of Impaired Water Bodies since 2004 for excessive levels of Enterococci bacteria. It is included on the Draft 2010 303(d) List because 19/57 Enteerococci samples taken from the lower portion of the bay exceeded the standard of 104 cfu/100mL. Eleven samples were collected by Texas A&M Corpus Christi students to determine the possible influence of the Oso Wastewater Treatment Plant on the bacteria concentrations in Oso Bay. One site was positioned roughly 100 m upstream from the discharge. One was directly out of the discharge, and one was at the confluence with Oso Bay, downstream of the discharge.

Seven of the 11 samples (64%) yielded no *E. coli* Bacteria. Samples taken on 2/17/2009 yielded results too numerous to count (TNTC) at the WWTP outfall and 3,763 cfu/100 mL downstream from the outfall. The sample collected directly out of the WWTP outfall which yielded a value too numerous to count indicates there to have been a problem with the treatment of the discharge on that date.

Site D: Roughly 100m Upstream of WWTP Outfall in Unnamed Stream

Site D: Roughly 100m Upstream of WWTP Outfall in Unnamed Stream			
Sample Date	3/10/2009	4/7/2009	4/15/2009
Conductivity (µS/cm)	2300	2200	2300
Water Temperature (^{o}F)	79.7	77	78.8
Dissolved Oxygen (mg/L)	6	5.2	5.1
pH	7.5	7	7
Secchi Disk Transparency (m)	>0.75	>0.75	>0.75
Total Depth (m)	0.75	0.75	0.75
E. *coli* (cfu/100 mL)	0	0	0

Site E: WWTP Outfall

Site E: WWTP Outfall				
Sample Date	2/17/2009	3/10/2009	4/7/2009	4/15/2009
Conductivity (µS/cm)	2600	2100	2300	
Water Temperature (^{o}F)	77	78.8	77	
Dissolved Oxygen (mg/L)	4.8	6.8	4.6	
pH	7.4	7.3	7	
Secchi Disk Transparency (m)	>0.45			
Total Depth (m)	0.45			
E. *coli* (cfu/100 mL)	TNTC	0	0	0

Site F: WWTP Discharge Stream at Oso Bay Confluence

Site F: WWTP Discharge Stream at Oso Bay Confluence				
Sample Date	2/17/2009	3/10/2009	4/7/2009	4/15/2009
Conductivity (µS/cm)	6400	7100	2300	2500
Water Temperature (°F)	77	80.42	77	80.6
Dissolved Oxygen (mg/L)	8.6	6.5	6.1	5.6
pH	7.7	7.6	7.6	7.1
Total Depth (m)			0.5	
E. *coli* (cfu/100 mL)	3763	0	16.7	216.5

[i]Texas State Historical Association, *Oso Creek (Nueces County)*, available from http://www.tshaonline.org/handbook/online/articles/rbo28; accessed 7 February 2011.
[ii]Koenig, Larry, *Oso Creek and Oso Bay – Bacterial Impairments in a Coastal Watershed*, available from http://txstreamteam.rivers.txstate.edu/Projects/TMDLs/Oso-Bay-Oso-Creek/contentParagraph/03/text_files/file/Oso%20TMDL%20Koenig%20Article%20%282%29.pdf; accessed 7 February 2011.
[iii]Texas Commission on Environmental Quality, *Improving Water Quality in Oso Bay and Oso Creek – Two TMDLs for Bacteria*, available from http://www.tceq.texas.gov/assets/public/implementation/water/tmdl/67osobaybacteria/67-osobaybacteria.pdf; accessed 7 February 2011.