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Texas Stream Team Volunteer Water Quality Monitoring Program
2009 Arroyo Colorado Data Summary

This data summary report includes general basin volunteer monitoring activity, general water quality descriptive statistics, tables and graphs, and comparisons to stream standards as related to "aquatic life use" criteria.

In alignment with Texas Stream Team's core mission, monitors attempt to collect data that can be used in decision-making processes, to promote a healthier and safer environment for people and aquatic inhabitants. While many assume it is the responsibility of Texas Stream Team to serve as the main advocate for volunteer monitor data use, it has become increasingly important for monitors to be accountable for their monitoring information and how it can be infused into the decision-making process, from "backyard" concerns to state or regional issues. To assist with this effort, Texas Stream Team is coordinating with monitoring groups and government agencies to propagate numerous data use options.

Among these options, volunteer monitors can directly participate by communicating their data to various stakeholders. Some options include: participating in the Clean Rivers Program (CRP) Steering Committee Process (see box insert on this page); providing information during "public comment" periods; attending city council and advisory panel meetings; developing relations with local Texas Commission on Environmental Quality (TCEQ) and river authority water specialists; and, if necessary, filing complaints with environmental agencies; contacting elected representatives and media; or starting organizing local efforts to address areas of concern.

The Texas Clean Rivers Act established a way for the citizens of Texas to participate in building the foundation for effective statewide watershed planning activities. Each CRP partner agency has established a steering committee to set priorities within its basin. These committees bring together the diverse interests in each basin and watershed. Steering committee participants include representatives from the public, government, industry, business, agriculture, and environmental groups. The steering committee is designed to allow local concerns to be addressed and regional solutions are recommended. For more information about participating in these steering committee meetings and to contribute your views about water quality, contact the appropriate CRP partner agency for your river basin at: http://www.tnrcc.state.tx.us/water/quality/data/wmt/contract.html.

Currently, Texas Stream Team is working with various public and private organizations to facilitate data and information sharing. One component of this process includes interacting with watershed stakeholders at CRP steering committee meetings. A major function of these meetings is to discuss water quality issues and to obtain input from the general public. While participation in this process may not bring about instantaneous results, it is a great place to begin making institutional connections and to learn how to "work" the assessment and protection system that Texas agencies use to keep water resources healthy and sustainable.

In general, Texas Stream Team efforts to use volunteer data may include the following:

1. Assist monitors with data analysis and interpretation
2. Analyze watershed-level or site-by-site data for monitors and partners
3. Screen all data annually for values outside expected ranges
4. Network with monitors and pertinent agencies to communicate data
5. Attend meetings and conferences to communicate data
6. Participate in CRP stakeholder meetings
7. Provide a data viewing forum via the Texas Stream Team Data Viewer
8. Participate in professional coordinated monitoring processes to raise awareness of areas of concern

Information collected by Texas Stream Team volunteers utilizes a TCEQ and EPA approved quality assurance project plan (QAPP) to ensure data are correct and accurately reflects the environmental conditions being monitored. All data are screened for completeness, precision and accuracy where applicable, and scrutinized with data quality objective and data validation techniques. Sample results are intended to be used for education and research, baseline, local decision making, problem identification, and others uses deemed appropriate by the data user. Graphs are compiled and situated to assist the data user in obtaining information from the collected data. Where applicable, “time” is located on the “x” or horizontal axis and is chronologically listed from oldest to most recent sampling. The “y1” or “y2” axes contain the constituent(s) of interest. Note: pH values were not transformed for graphing purposes or for developing mean statistics; data collection events may not be evenly distributed over time (through seasons and years); sampling events may occur at different times of the day; sample collection and results documentation may have been completed by different monitors over time at each site; data collected by school groups should undergo additional scrutiny before use; data summary information is subject to change.

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Arroyo Colorado Watershed Description

The Arroyo Colorado is labeled TCEQ stream segment 2202 above tidal and 2201 in the tidal portion. The water body has been largely modified as an engineered canal system for irrigation and flood control purposes since the early 1900s. These drastic changes to the watershed have allowed the Lower Rio Grande Valley to become an intensely agricultural region, while removing much of the wildlife and plant diversity. The watershed is approximately 706 square miles and bounded by drainage divides on all three inland sides. The water body flows nearly 90 miles from its headwaters southwest of the city of Mission, to its confluence with the Lower Laguna Madre.

Segment 2202 of the Arroyo Colorado has been listed on the TCEQ's 303 (d) List of Impaired Water Bodies for bacteria since 1996 and for mercury and PCBs (polychlorinated biphenyls) in edible fish tissue since 2008. The 2201 tidal portion has been listed for depressed dissolved oxygen since 1996, bacteria since 2006, and mercury and PCBs in edible fish tissue since 2008.

The land uses in the watershed are dominated by intense agriculture with the large urban areas of McAllen and Harlingen. The water body is used as a wastewater conveyance for most of the way and the lower section serves commercial barge traffic and recreational boating and fishing. Near the coast, it also is used as a nursery and foraging area for species of fish, shrimp, and crab.

Field observations reveal that there is an abundance of wildlife diversity in the basin including: butterflies, dragonflies, turtles, red wing blackbirds, grackles, egret, kingfishers, as well as a host of other birds.

DATA

The following information summarizes water quality data collected at eight sites in the Arroyo Colorado basin region in Hidalgo County and Cameron County, Texas. Information presented in this report will be accompanied by corresponding charts and graphs.
For all graphs, site name or sample date is located on the "x" or horizontal axis. This axis represents the independent variable, location of site or time. The data points on the "x" axis progress from upstream to downstream or chronologically from oldest to most recent sampling. The "y1" or "y2" axes contain the constituent(s) of interest.

Data collected by Texas Stream Team monitors include: pH, specific conductivity, water and air temperature, dissolved oxygen, total depth, Secchi depth, *E.coli*, field observations, flow severity, days since last precipitation, and others.

There were 149 samples taken from the Arroyo Colorado, Donna Canal, the North Alamo Road Canal, and the Drainage Ditch at Hwy 100 and 510 from October 26th, 1995 to March 8th, 2009. All monitoring was conducted by Texas Stream Team volunteers in partnership with the Arroyo Colorado Partnership. One site, "Arroyo Colorado Tidal upstream of Marker 36," was monitored from 1995 to 1998. After that, sampling resumed once again on June 3rd, 2007 and has been fairly consistent at the other seven sites. For geographic and temporal considerations, this report will make distinctions between the Arroyo Colorado main stem and the other sites in the watershed, as well as for older data versus newer data.

Water Temperature Summary

Water temperature affects many different aspects of water quality. It can effect feeding, reproduction, and the metabolism of aquatic animals as well as the rate of chemical reactions and solubility of compounds in the water.

In this data set, mean water temperature readings ranged from 22.6° C to 26°. The maximum reading of 38.5° was taken at FM 493 on August 2nd 2008 and the minimum of 12.5° was taken at South Alamo Floodway on December 6th, 2008.

Specific Conductivity Summary

Specific Conductivity (SC) levels measure the amount of Total Dissolved Solids (TDS) that are present in a water sample. These can be a wide variety of inorganic substances such as sodium, chloride, nitrates, and phosphates. Generally, high SC values indicate salt water, while lower values are usually observed in fresh water. SC is measured using micro Siemens per centimeter (µS/cm).

In this data set, mean SC values ranged from 1533 to 16720 µS/cm. The maximum value of 19900 µS/cm was observed at the "Tidal upstream of Marker 36" site on August 14th, 1996 and the minimum value of 710 µS/cm was observed at the Drainage Ditch at Hwy 100 and 510 on September 10th, 2008.

Dissolved Oxygen Summary

Dissolved Oxygen (DO) is the oxygen freely available to fish and other aquatic life. Traditionally, the level of DO has been accepted as the single most important indicator of a water body's ability to support desirable aquatic life. It is measured in milligrams per liter (mg/L). When DO levels drop below 5.0 mg/L, it is deemed in exceedance of safe DO levels, thus, dangerous for aquatic life. While DO values are only quality-assured with evidence of dual titrations, all values were kept intact in this dataset for purposes of data completeness. Each site's DO values were fully incorporated into statistical analysis, however, not denoted 100% complete when dual titrations are absent.

In this data set, mean DO values ranged from 4.9 to 7.6 mg/L. The maximum value of 10.9 mg/L was observed at the "Tidal upstream of Marker 36" site on January 10th, 1996 and the minimum value of 1.95 mg/L was observed at the Drainage Ditch at Hwy 100 and 510 on August 11th, 2008.

pH Summary

pH levels measure how acidic or alkaline the water sample is. A reading is taken on a 0 – 14 scale measured in standard units (su). When pH levels fall out of the 5 – 9 su range, it begins to become a problem for aquatic life

In this data set, mean pH values ranged from 7.6 to 8.3 su. The maximum and minimum values were both observed at South Alamo Floodway. The maximum value of 9.9 su was observed on June 3rd, 2007 and the minimum value of 5.2 su was observed on October 6th, 2007.

***E.coli* Summary**

E.coli is an indicator bacteria for harmful pathogens present in a water body. It is measured in colony forming units (cfu)/100mL. For a water body to meet the TCEQ contact recreation standards, the *E.coli* count must be less than or equal to 394 cfu/100mL. If the site

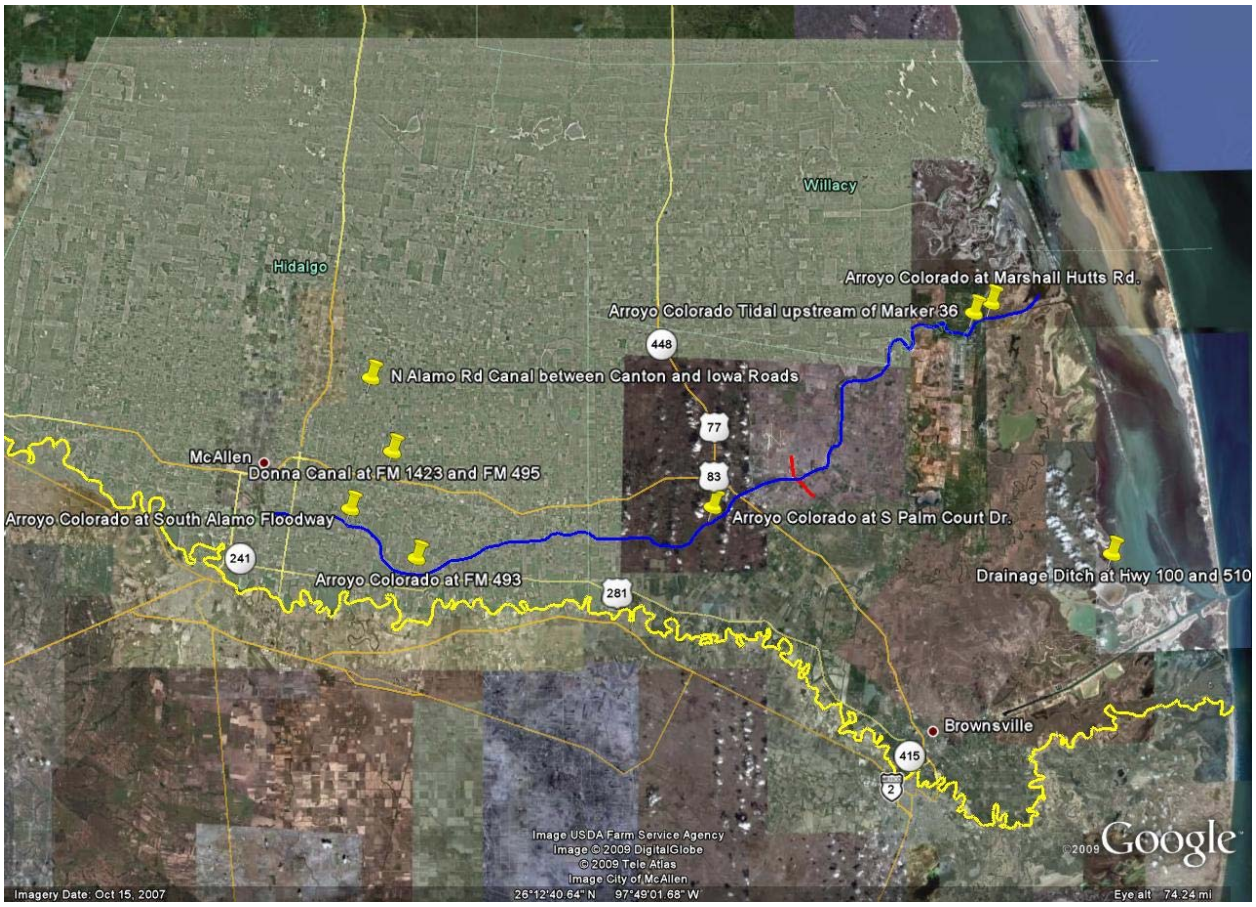
yields exceedingly high values 25% of all sampling events, it is considered to exceed contact recreation standards.

In this data set, mean *E.coli* values ranged from 143 to 2343 cfu/100mL. The maximum value of 17500 cfu/100mL was observed at the N Alamo Rd Canal site on December 6th, 2008. The next highest value of 6900 cfu/100mL was recorded on the Arroyo Colorado main stem at the S Alamo Floodway site also on December 6th, 2008. The minimum value of 0 cfu/100mL was observed twice between February and March of 2008 at the Donna Canal site.

SITE BY SITE

Site by site analysis of the watershed will be split into two basic categories: Arroyo Colorado main stem and other related sites. Within these categories, sites are listed from upstream to downstream. Other considerations should be made about the "Arroyo Colorado Tidal upstream of Marker 36" site due to the fact that all data collected there precedes the rest of the data presented in this report by nine years.

A satellite image of the area is shown below:



The two sites "N Alamo Rd Canal between Canton and Iowa Roads" and "Donna Canal at FM 1423 and FM 495" are part of an extensive canal system called The North Floodway. While these sites are not technically in the Arroyo Colorado watershed, they are of interest because the water comes from a similar source during flood events. From the site at S. Palm Court Dr. the Arroyo Colorado flows to the northeast into the tidal portion. The red line delineates segment 2202 from 2201, the tidal portion. The two sites "Arroyo Colorado Tidal upstream of Marker 36" and "Arroyo Colorado at Marshall Hutts Rd." are in segment 2201 and the sites at South Alamo Floodway, FM 493, and S. Palm Court Dr. are upstream in segment 2202. South of the tidal portion, a drainage ditch flows into the Laguna Madre from the main stem and the site "Drainage Ditch at Hwy 100 and 510" monitors the water at that point.

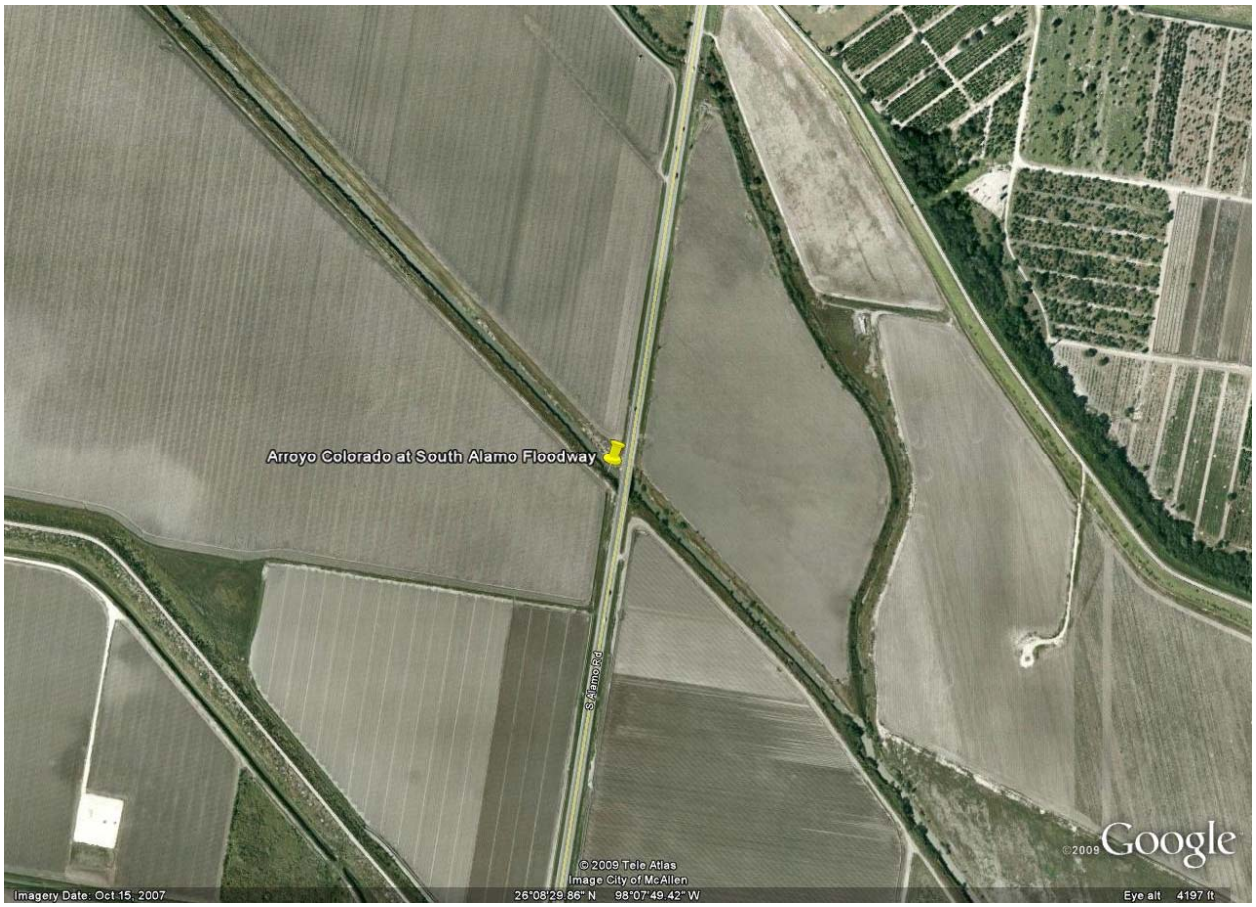
ARROYO COLORADO MAIN STEM

There were 101 samples taken from 5 sites on the Arroyo Colorado main stem in this data set. 29 of these samples were taken at the "Tidal upstream of Marker 36" site from 1995 to 1998. The remaining 72 samples were taken from June 2007 to March 2009. Sampling times ranged from 6:40 am to 7:00 pm.

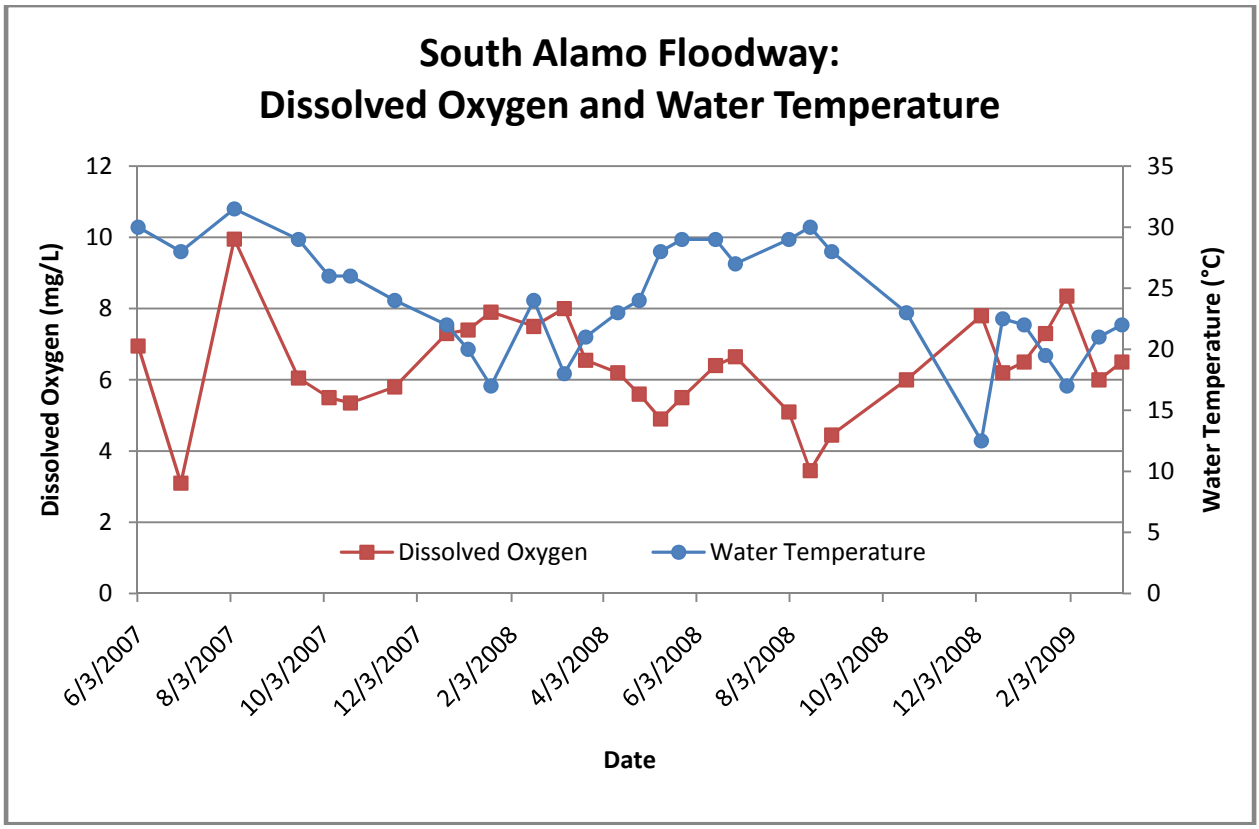
Arroyo Colorado at South Alamo Floodway

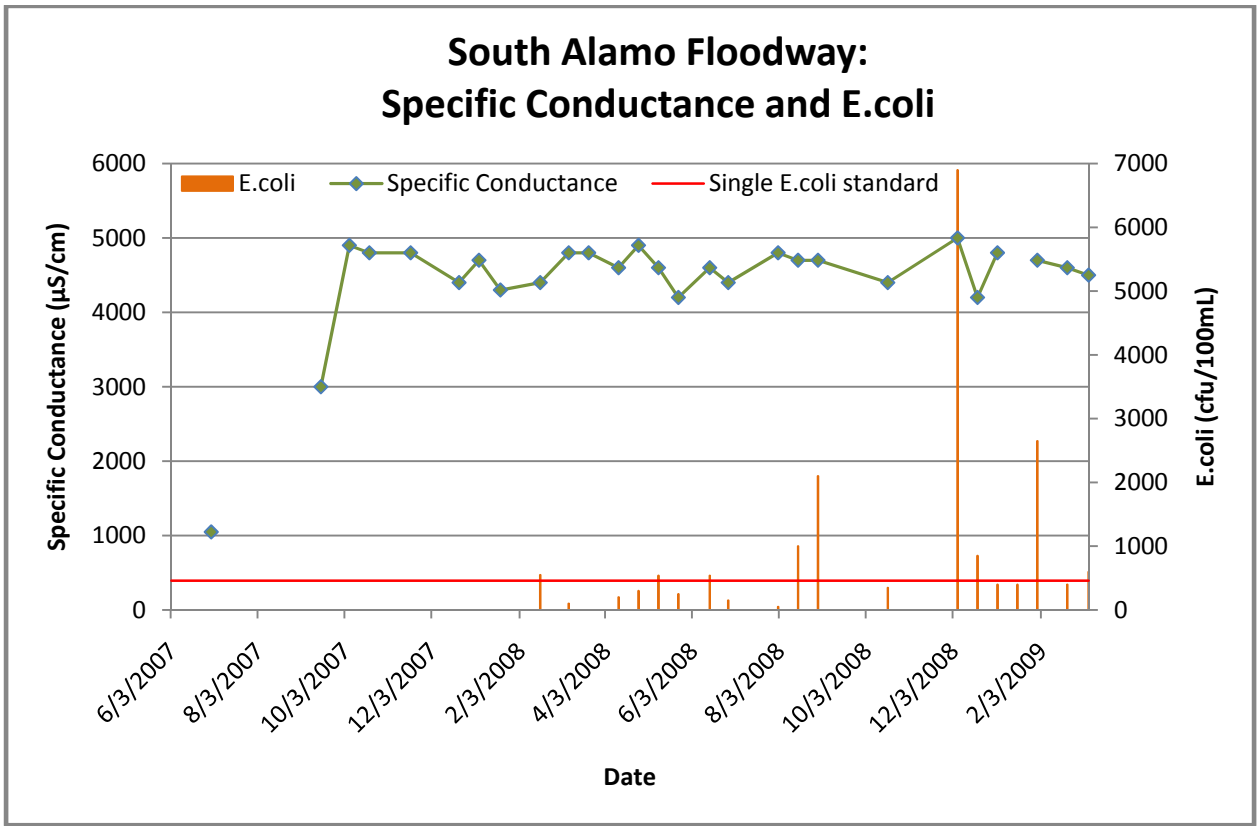
There were 30 samples taken from the South Alamo Floodway site in TCEQ stream segment 2202 from June 3rd, 2007 to March 8th, 2009. Sampling times ranged from 9:30 am to 7:00 pm with the average sampling time occurring at 12:00 pm. All sampling was conducted by Sharon Slagle and Richard Ramke. Water temperature readings ranged from 12.5° C to 31.5° with an average of 24.1°. SC values ranged from 1050 to 5000 µS/cm with an average value of 4431 µS/cm. DO values ranged from 3.1 to 9.95 mg/L with an average value of 6.3 mg/L. Of all DO values, 4 were less than the 5.0 mg/L standard, giving the site a 13% exceedance rate. pH values ranged from 5.2 to 9.9 su with an average value of 7.6 su. South Alamo Floodway displayed both the lowest and highest pH values in this data set. These values are among the outer reaches of acceptable pH values with the reading of 9.9 su actually outside the acceptable range. pH values this high can cause a multitude of problems for aquatic life. The next highest recorded pH value at this site is 8.0 su and within the acceptable range. Therefore, the 9.9 su reading observed on June 3rd, 2007 may be seen as an outlier and not indicative of ambient conditions. *E.coli* values ranged from 50 to 6900 cfu/100mL with an average value of 965 cfu/100mL. Of all *E.coli* values, 12 were greater than the 392/100mL contact recreation standard, giving the site a 63% exceedance rate. This data supports the TCEQ's 303 (d) listing for impairment for bacteria in segment 2202.

There are graphs shown below for DO and water temperature, and for *E.coli* and SC. The inverse nature of DO and water temperature can be observed, as colder water has the ability to hold more oxygen. SC and *E.coli* were graphed together to attempt to draw connections between total dissolved solids and bacteria. It is known that bacteria thrive in clumped sediment; however the graph below shows minimum visual correlation.



S Alamo Floodway (Site # 80426)						
Parameter	**N**	**% complete**	**Min**	**Mean**	**Max**	**Std. Dev.**
Sample Time	28	93	9:30	12:00	19:00	2:31
Total Depth (m)	1	3		1		
Secchi Depth (m)	27	90	0.1	0.4	1	0.2
Air Temperature (°C)	30	100	13.5	24.9	34	5.1
Water Temperature (°C)	30	100	12.5	24.1	31.5	4.7
Specific Conductivity (µS/cm)	27	90	1050	4431	5000	774
Dissolved Oxygen (mg/L)	30	100	3.1	6.3	9.95	1.4
pH (su)	29	97	5.2	7.6	9.9	0.6
E.coli (cfu/100mL)	19	63	50	965	6900	1584
DO exceedance [< 5.0 mg/L]		4 of 30	13%			
E.coli [> 394 cfu/100ml]		12 of 19	63%			


South Alamo Floodway:
Dissolved Oxygen and Water Temperature
Dissolved Oxygen (mg/L)
Water Temperature (°C)
Dissolved Oxygen
Water Temperature
Date
6/3/2007
8/3/2007
10/3/2007
12/3/2007
2/3/2008
4/3/2008
6/3/2008
8/3/2008
10/3/2008
12/3/2008
2/3/2009


South Alamo Floodway:
Specific Conductance and E.coli
Specific Conductance (µS/cm)
E.coli (cfu/100mL)
E.coli
Specific Conductance
Single E.coli standard
Date
6/3/2007
8/3/2007
10/3/2007
12/3/2007
2/3/2008
4/3/2008
6/3/2008
8/3/2008
10/3/2008
12/3/2008
2/3/2009

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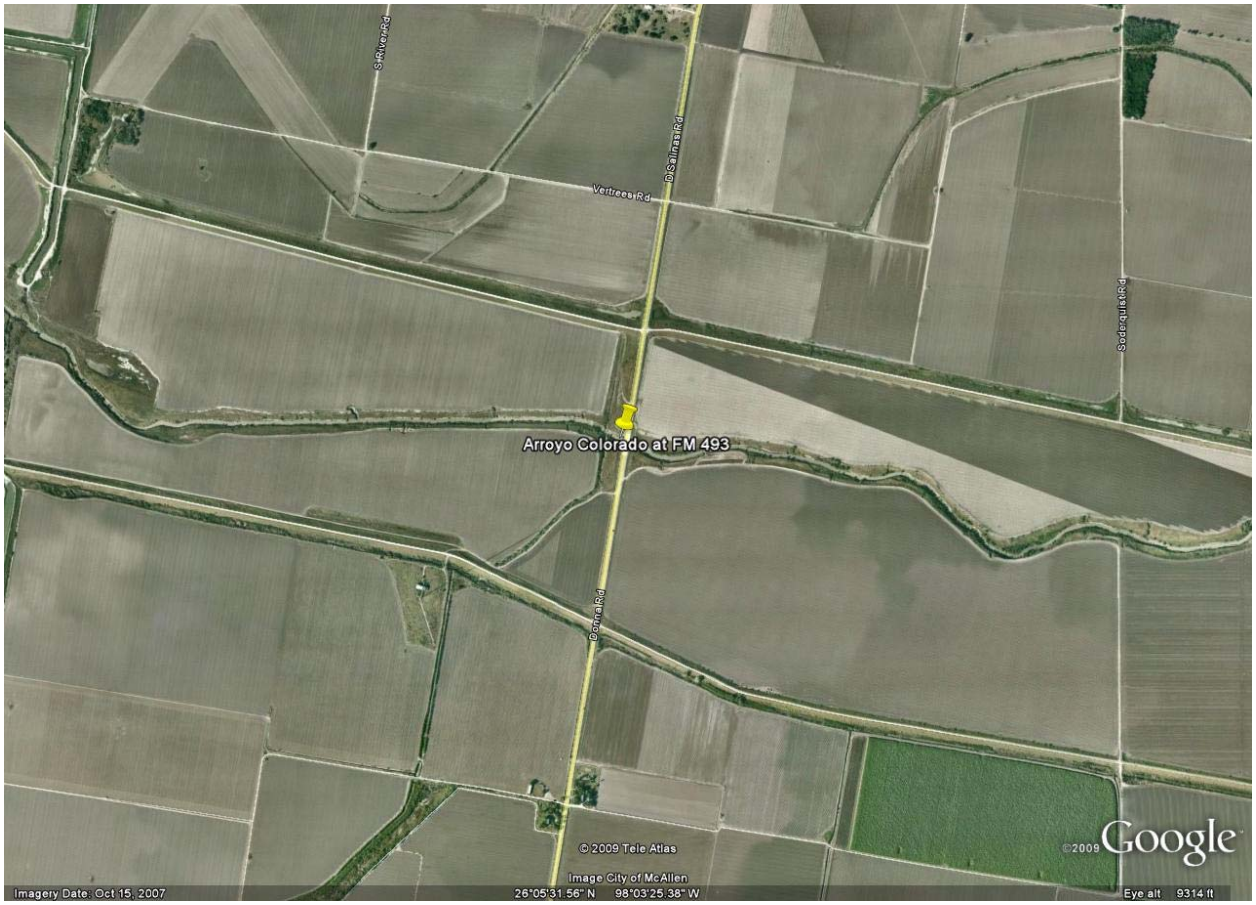
Arroyo Colorado at FM 493

There were 29 samples taken from FM 493 in TCEQ stream segment 2202 from September 22nd, 2007 to March 8th, 2009. Sampling times ranged from 8:30 am to 1:30 pm with the average sampling time occurring at 10:16 am. All sampling was conducted by Sharon Slagle and Richard Ramke. Water temperature readings ranged from 15° C to 38.5° with an average of 23.7°. SC values ranged from 3800 to 5300 µS/cm with an average value of 4526 µS/cm. DO values ranged from 4.7 to 8.6 mg/L with an average value of 6.5 mg/L. Of all DO values, only 2 were less than the 5.0 mg/L standard, giving the site a 7% exceedance rate. pH values ranged from 5.6 to 7.9 su with an average value of 7.6 su. *E.coli* values ranged from 320 to 6000 cfu/100mL with an average value of 1653 cfu/100mL. Of all *E.coli* values, 17 were greater than the 394 cfu/100mL contact recreation standard, giving the site an 89% exceedance rate. This data supports the TCEQ's 303 (d) listing for impairment for bacteria in segment 2202.
There are graphs shown below for DO and water temperature, and for *E.coli* and SC. Due to somewhat incomplete DO records, the graph is missing some data. However, the inverse nature of DO and water temperature can still be observed, as colder water has the ability to hold more oxygen. SC and *E.coli* were graphed together to attempt to draw connections between total dissolved solids and bacteria. It is known that bacteria thrive in heavy sediment; however the graph below shows minimum visual correlation.



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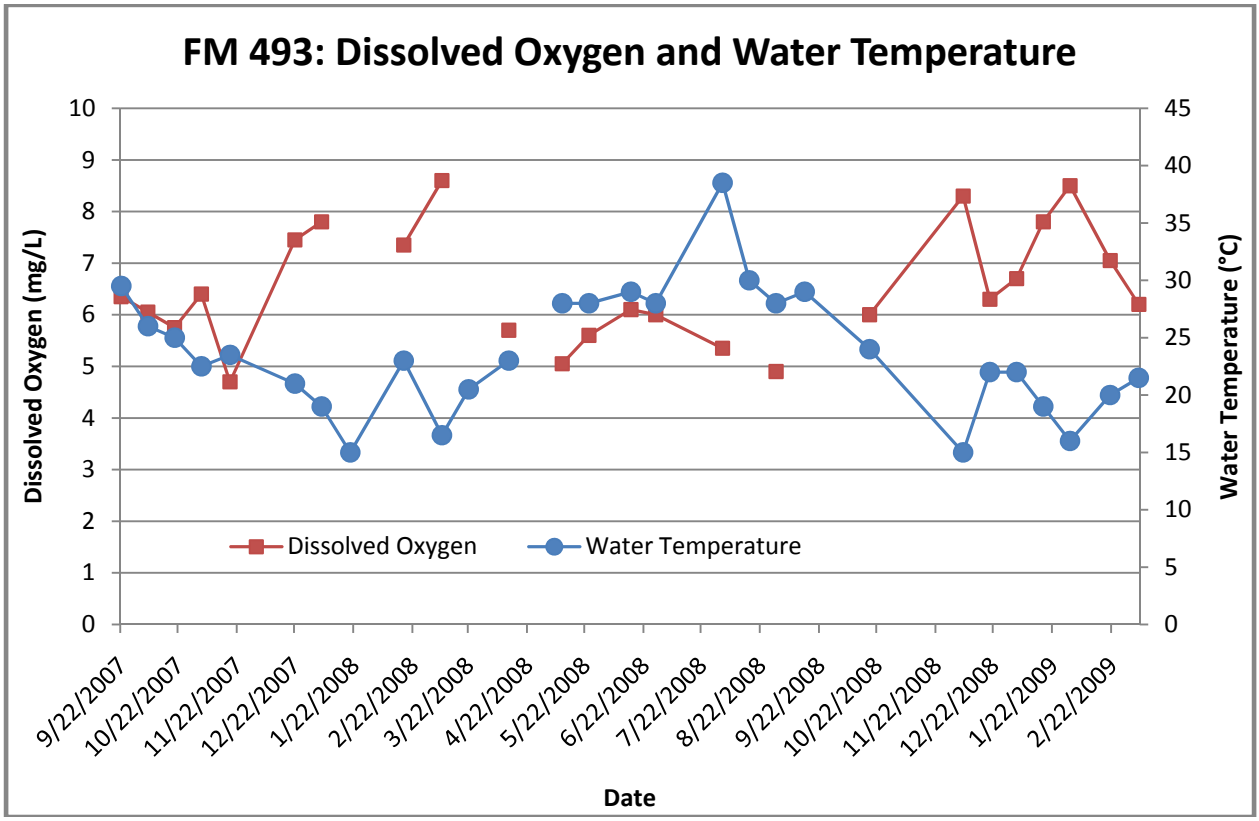
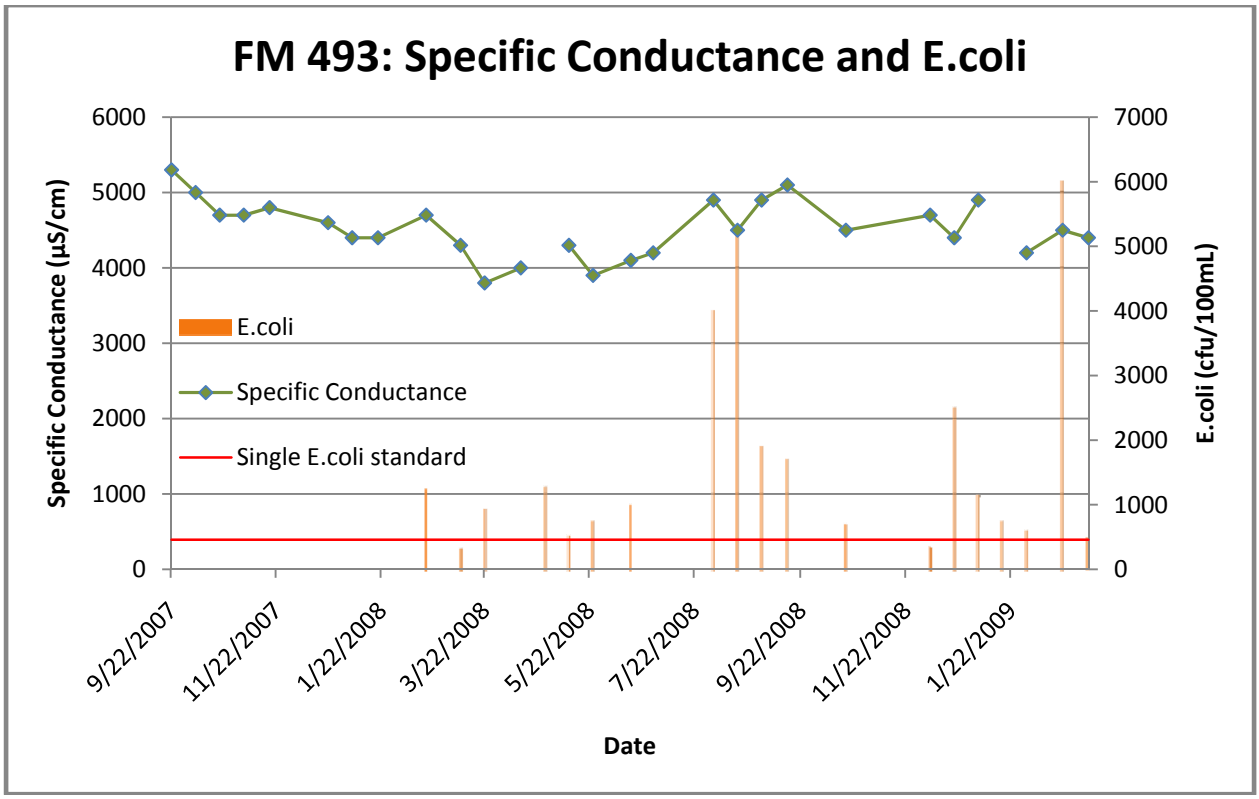
FM 493 (Site # 80445)						
Parameter	**N**	**% complete**	**Min**	**Mean**	**Max**	**Std. Dev.**
Sample Time	28	97	8:30	10:16	13:30	2:23
Total Depth (m)	0	0				
Secchi Depth (m)	28	97	0.1	0.3	0.7	0.1
Air Temperature (°C)	28	97	13	24.5	34	5.3
Water Temperature (°C)	28	97	15	23.7	38.5	5.4
Specific Conductivity (µS/cm)	27	93	3800	4526	5300	369
Dissolved Oxygen (mg/L)	24	83	4.7	6.5	8.6	1.1
pH (su)	26	90	5.6	7.6	7.9	0.4
E.coli (cfu/100mL)	19	66	320	1653	6000	1650

DO exceedance [< 5.0 mg/L]	2 of 29	7%
E.coli [> 394 cfu/100ml]	17 of 19	89%





Arroyo Colorado at S. Palm Court Dr.

There were 5 samples taken from S. Palm Court Dr. in TCEQ stream segment 2202 from June 7th, 2007 to December 30th, 2007. Sampling times ranged from 8:30 am to 10:30 am with the average sampling time occurring at 9:41 am. All sampling was conducted by David Moulder. Water temperature readings ranged from 16.5° C to 28° with an average of 22.6°. SC values ranged from 3900 to 4800 µS/cm with an average value of 4300 µS/cm. DO values ranged from 4.1 to 6.6 mg/L with an average value of 5.4 mg/L. Of all DO values, only 1 was less than the 5.0 mg/L standard, giving the site a 25% exceedance rate. pH values ranged from 7.8 to 7.9 su with an average value of 7.9 su. *E.coli* values ranged from 350 to 490 cfu/100mL with an average value of 402 cfu/100mL. Of the 3 *E.coli* samples taken from this site, only 1 was greater than the 394 cfu/100mL contact recreation standard, giving the site a 33% exceedance rate. This data supports the TCEQ's 303 (d) listing for impairment for bacteria. Due to the overall lack of data, graphs were not generated for this site.

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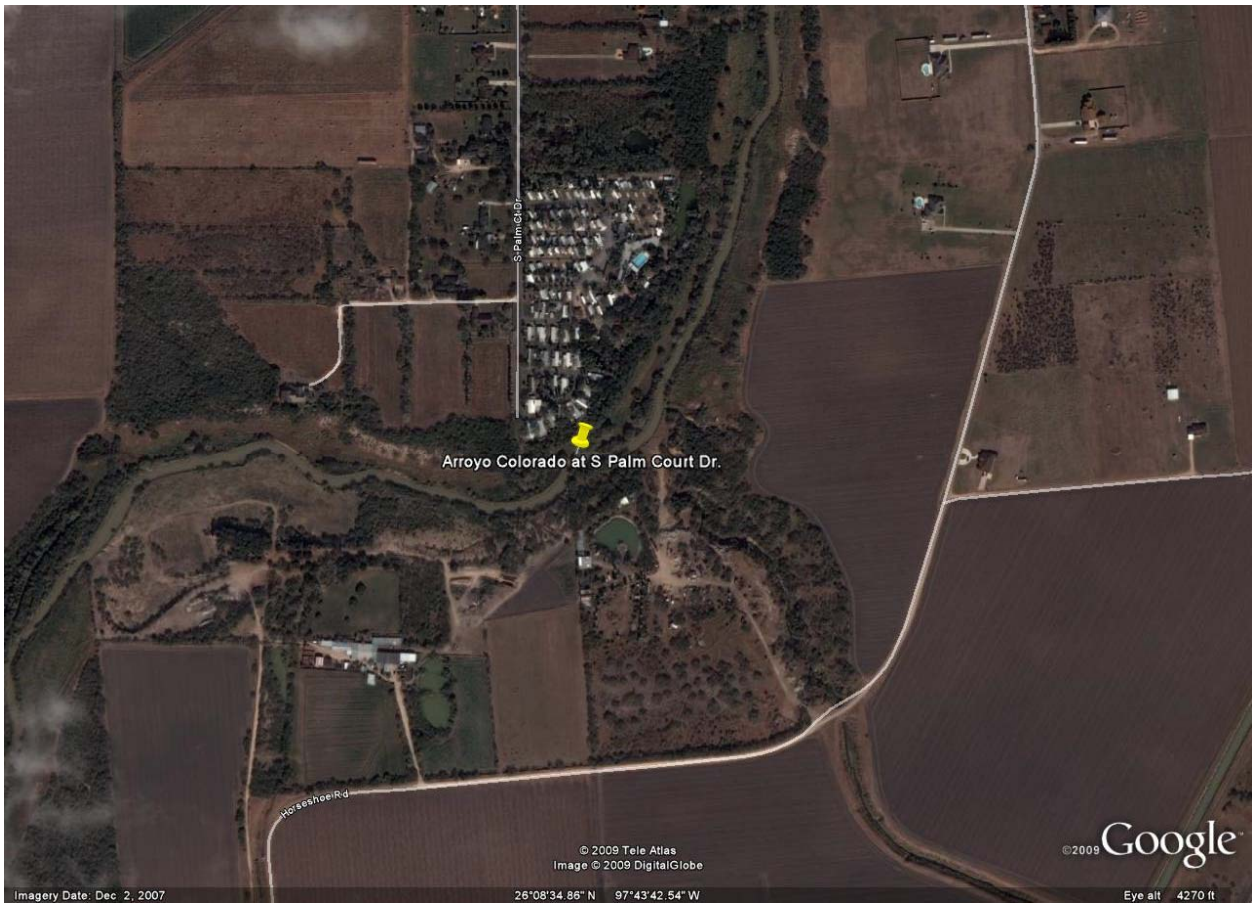


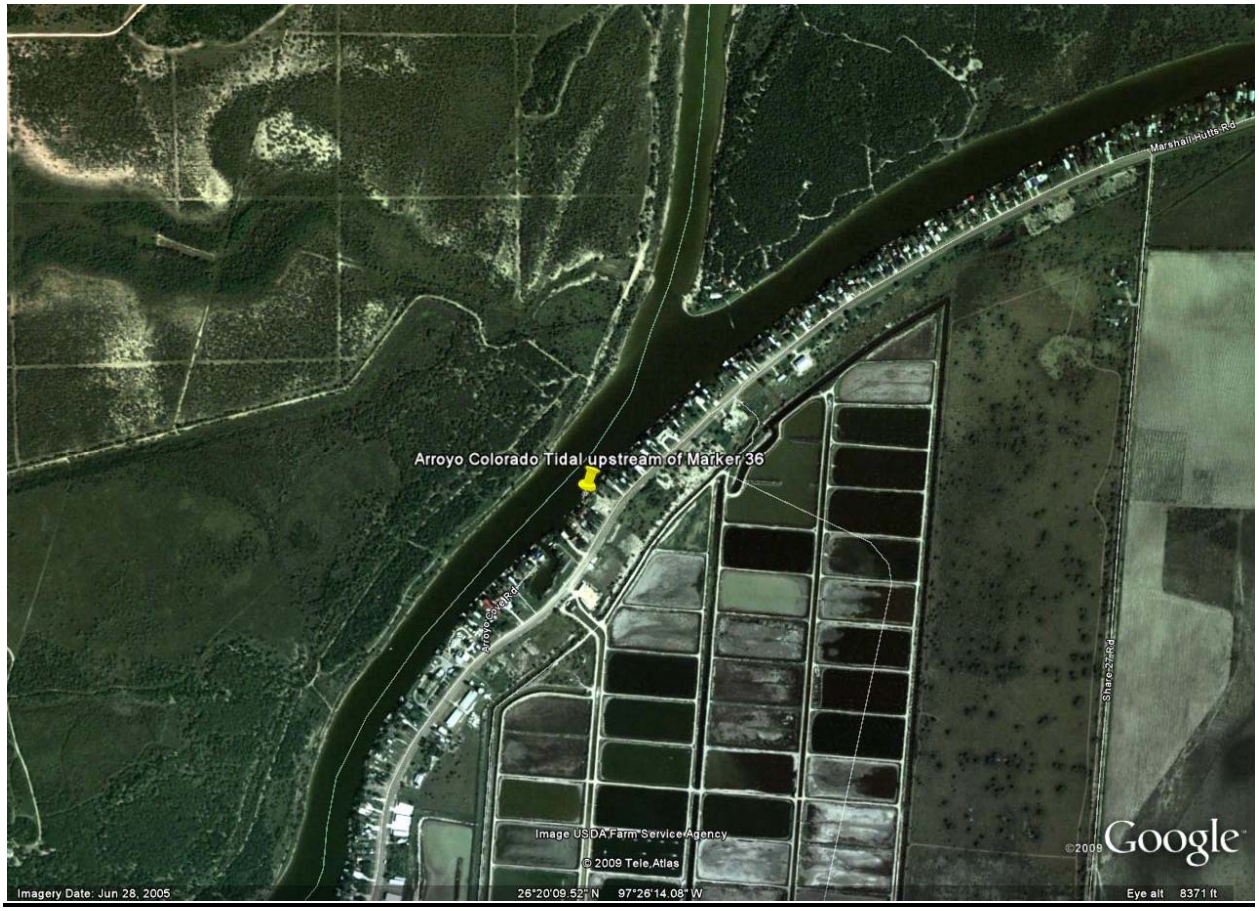
S Palm Court Dr (Site # 80423)						
Parameter	**N**	**% complete**	**Min**	**Mean**	**Max**	**Std. Dev.**
Sample Time	5	100	8:30	9:41	10:30	0:46
Total Depth (m)	0	0				
Secchi Depth (m)	4	80	0.1	0.14	0.2	0.05
Air Temperature (°C)	4	80	17	23.1	28	5.7
Water Temperature (°C)	4	80	16.5	22.6	28	5.7
Specific Conductivity (µS/cm)	3	60	3900	4300	4800	458
Dissolved Oxygen (mg/L)	4	80	4.1	5.4	6.6	1.1
pH (su)	4	80	7.8	7.9	7.9	0.05
E.coli (cfu/100mL)	3	60	350	402	490	77

DO exceedance [< 5.0 mg/L]	1 of 4	25%
E.coli [> 394 cfu/100ml]	1 of 3	33%

Arroyo Colorado Tidal upstream of Marker 36

There were 29 samples taken from the Tidal upstream of Marker 36 site in TCEQ stream segment 2201 from October 26th, 1995 to October 4th, 1998. Sampling times ranged from 6:40 am to 6:15 pm with the average sampling time occurring at 11:53 am. All sampling was conducted by Christine Rakestraw. Water temperature readings ranged from 15° C to 31.5° with an average of 25.7°. Secchi depth measurements ranged from 0.3 to 1.1 m with an average measurement of 0.6 m. Total depth measurements ranged from 0.6 to 2 m with an average measurement of 1.5 m. SC values ranged from 10300 to 19900 µS/cm with an average value of 16720 µS/cm. DO values ranged from 3.8 to 10.9 mg/L with an average value of 7.6 mg/L. Of all DO samples, only 2 were less than the 5.0 mg/L standard, giving the site a 7% exceedance rate. Because evidence of dual titrations were absent from the dataset, DO values are considered incomplete. However, to be able to understand trends in the data, inclusion was necessary. pH values ranged from 7.4 to 8.8 su with an average value of 8.3 su. There were no *E.coli* samples taken at this site.

There are graphs shown below for DO and water temperature, and for Secchi and total depth. Usually, DO and water temperature display a strong, inverse relationship. The graph for this station does not follow this inverse trend as strongly as the other stations in this report. The graph for Secchi and total depth shows the water to be more turbid toward the end of the sampling at this station.



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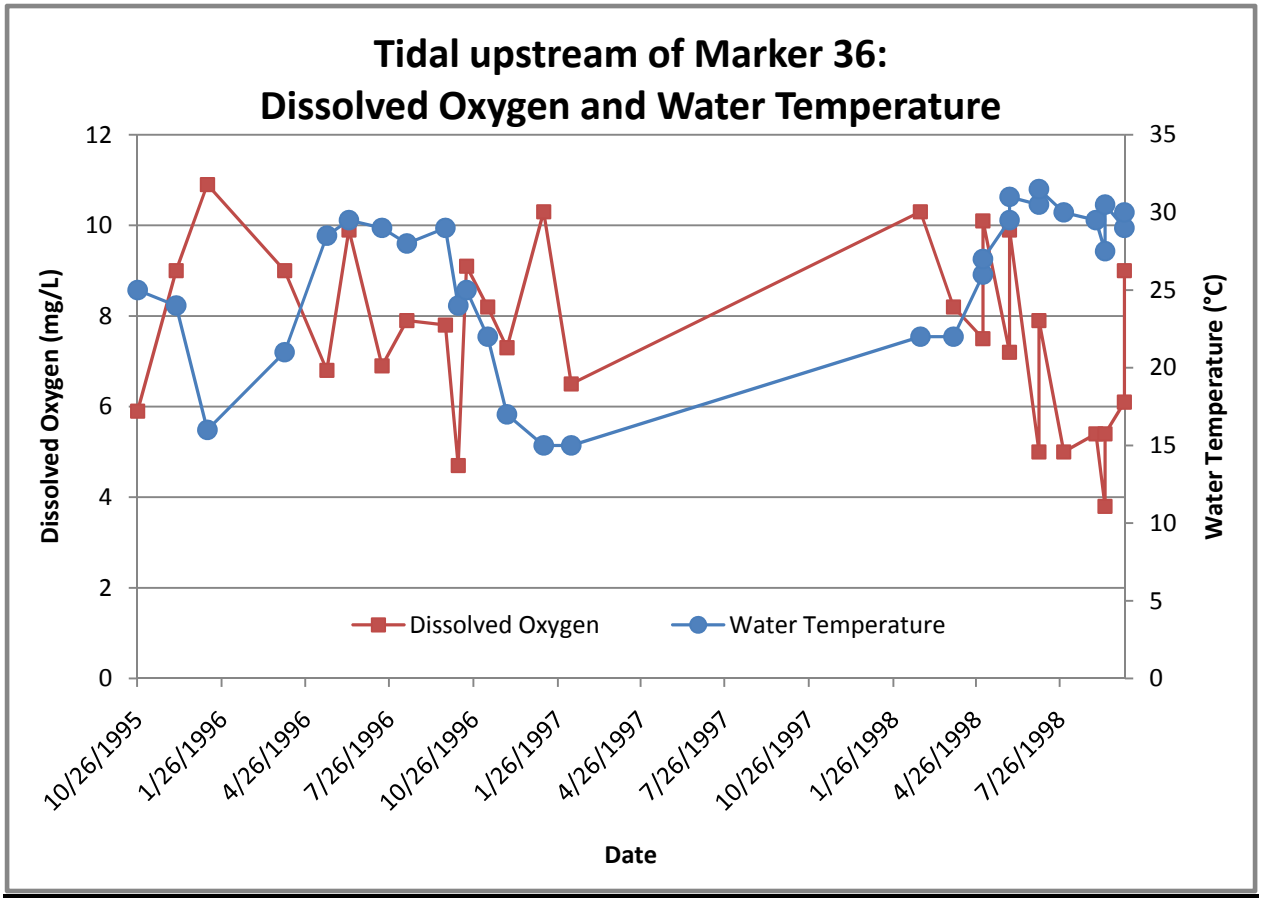
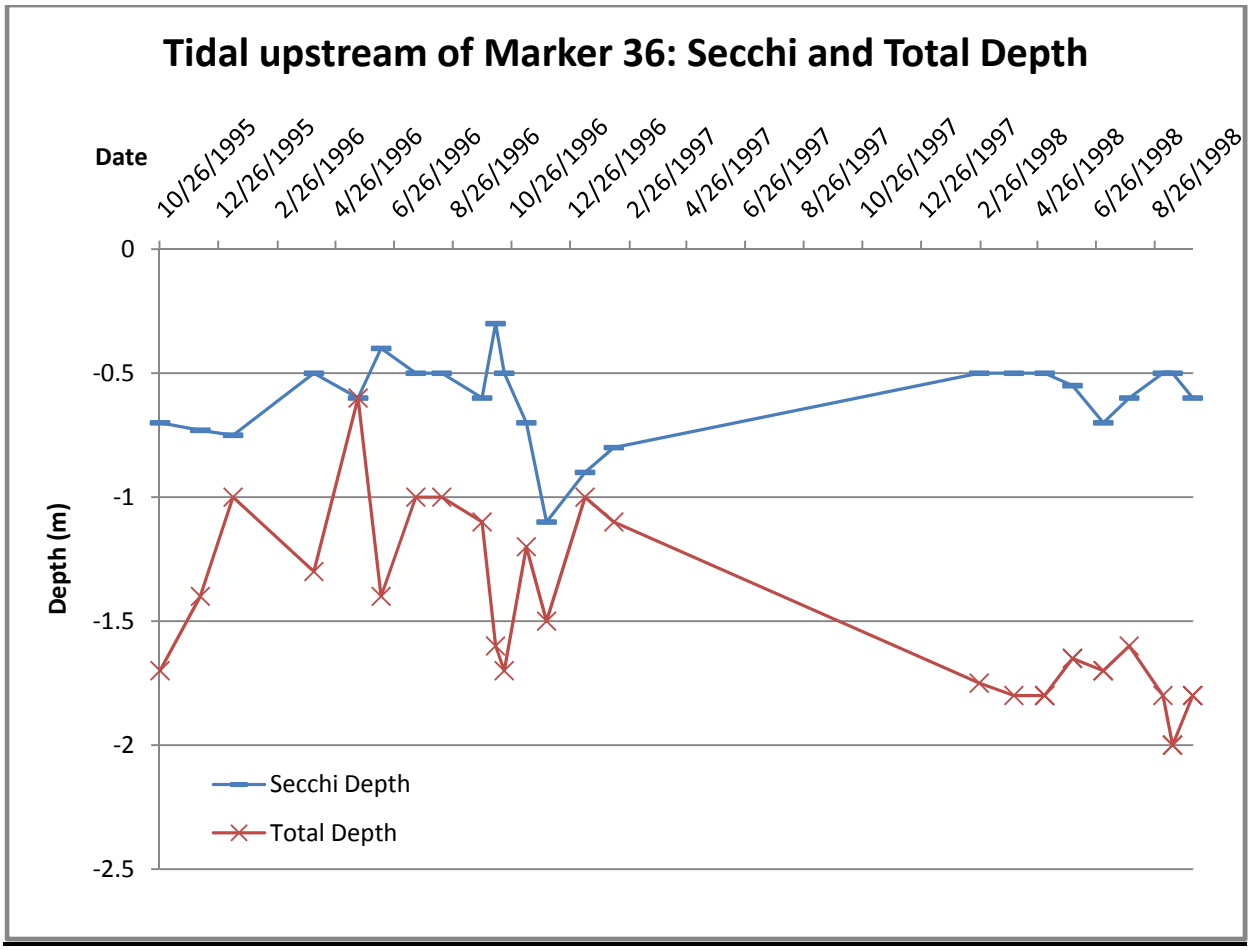
Tidal upstream of Marker 36 (Site # 15794)						
Parameter	**N**	**% complete**	**Min**	**Mean**	**Max**	**Std. Dev.**
Sample Time	29	100	6:40	11:53	18:15	3:19
Total Depth (m)	29	100	0.6	1.5	2	0.4
Secchi Depth (m)	29	100	0.3	0.6	1.1	0.2
Air Temperature (°C)	29	100	14	25.8	33	4.9
Water Temperature (°C)	29	100	15	25.7	31.5	5
Specific Conductivity (µS/cm)	5	17	10300	16720	19900	3917
Dissolved Oxygen (mg/L)	29	0*	3.8	7.6	10.9	2
pH (su)	29	100	7.4	8.3	8.8	0.3
E.coli (cfu/100mL)	0	0				
* dual titrations not complete						
DO exceedance [< 5.0 mg/L]		2 of 29	7%			
E.coli [> 394 cfu/100ml]		NA	NA			

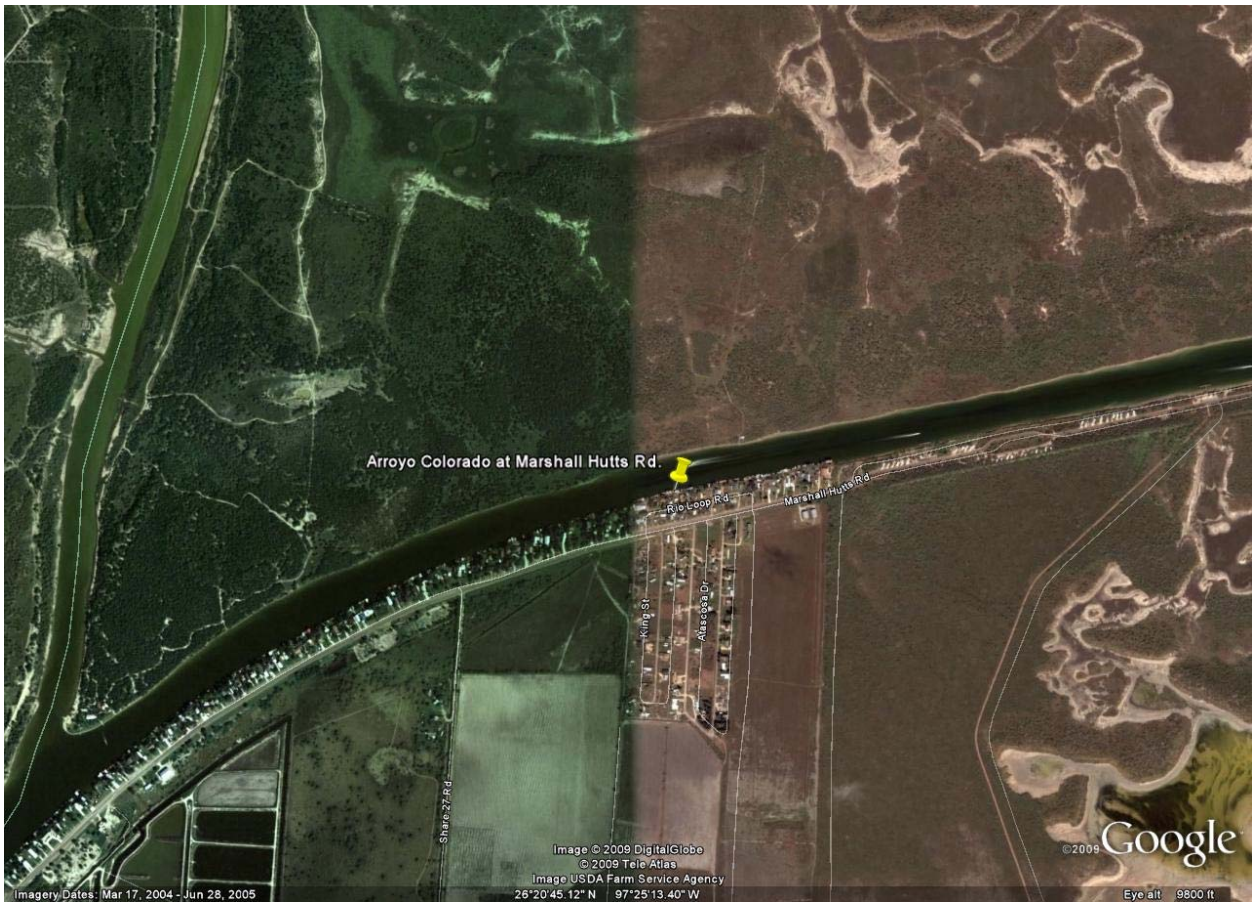



Tidal upstream of Marker 36: Secchi and Total Depth
Date
10/26/1995
12/26/1995
2/26/1996
4/26/1996
6/26/1996
8/26/1996
10/26/1996
12/26/1996
2/26/1997
4/26/1997
6/26/1997
8/26/1997
10/26/1997
12/26/1997
2/26/1998
4/26/1998
6/26/1998
8/26/1998
Depth (m)
0
-0.5
-1
-1.5
-2
-2.5
Secchi Depth
Total Depth

Arroyo Colorado at Marshall Hutts Rd

There were 8 samples taken from the site at Marshall Hutts Rd in TCEQ stream segment 2201 from February 4th, 2008 to October 6th, 2008; this site is the farthest downstream on the Arroyo Colorado main stem in this report. Sampling times ranged from 9:00 am to 11:30 am with the average sampling time occurring at 10:13 am. All sampling was conducted by Rex White. Water temperature readings ranged from 20° C to 29° with an average of 26°. Secchi depth measurements ranged from 0.22 to 0.67 m with an average measurement of 0.51 m. Total depth measurements ranged from 1.2 to 1.79 m with an average measurement of 1.57 m. SC values ranged from 1450 to 17400 µS/cm with an average value of 6934 µS/cm. DO values ranged from 2.5 to 6.25 mg/L with an average value of 4.9 mg/L. Of all DO samples 4 were less than the 5.0 mg/L standard, giving the site a 50% exceedance rate. All of the sites in this report, Marshall Hutts Rd has the lowest maximum and mean value. This comes as no surprise when seeing that the Tidal portion of the Arroyo Colorado is impaired for depressed DO levels. pH values ranged from 7.3 to 7.9 su with an average value of 7.7 su. There were no *E.coli* samples taken at this site.

There are graphs shown below for DO and water temperature, and for Secchi and total depth. Water temperature stays fairly constant, with DO fluctuating only slightly. The lack of change in these two parameters compared with the other sites in this report could be due to the sampling only lasting 9 months from the end of winter until early autumn. When these two parameters are graphed over a couple of years time, the relationship becomes more apparent. In the Secchi and total depth graph, water clarity appears to stay quite constant over sampling events.



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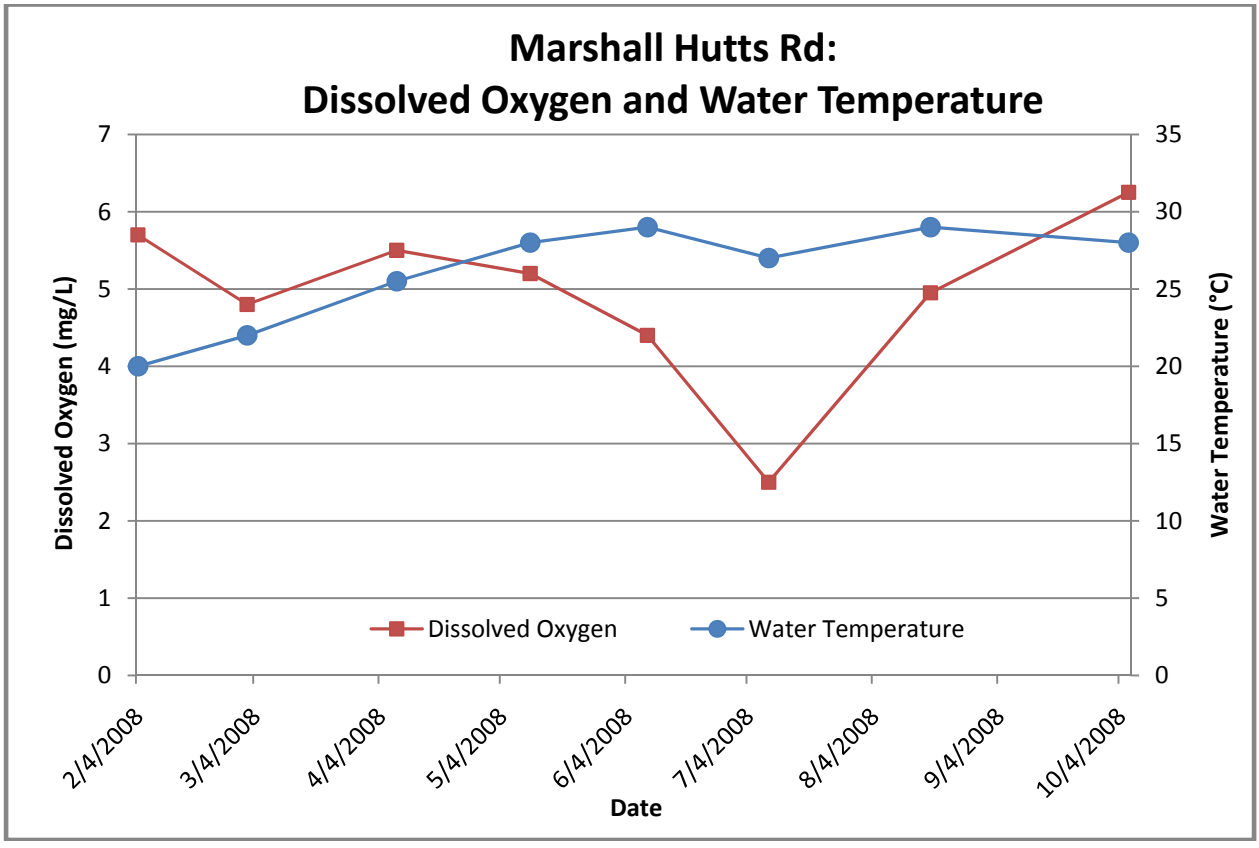
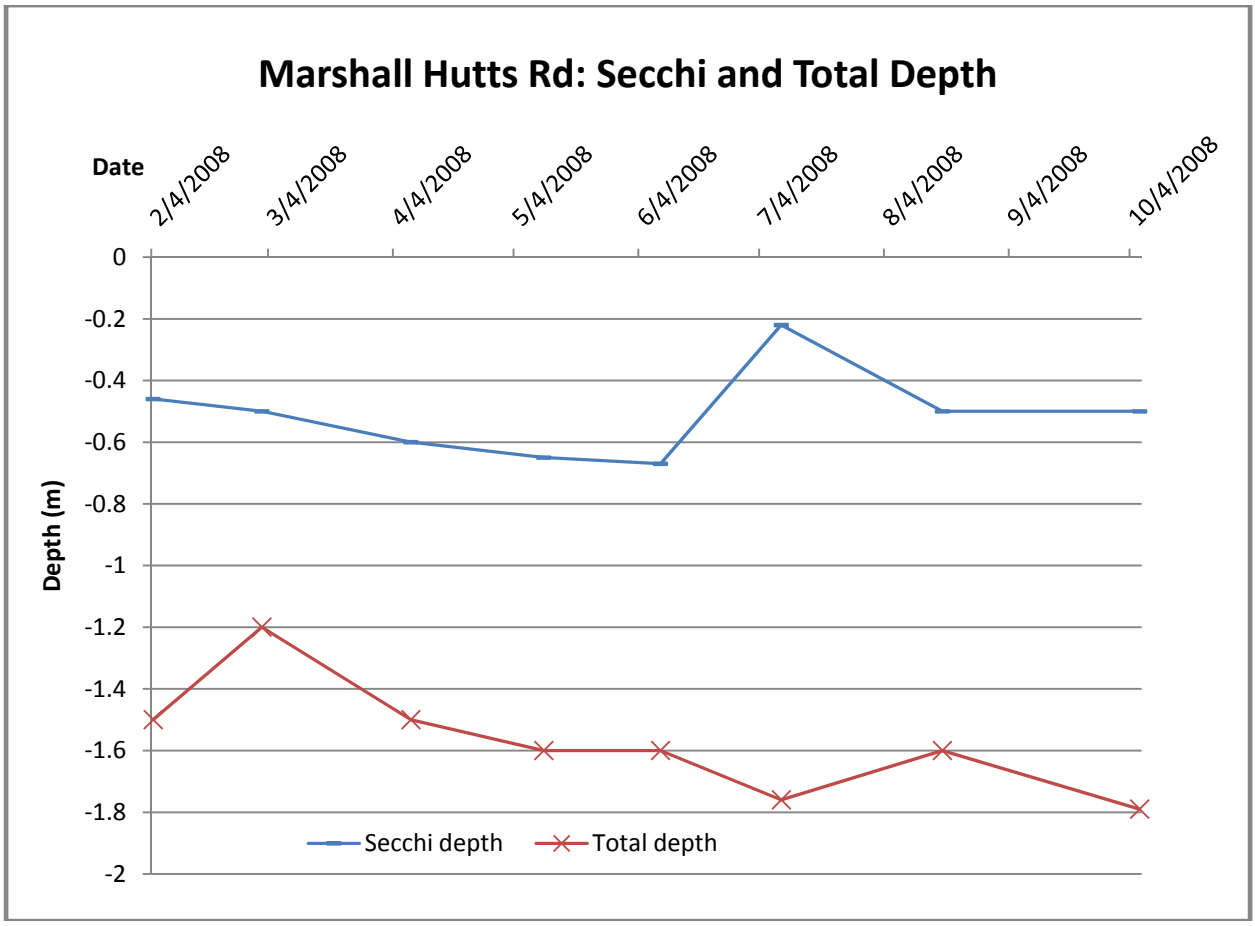
Marshall Hutts Rd (Site # 80468)						
Parameter	**N**	**% complete**	**Min**	**Mean**	**Max**	**Std. Dev.**
Sample Time	8	100	9:00	10:13	11:30	0:58
Total Depth (m)	8	100	1.2	1.57	1.79	0.18
Secchi Depth (m)	8	100	0.22	0.51	0.67	0.14
Air Temperature (°C)	8	100	24	28.4	33	3.1
Water Temperature (°C)	8	100	20	26	29	3.4
Specific Conductivity (µS/cm)	8	100	1450	6934	17400	6207
Dissolved Oxygen (mg/L)	8	100	2.5	4.9	6.25	1.1
pH (su)	8	100	7.3	7.7	7.9	0.2
E.coli (cfu/100mL)	0	0				

DO exceedance [< 5.0 mg/L]	4 of 8	50%
E.coli [> 394 cfu/100ml]	NA	NA




Marshall Hutts Rd: Secchi and Total Depth
Date
2/4/2008
3/4/2008
4/4/2008
5/4/2008
6/4/2008
7/4/2008
8/4/2008
9/4/2008
10/4/2008
Depth (m)
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
Secchi depth
Total depth

OTHER RELATED SITES

There were 48 samples taken at three other sites not in the specific Arroyo Colorado watershed. These sites are of interest due to their proximity to the Arroyo Colorado and the similar land uses surrounding both water bodies.

Donna Canal at FM 1423 and FM 495

There were 19 samples taken from Donna Canal from June 2nd, 2007 to January 31st, 2009. Sampling times ranged from 8:00 am to 6:00 pm with the average sampling time occurring at 12:14 pm. All monitoring was conducted by Sharon Slagle and Richard Ramke. Water temperature readings ranged from 15° C to 32.5° with an average of 24.4°. Secchi depth measurements ranged from 0.2 to 1 m with an average measurement of 0.4 m. Total depth measurements ranged from 1.31 to 3 m with an average measurement of 2.5 m. SC values ranged from 1010 to 6400 µS/cm with an average value of 1533 µS/cm. DO values ranged from 4.6 to 9.6 mg/L with an average value of 6.7 mg/L. Of all DO values, 3 were less than the 5.0 mg/L standard, giving the site a 16% exceedance rate. pH values ranged from 7.7 to 9.1 su with an average value of 8.3 su. The maximum value of 9.1 su is considered to be out of the acceptable range for aquatic life safety. *E.coli* values ranged from 0 to 850 cfu/100mL with an average value of 143 cfu/100mL. Only 1 *E.coli* sample exceeded the 394 cfu/100mL contact recreation standard, giving the site an 8% exceedance rate for this parameter.
There are graphs shown below for DO and water temperature, Secchi and total depth, and *E.coli* and SC. DO and water temperature show an inverse relationship in the winter months and a corresponsive relationship in the summer months. Water clarity tends to stay between a half and quarter-meter until August 30th, 2008 when clarity suddenly increases to 1 meter before returning to the ambient condition. There is a noticeable jump in both SC and *E.coli* on December 6th, 2008. Field observations for that day do not reveal anything out of the ordinary.

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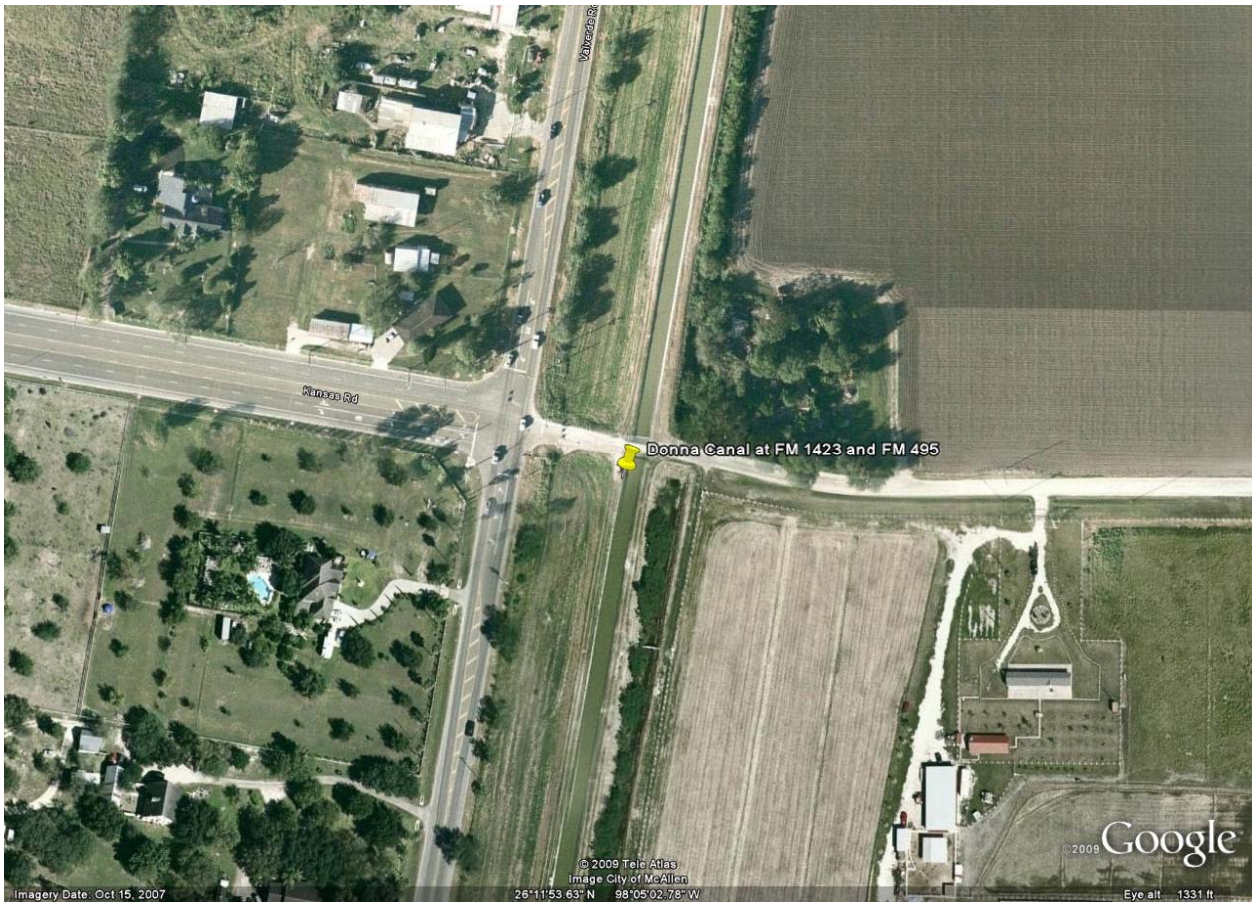
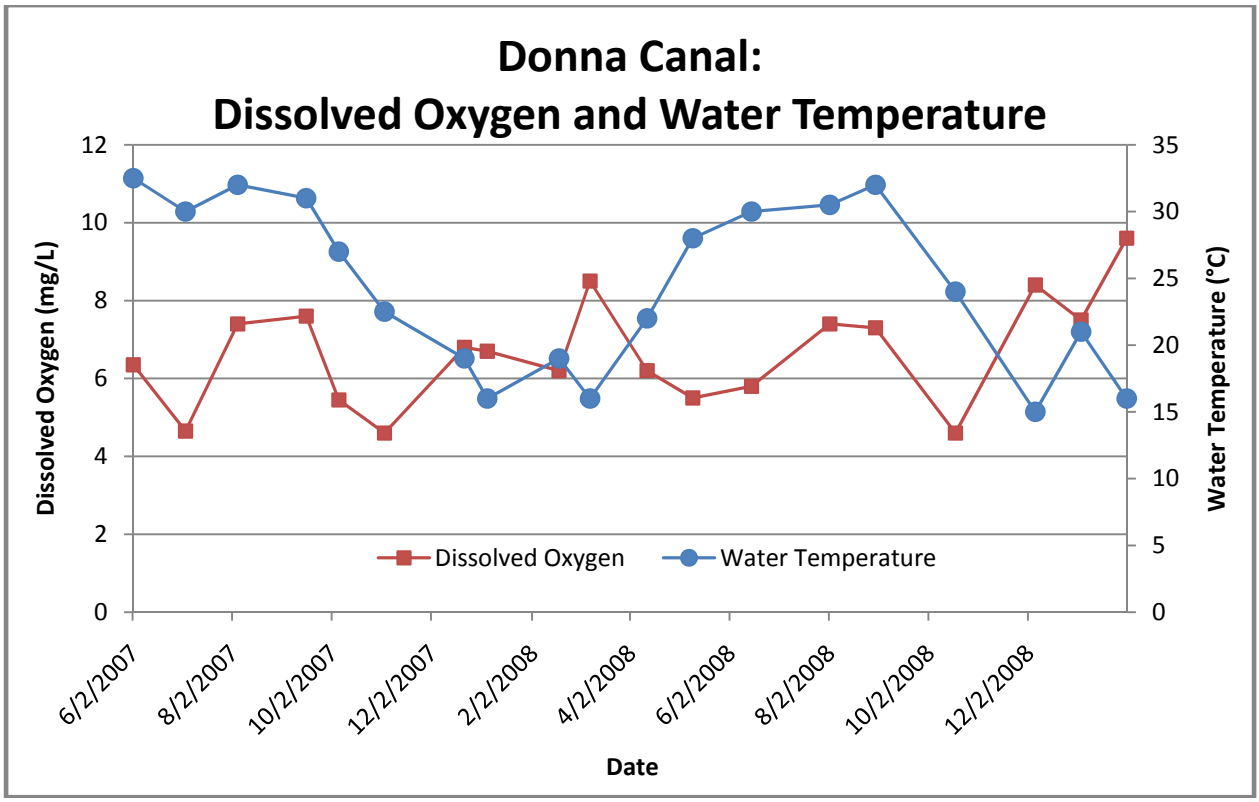
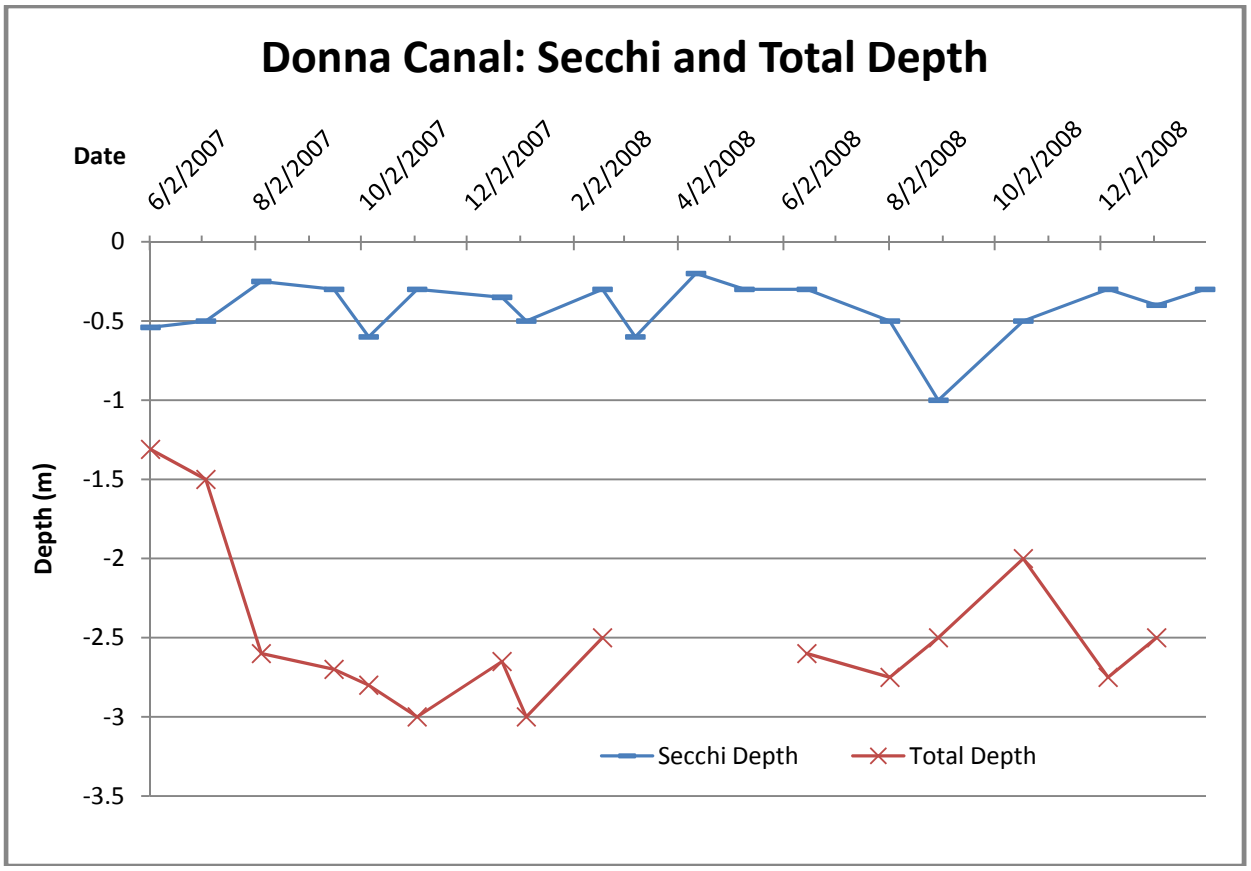
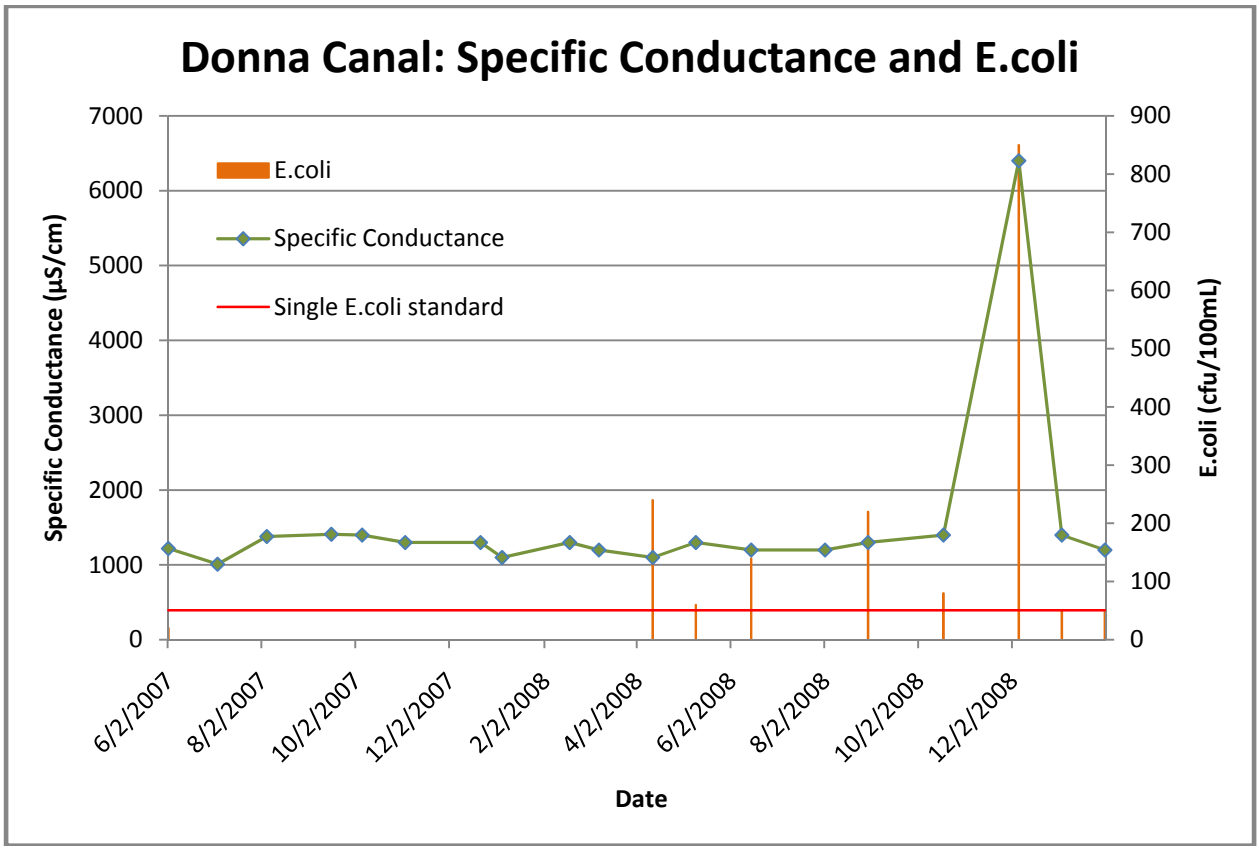


Donna Canal (Site # 80425)						
Parameter	**N**	**% complete**	**Min**	**Mean**	**Max**	**Std. Dev.**
Sample Time	17	89	8:00	12:14	18:00	2:58
Total Depth (m)	15	79	1.31	2.5	3	0.5
Secchi Depth (m)	19	100	0.2	0.4	1	0.2
Air Temperature (°C)	19	100	17	24.8	33.5	5.9
Water Temperature (°C)	19	100	15	24.4	32.5	6.3
Specific Conductivity (µS/cm)	19	100	1010	1533	6400	1184
Dissolved Oxygen (mg/L)	19	100	4.6	6.7	9.6	1.4
pH (su)	18	95	7.7	8.3	9.1	0.3
E.coli (cfu/100mL)	12	63	0	143	850	237

DO exceedance [< 5.0 mg/L]	3 of 19	16%
E.coli [> 394 cfu/100ml]	1 of 12	8%


Donna Canal:
Dissolved Oxygen and Water Temperature
Dissolved Oxygen (mg/L)
Water Temperature (°C)
12
10
8
6
4
2
0
35
30
25
20
15
10
5
0
Dissolved Oxygen
Water Temperature
6/2/2007
8/2/2007
10/2/2007
12/2/2007
2/2/2008
4/2/2008
6/2/2008
8/2/2008
10/2/2008
12/2/2008
Date


Donna Canal: Secchi and Total Depth
Date
6/2/2007
8/2/2007
10/2/2007
12/2/2007
2/2/2008
4/2/2008
6/2/2008
8/2/2008
10/2/2008
12/2/2008
Depth (m)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
Secchi Depth
Total Depth



North Alamo Rd Canal between Canton and Iowa Roads

There were 19 samples taken from the North Alamo Rd Canal from June 2nd, 2007 to January 31st, 2009. Sampling times ranged from 8:00 am to 5:45 pm with the average sampling time occurring at 12:15 pm. All sampling was conducted by Sharon Slagle and Richard Ramke. Water temperature readings ranged from 14° C to 32° with an average of 24°. SC values ranged from 760 to 4200 µS/cm with an average value of 2731 µS/cm. DO values ranged from 4.7 to 9.5 mg/L with an average value of 7.2 mg/L. Of all DO values, only 1 was less than the 5.0 mg/L standard, giving the site a 5% exceedance rate. pH values ranged from 7.8 to 8.4 su with an average value of 8.0 su. *E.coli* values ranged from 100 to 17500 cfu/100mL with an average value of 2343 cfu/100mL. Of all *E.coli* values, 4 samples exceeded the 394 cfu/100mL contact recreation standard, giving the site a 36% exceedance rate.

There are graphs shown below for DO and water temperature, and for *E.coli* and SC. DO and water temperature display a strong inverse relationship in the graph. The relationship between *E.coli* and SC appears weak. The highest *E.coli* value presented in the report can be seen on December 6th, 2008, however a direct correlation with SC is not shown.

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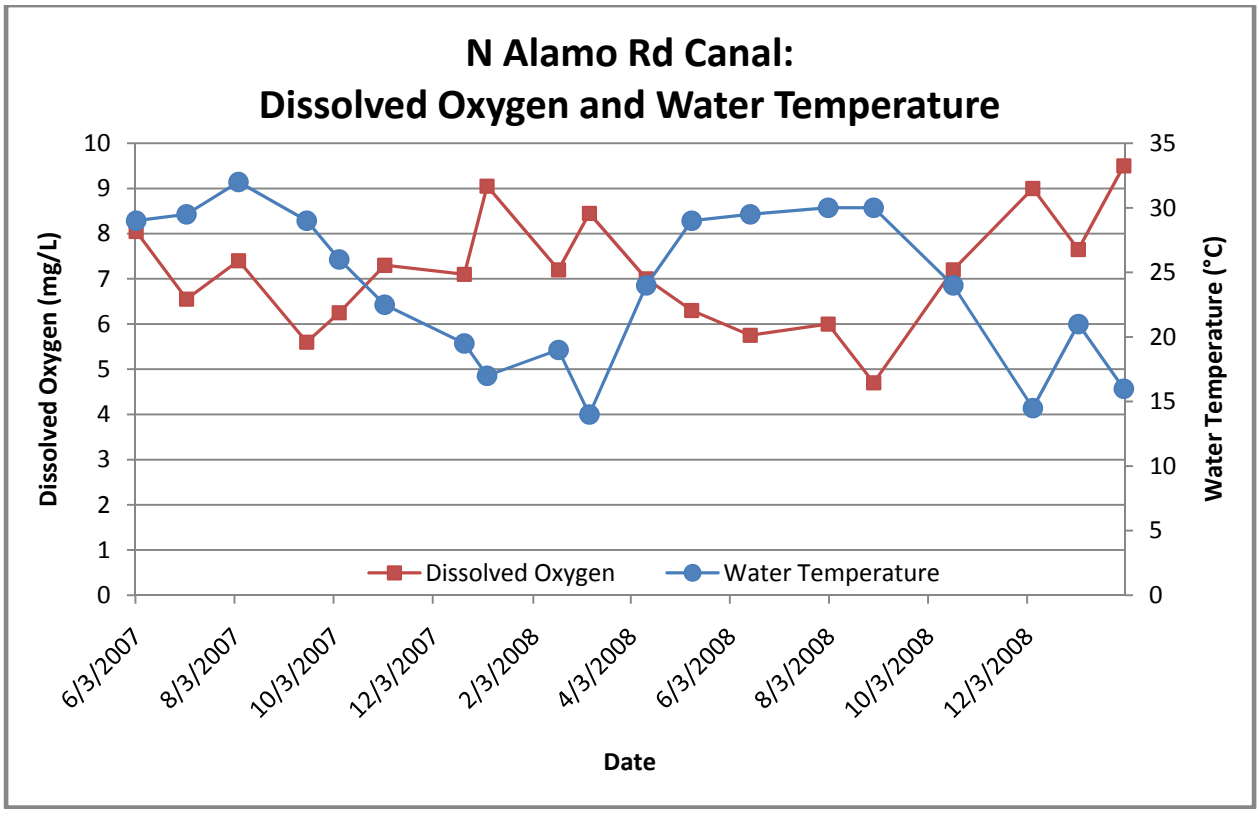
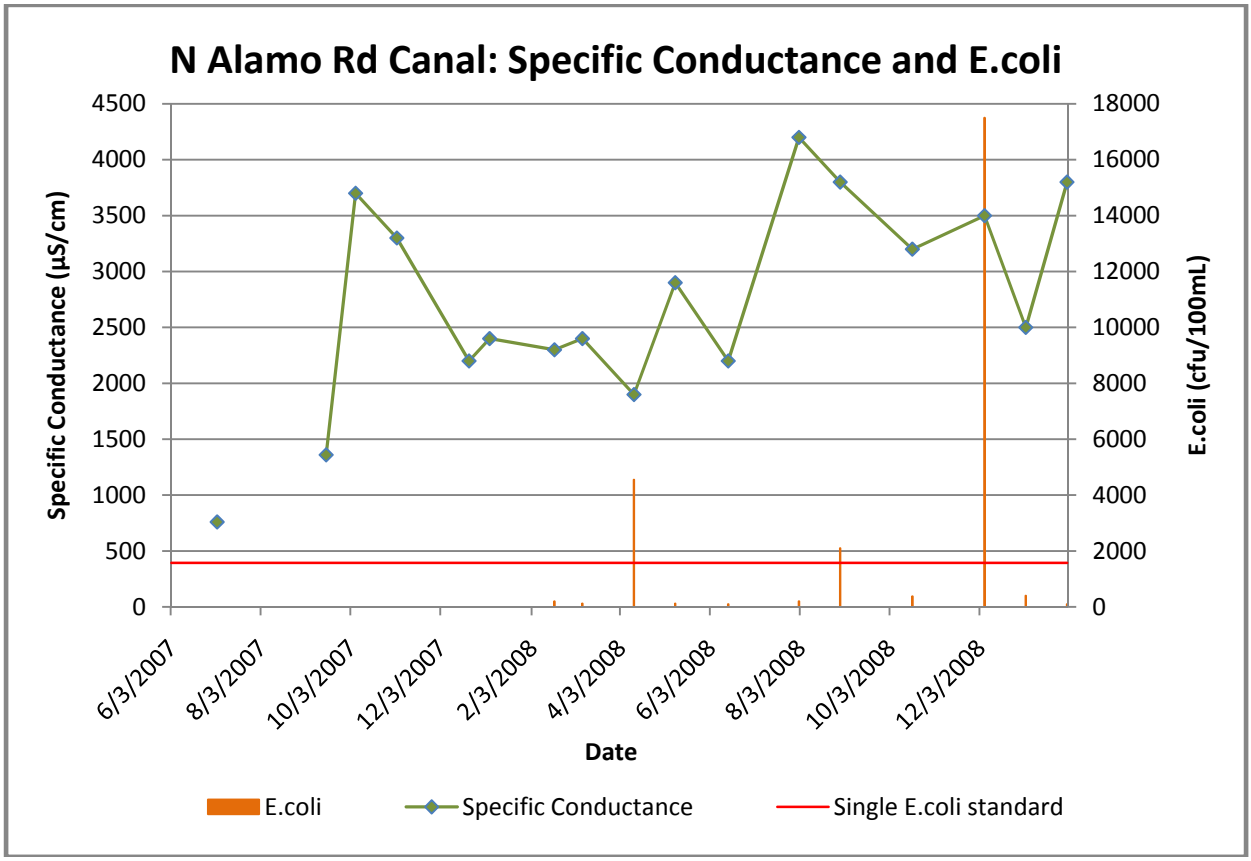
N Alamo Rd Canal between Canton and Iowa Roads
S Alamo Rd
Iowa Rd
Agape Dr
Slaughter Dr
E Canton Rd
Canton Dr
Friendly Dr
Image City of McAllen
© 2009 Tele Atlas
© 2009 Google
Imagery Date: Oct 15, 2007
26°16'15.27" N 98°06'31.78" W
Eye alt 4820 ft


N Alamo Rd Canal:
Dissolved Oxygen and Water Temperature
Dissolved Oxygen (mg/L)
Water Temperature (°C)
Dissolved Oxygen
Water Temperature
Date
6/3/2007
8/3/2007
10/3/2007
12/3/2007
2/3/2008
4/3/2008
6/3/2008
8/3/2008
10/3/2008
12/3/2008


N Alamo Rd Canal: Specific Conductance and E.coli
Specific Conductance (µS/cm)
E.coli (cfu/100mL)
Date
E.coli
Specific Conductance
Single E.coli standard
6/3/2007
8/3/2007
10/3/2007
12/3/2007
2/3/2008
4/3/2008
6/3/2008
8/3/2008
10/3/2008
12/3/2008

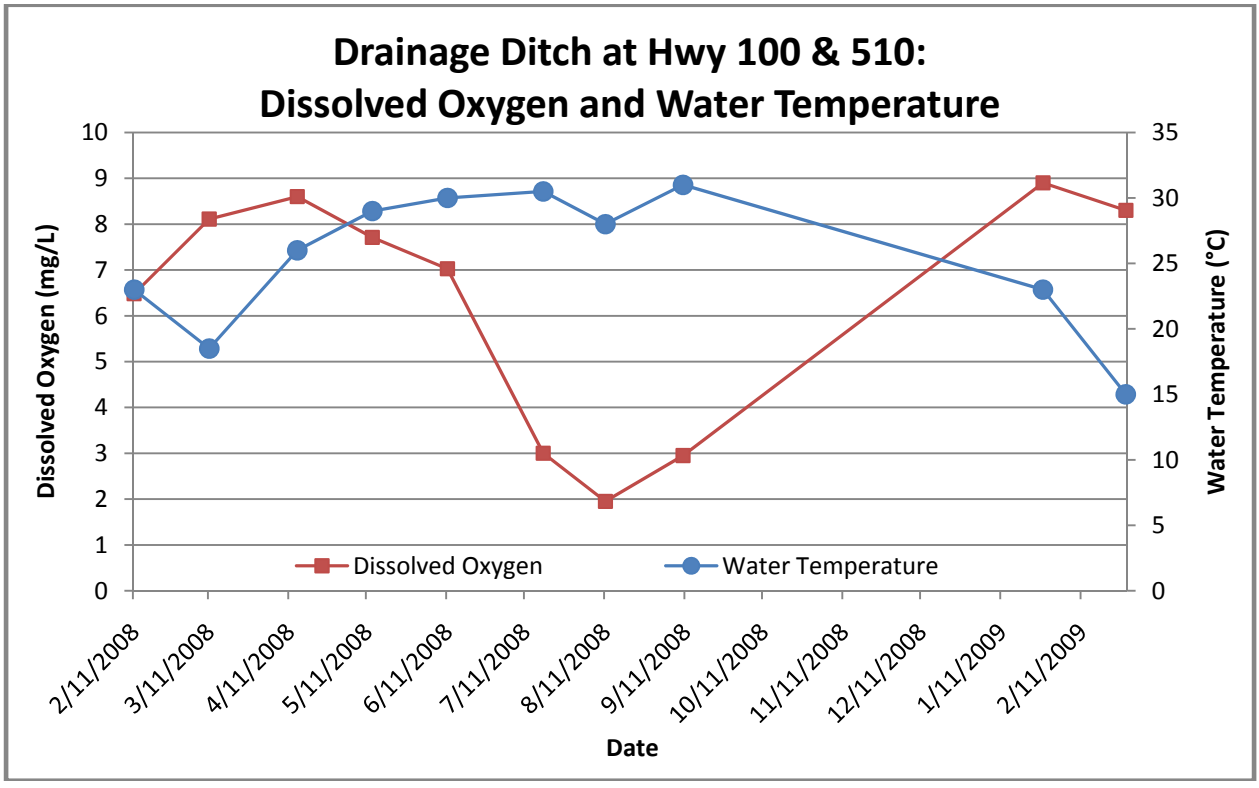
Drainage Ditch at Hwy 100 and 510

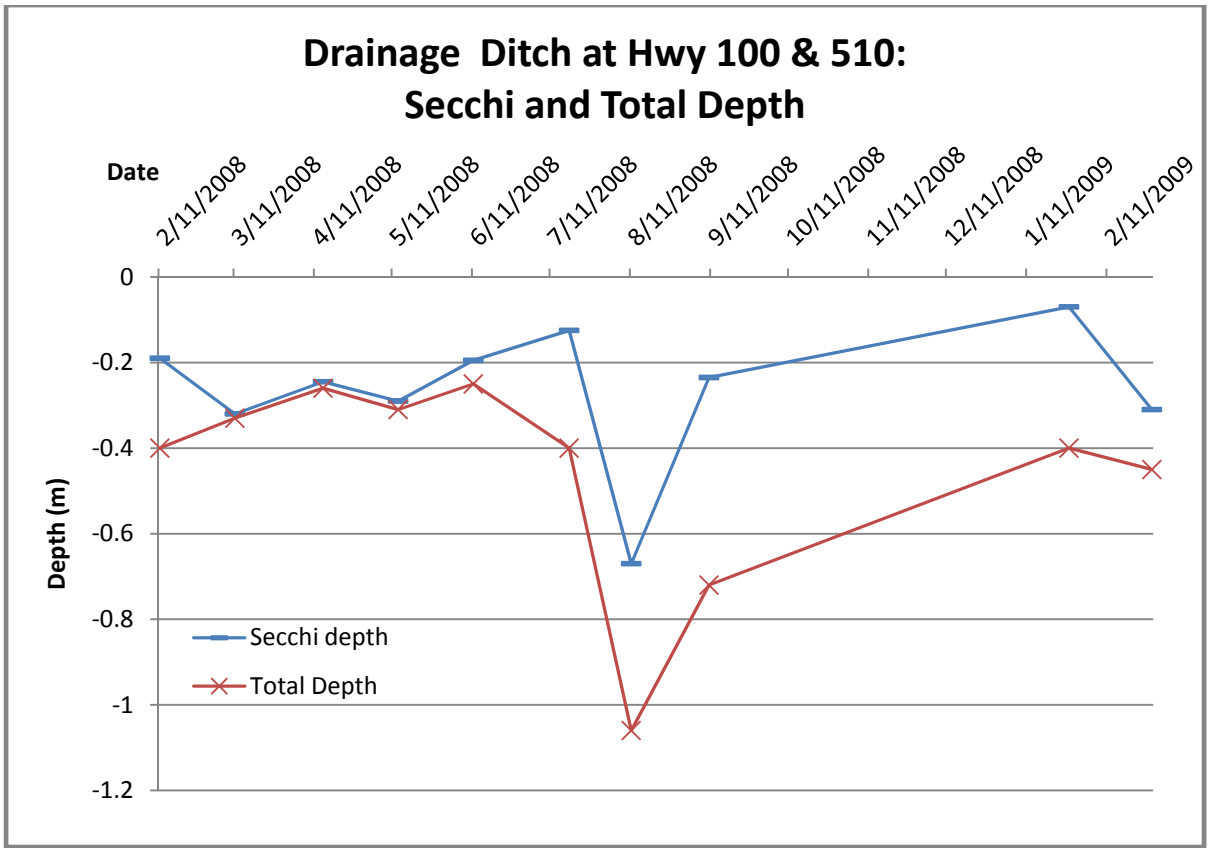
There were 10 samples taken at the Drainage Ditch at Hwy 100 and 510 from February 11th, 2008 to February 28th, 2009. Sampling times ranged from 9:00 am to 2:30 pm with the average sampling time occurring at 11:45 am. All sampling was conducted by John Gray. Water temperature readings ranged from 15° C to 31° with an average of 25.4°. Secchi depth measurements ranged from 0.07 to 0.67 m with an average measurement of 0.27 m. Total depth measurements ranged from 0.25 to 1.06 m with an average measurement of 0.46 m. SC values ranged from 710 to 5900 µS/cm with an average value of 3103 µS/cm. DO values ranged from 1.95 to 8.9 mg/L with an average value of 6.3 mg/L. Of all DO values, 3 were less than the 5.0 mg/L standard, giving the site a 30% exceedance rate. The minimum value of 1.95 mg/L is the lowest value presented in this data set. Field comments indicate that the ditch water was residual from Hurricane Dolly for that sampling event on August 11th, 2008. pH values ranged from 8 to 8.5 su with an average of 8.2 su. There were no *E.coli* samples taken at this site.

Graphs are shown below for DO and water temperature, and Secchi and total depth. It can be observed from the graphs that DO was at the lowest level and total depth was at the greatest level on August 11th, 2008 as a result of Hurricane Dolly flood water. DO values register 3.0 mg/L and lower for the sampling events preceding and following this August 11th monitoring event. Total depth measurements stay between 0.4 and 0.2 m before Hurricane Dolly.

DRAFT

Drainage Ditch at HWY 100 & 510 (Site # 80482)						
Parameter	**N**	**% complete**	**Min**	**Mean**	**Max**	**Std. Dev.**
Sample Time	10	100	9:00	11:45	14:30	1:38
Total Depth (m)	10	100	0.25	0.46	1.06	0.25
Secchi Depth (m)	10	100	0.07	0.27	0.67	0.16
Air Temperature (°C)	10	100	12	27.7	34.5	7.1
Water Temperature (°C)	10	100	15	25.4	31	5.4
Specific Conductivity (µS/cm)	3	30	710	3103	5900	2618
Dissolved Oxygen (mg/L)	10	100	1.95	6.3	8.9	2.6
pH (su)	10	100	8	8.2	8.5	0.2
E.coli (cfu/100mL)	0	0				
DO exceedance [< 5.0 mg/L]		3 of 10	30%			
E.coli [> 394 cfu/100ml]		NA	NA			





CONCLUSIONS

The overall amount of data collected in this area has increased greatly in the past couple of years. Prior to June 2007, Texas Stream Team only had one monitoring station in the Arroyo Colorado basin region. While one station has been left derelict since efforts began, there are now seven monitoring stations with recent sampling. The increase in monitoring activity is definitely a necessary step toward increasing watershed awareness and achieving desirable water quality conditions. Sharon Slagle, who along with Richard Ramke conduct monitoring on four of the sites presented in this report, stated that it is a well known fact in the area that oil and septic trucks regularly are seen dumping into the Arroyo Colorado and other canals in the area. She believes this to be a misconception by the polluters that it is acceptable to dump into the waterways. The intentional lack of vegetation to assist the conveyance of floodwaters and the absence of signage leads some people to think of the Arroyo Colorado as a mere ditch. This behavior of dumping undoubtedly contributes to high bacteria levels and other pollutants as well.

The two highest *E.coli* exceedance rates were at FM 493 (89%) and the S Alamo Floodway site (63%), the two most upstream sites in segment 2202 on the Arroyo Colorado main stem. These high bacteria levels support the TCEQ's 303 (d) listing for impairment for bacteria since 1996. With the accounts of septic trucks dumping into the waterways, this comes as little of a surprise. The highest value (17500 cfu/100mL) was recorded at the N Alamo Rd Canal and the second highest (6900 cfu/100mL) was recorded at the site with the highest exceedance rate, "Arroyo Colorado at S Alamo Floodway." Field observations tell of foamy, sudsy water that day at the N Alamo Rd Canal site. The two highest *E.coli* values in the dataset were recorded on the same day, December 6th, 2008. The highest *E.coli* value at the Donna Canal site (850 cfu/100mL) was also recorded on the December 6th monitoring event. The amount of wastewater present in the Arroyo Colorado, coupled with the lack of riparian vegetation, certainly exacerbates the amount of bacteria present in the water body. As run-off picks up sediment, there is no filtration before the water hits the stream. This sediment provides a favorable environment for the bacteria to thrive.

The two highest DO exceedance rates were at Marshall Hutts Rd (50%) and the Drainage Ditch south of the Arroyo Colorado (30%). Both of these sites are in tidally influenced portions of the water where aeration is minimal. The lowest DO value presented in this report (1.95 mg/L) was observed after Hurricane Dolly at the Drainage Ditch. These low DO levels support the TCEQ's 303 (d) listing for impairment for depressed DO in the tidal portion. The lowest DO value on the Arroyo Colorado main stem of 2.5 mg/L was observed at Marshall Hutts Rd in the tidal portion. This site also has the lowest mean DO value in the report of 4.9 mg/L, less than the 5.0 mg/L aquatic life use standard.

The volunteer collected Texas Stream Team data presented in this report generally supports the TCEQ's 303 (d) listings for bacteria in segment 2202 and depressed DO in segment 2201. After understanding the behavior being exhibited in the watershed from accounts of septic and oil trucks dumping directly into the water ways, and the amount of wastewater effluent in the Arroyo Colorado, it is not surprising to see impairment for bacteria.