Nueces River Authority

# 2013 BASIN SUMMARY REPORT

## San Antonio-Nueces Coastal Basin

## Nueces River Basin

## Nueces-Rio Grande Coastal Basin

This document was prepared in cooperation with the
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# EXECUTIVE SUMMARY

In 1991, the Texas Legislature passed the Texas Clean Rivers Act (Senate Bill 818) requiring basin-wide water quality assessments to be conducted for each river basin in Texas. Under this act, the Clean Rivers Program (CRP) developed an effective partnership involving the Texas Commission on Environmental Quality (TCEQ), other state agencies, river authorities, local governments, industry, and citizens. CRP was originally funded by dedicated fees paid by municipal and industrial dischargers and water rights holders. These fees are now combined with other fees collected by TCEQ. This larger pool of money funds a number of different water programs administered by TCEQ.

Using a watershed management approach, the Nueces River Authority (NRA) and TCEQ work together to identify and evaluate surface water quality issues and to establish priorities for corrective action. Under CRP, NRA is responsible for the San Antonio – Nueces Coastal Basin, the Nueces River Basin, the Nueces – Rio Grande Coastal Basin, and the adjacent bays and estuaries, an area roughly 30,500 square miles, ranging from the hill country in Edwards County to San Antonio Bay in Refugio County to the Brownsville Ship Channel in Cameron County.

Sixteen CRP partners collect data from over 1,800 water monitoring sites throughout the state. Data are used in the development of Texas Surface Water Quality Standards, for modeling water quality trends, providing baseline data for water quality projects, and to help establish wastewater permit limits. Steering Committees, made up of fee payers, elected officials, and the public, are created to help guide CRP efforts by providing input on local water quality concerns.

The long term goals of the CRP are to:

- Provide quality assured data to TCEQ for use in water quality decision-making
- Identify and evaluate water quality issues
- Promote cooperative watershed planning
- Inform and engage stakeholders
- Maintain efficient use of public funds
- Adapt to emerging water quality issues

To accomplish the goals set forth by the CRP, funding is allocated on a biennial cycle to CRP partners. During this reporting period, CRP partners including NRA, TCEQ Region 13 (San Antonio), Region 14 (Corpus Christi), Region 15 (Harlingen), and Region 16 (Laredo) provided water quality data for this report. Additional water quality data was gathered through projects and monitoring done by the Texas Institute for Applied Environmental Research (TIAER), Texas State Soil and Water Conservation Board (TSSWCB), and United States Geological Survey (USGS).

The water quality data are compiled from the Surface Water Quality Monitoring Information System (SWQMIS) database. The *Texas Integrated Report (IR) of Surface Water Quality* is prepared and submitted to the U.S. Environmental Protection Agency (EPA) every two years in even numbered years, as required by law. This report satisfies the requirements of the federal Clean Water Act Sections 305(b) and 303(d). The 303(d) List of impaired water bodies must be approved by EPA before it becomes final.

The 2012 Texas 303(d) List was approved for submission by TCEQ on February 13, 2013. It was submitted to EPA on February 21, 2013 and approved on May 9, 2013.

## Significant Findings

The water quality analysis for this report reviewed 12 parameters for assessment units (AU) on 54 segments in the San Antonio – Nueces Coastal Basin, the Nueces River Basin, the Nueces – Rio Grande Coastal Basin, and the adjacent bays and estuaries.

The following lists summarize the findings for each segment. More detailed information is found in the individual segment write-ups beginning on Page 10. The criteria used to designate a concern or impairment is found in the Water Quality Analysis – Terminology and Methodology Section beginning on Page 2.

## San Antonio – Nueces Coastal Basin

**Segment 2001 – Mission River Tidal**
Impairments: bacteria

**Segment 2002 – Mission River Above Tidal**
Concerns: bacteria

**Segment 2003 – Aransas River Tidal**
Impairments: bacteria

**Segment 2004 – Aransas River Above Tidal**
Concerns: low dissolved oxygen (DO), bacteria, nitrates, total phosphorus

**Segment 2004A – Aransas Creek**
Concerns: low DO
Impairments: bacteria

**Segment 2004B – Poesta Creek**
Concerns: low DO, bacteria

## Nueces River Basin

**Segment 2101 – Nueces River Tidal**
Concerns: chlorophyll-*a*

**Segment 2102 – Nueces River Below Lake Corpus Christi**
Concerns: chlorophyll-*a*
Impairments: total dissolved solids (TDS)

**Segment 2103 – Lake Corpus Christi**
Concerns: chlorophyll-*a*, total phosphorus
Impairments: TDS

**Segment 2104 – Nueces River Above Frio River**
Concerns: low DO, impaired fish community, impaired macrobenthic community

**Segment 2105 – Nueces River Above Holland Dam**
Concerns: low DO, chlorophyll-*a*
Impairments: low DO

**Segment 2106 – Nueces River / Lower Frio River**
Impairments: TDS

**Segment 2107 – Atascosa River**
Concerns: low DO, chlorophyll-*a,* impaired habitat
Impairments: low DO, bacteria, impaired macrobenthic community, impaired fish community

**Segment 2108 – San Miguel River**
Impairments: bacteria

**Segment 2109 – Leona River**
Concerns: nitrates
Impairments: bacteria

**Segment 2110 – Lower Sabinal River**
Impairments: nitrates

**Segment 2111 – Upper Sabinal River**
No concerns or impairments

**Segment 2112 – Upper Nueces River**
No concerns or impairments

**Segment 2113 – Upper Frio River**
Concerns: impaired habitat, impaired fish community
Impairments: impaired macrobenthic community, impaired fish community

**Segment 2114 – Hondo Creek**
Concerns: nitrates
Impairments: chloride

**Segment 2115 – Seco Creek**
No concerns or impairments

**Segment 2116 – Choke Canyon Reservoir**
Concerns: chlorophyll-*a*

**Segment 2117 – Frio River Above Choke Canyon Reservoir**
Concerns: low DO, bacteria, nitrates
Impairments: bacteria

## Nueces – Rio Grande Coastal Basin

**Segment 2201 – Arroyo Colorado Tidal**
Concerns: low DO, bacteria, chlorophyll-*a,* nitrates
Impairments: low DO, bacteria, Dichlorodiphenylethylene (DDE) in edible tissue, mercury in edible tissue, Polychorinated byphenyls (PCBs) in edible tissue

**Segment 2201A – Harding Ranch Drainage Ditch Tributary**
Concerns: ammonia

**Segment 2201B – Unnamed Drainage Ditch Tributary In Cameron County Drainage District #3**
Concerns: chlorophyll-*a,* nitrates
Impairments: bacteria

**Segment 2202 – Arroyo Colorado Above Tidal**
Concerns: chlorophyll-*a,* nitrates, total phosphorus
Impairments: bacteria, DDE in edible tissue, mercury in edible tissue, PCBs in edible tissue

**Segment 2202A – Donna Reservoir**
Impairments: PCBs in edible fish

**Segment 2202B – Unnamed Drainage Ditch Tributary**
Concerns: bacteria, ammonia, chlorophyll-*a*

**Segment 2202C – Unnamed Drainage Ditch Tributary**
Concerns: bacteria, ammonia

**Segment 2203 – Petronila Creek Tidal**
Concerns: chlorophyll-*a*
Impairments: bacteria

**Segment 2204 – Petronila Creek Above Tidal**
Concerns: chlorophyll-*a*
Impairments: chloride, sulfate, TDS

## Bays and Estuaries

**Segment 2462 - San Antonio Bay / Hynes Bay**
Concerns: chlorophyll-*a*
Impairments: bacteria in oyster waters

**Segment 2463 - Mesquite Bay**
No concerns or impairments

**Segment 2471 - Aransas Bay**
Impairments: bacteria at recreational beaches

**Segment 2471A - Little Bay**
Concerns: chlorophyll-*a*

**Segment 2472 - Copano Bay**
Impairments: bacteria in oyster waters

**Segment 2473 – St. Charles Bay**
Concerns: low DO

**Segment 2481 – Corpus Christi Bay**
Concerns: bacteria at recreational beaches
Impairments: bacteria at recreational beaches

**Segment 2482 – Nueces Bay**
Impairments: zinc in edible tissue

**Segment 2483 – Redfish Bay**
Impairments: bacteria in oyster waters

**Segment 2483A – Conn Brown Harbor**
Concerns: copper in water
Impairments: copper in water

**Segment 2484 – Corpus Christi Inner Harbor**
Concerns: ammonia, chlorophyll-*a*. nitrates

**Segment 2485 – Oso Bay**
Concerns: low DO, chlorophyll-*a*, total phosphorus
Impairments: low DO, bacteria in oyster waters

**Segment 2485A – Oso Creek**
Concerns: low DO, chlorophyll-*a*, nitrates, total phosphorus
Impairments: bacteria

**Segment 2485B – Unnamed Tributary**
Concerns: total phosphorus

**Segment 2485D – West Oso Creek**
Concerns: total phosphorus

**Segment 2491 – Laguna Madre**
Concerns: low DO, chlorophyll-*a,* nitrates
Impairments: low DO, bacteria, bacteria in oyster waters

**Segment 2492 – Baffin Bay / Alazan Bay / Cayo Del Grullo / Laguna Salada**
Concerns: chlorophyll-*a*

**Segment 2492A – San Fernando Creek**
Concerns: chlorophyll-*a,* nitrates, total phosphorus
Impairments: bacteria

**Segment 2493 – South Bay**
No concerns or impairments

**Segment 2494 – Brownsville Ship Channel**
Concerns: low DO
Impairments: bacteria

**Segment 2494A – Port Isabel Fishing Harbor**
Impairments: bacteria

**Segment 2501 – Gulf of Mexico**
Impairments: mercury in edible tissue

## List of Acronyms

| | |
|---|---|
| ACWP | Arroyo Colorado Watershed Partnership |
| ALUAA | Aquatic Live Use Attainability Analysis |
| AU | Assessment Unit |
| BMP | Best Management Practice |
| CM | Channel Marker |
| CN | Use Concern |
| CR | County Road |
| CRP | Clean Rivers Program |
| CS | Screening Level Concern |
| DDE | Dichlorodiphenylethylene |
| DO | Dissolved Oxygen |
| DOJ | Department of Justice |
| DSHS | Department of State Health Services |
| EPA | Environmental Protection Agency |
| FM | Farm-to-Market |
| FS | Fully Supporting |
| FY | Fiscal Year |
| GIS | Geographic Information System |
| I-Plan | Implementation Plan |
| ICWW | Intracoastal Waterway |
| IR | Integrated Report |
| LP | Limited Partnership |
| LOQ | Limit of Quantitation |
| MUD | Municipal Utility District |
| NA | Not Applicable |
| NAS | Naval Air Station |
| NC | No Concern |
| ND | Non-Detect |
| NELAC | National Environmental Laboratory Accreditation Conference |
| NRA | Nueces River Authority |
| NS | Non-Supporting |
| OSSF | On-Site Sewager Facility |
| PCBs | Polychorinated byphenyls |
| RRC | Railroad Commission |
| RUAA | Recreational Use Attainability Analysis |
| SB | Senate Bill |
| SH | State Highway |
| SWQM | Surface Water Quality Monitoring |
| SWQMIS | Surface Water Quality Monitoring Information System |
| TAMUCC | Texas A&M University – Corpus Christi |
| TCEQ | Texas Commission on Environmental Quality |
| TDS | Total Dissolved Solids |
| TIAER | Texas Institute for Applied Environmental Research |
| TMDL | Total Maximum Daily Load |
| TPWD | Texas Parks and Wildlife Department |
| TSSWCB | Texas State Soil and Water Conservation Board |
| TWRI | Texas Water Resources Institute |
| TxDOT | Texas Department of Transportation |
| USGS | United States Geological Survey |
| WCID | Water Control and Improvement District |
| WPP | Watershed Protection Plan |
| WSC | Water Supply Corporation |
| WTP | Water Treatment Plan |
| WWTF | Wastewater Treatment Facility |

**Unit Abbreviations**

| | |
|---|---|
| °C | Degrees Celsius |
| AF | Acre-Feet |
| cfs | Cubic Feet per Second |
| cfu | Colony Forming Units |
| gpd | Gallons Per Day |
| Hr | Hour |
| km | Kilometers |
| m | Meters |
| mg/l | Milligrams Per Liter |
| ml | Milliliters |
| MSL | Mean Sea Level |
| NTU | Nephelometric Turbidity Unit |
| su | Standard Units |
| µg/l | Micrograms Per Liter |

# PUBLIC INVOLVEMENT

NRA participates in many CRP related activities that are intended to increase awareness of the value and function of our water resources. The following paragraphs describe activities and functions that NRA coordinates and/or participates in this effort.

## CRP Steering Committee

NRA's CRP Steering Committee is composed of individuals representing a wide variety of interests including: landowners, federal, state and local government agencies, farmers, ranchers and the general public. The diversity of the Steering Committee Members helps to ensure that varying interests, concerns, and priorities are represented.

Steering Committee Members are vital in providing input on projects and programs. Meetings are held on an annual basis. Generally, one meeting is held in the lower portion of the Nueces River watershed and a second meeting takes place in the middle or upper basin. Although no boundary has been officially identified between the lower, middle, and upper basins, Steering Committee Members are welcome at all meetings to discuss issues or concerns that have impact in the watershed.

## Stakeholder Meetings

NRA is also involved in a number of CRP related projects including Total Maximum Daily Load (TMDL) and Recreational Use Attainability Analysis (RUAA) studies and the development of Watershed Protection Plans (WPP). NRA coordinates and or attends as many of these stakeholder meetings as possible.

## Outreach and Education

NRA's Education and Outreach Program is dedicated to preserving and protecting the natural resources and function of river systems through public awareness activities and environmental education and outreach. NRA has multiple environmental education tools including the custom made topographic watershed model, a rainfall runoff model, and a water collection model. NRA utilizes these tools at education events such as Earth Day Bay Day, World of Water Day, agriculture fairs, science fairs, education fairs and through numerous scheduled events at dozens of schools and functions throughout NRA's jurisdiction. These tools provide a way for the community to visualize how pollution occurs and offers ways to protect our natural resources.

# WATER QUALITY ANALYSIS – TERMINOLOGY AND METHODOLOGY

For this Basin Summary Report, each segment within the San Antonio – Nueces Coastal Basin, Nueces River Basin, Nueces – Rio Grande Coastal Basin, and the adjacent Bays and Estuaries is discussed in detail. For each segment, there is:

- a description of the segment;
- a land use / land cover map of the watershed which includes the location of all sampling sites used in the 2012 IR;
- a table containing the drainage area, aquifers, cities, counties, ecoregions, climate, uses, and wastewater treatment facility (WWTF) information for the watershed;
- references to any special studies that have been done within the watershed;
- descriptions of the stations used in the water quality analysis;
- a summary of the concerns and impairments for the segment;
- a description of the watershed;
- results of the water quality analysis (see below for the parameter list);
- graphs of concern, impairments, and trends along with possible explanations; and
- summaries of the 2012 IR findings for the fish consumption use, public water supply use, oyster waters use, and recreational beaches, where applicable.

The 2012 IR assesses all SWQMIS data for a 7-year period. Assessments are done every two years. In most cases, a minimum of 10 samples is required to conduct the assessment. In some cases, the 10 samples are obtained by using a slightly longer period of time. The 2012 Assessment included data from December 1, 2003 through November 30, 2010.

The water quality analysis for this report includes analysis of available data for a representative station on the segment. The most downstream station of each AU, when appropriate, was used. Pictures of the sampling sites are included where available. Data from multiple stations were used when needed. Therefore, the number of samples, number of exceedances, means, and averages do not necessarily match the 2012 IR, but the analysis, in all but a few instances, resulted in the same findings as the 2012 IR. For those few instances, the differences are explained. The watershed maps display the locations of all the stations from which data were used for the 2012 IR.

Trend analysis was conducted on available data from January 1, 2000 through December 31, 2011. In most cases, the analysis was only conducted when there was at least 9 years of data, without significant gaps, and at least 19 data records. Significant trends (t-ratio => |2| and p-value <0.1) are plotted and possible explanations are given. The t-ratio is related to the change of the measured values over time. The p-value is the probability that a calculated test statistic occurred by chance alone. Therefore, the combination of a high t-ratio and a low p-value is indicative of a significant trend.

The water body uses and corresponding parameters analyzed for this report include:

- Aquatic Life Use
  - DO
- Recreation Use
  - *E.coli* for fresh water segments
  - Enterococcus on tidal and marine segments
- General Use
  - water temperature
  - pH
  - ammonia
  - chlorophyll-*a*
  - nitrates (nitrite+nitrate)
  - total phosphorus
  - chloride – fresh water segments only
  - sulfate – fresh water segments only
  - TDS – fresh water segments only

The 2012 IR and previous basin summary reports included orthophosphorus is the analyses. This parameter is being phased out by the TCEQ, and therefore omitted from this report.

The following table explains the potential impacts when the water quality standards are not met along with an explanation of the most common causes for the standards not to be met.

| Impacts and Causes of Water Quality Concerns and Impairments | | |
|---|---|---|
| **Parameter** | **Impact** | **Cause** |
| DO | Organisms that live in water need oxygen to survive. In segments where DO is low, organism may not have sufficient oxygen to survive. | Modifications to the riparian zone, human activity that causes water temperatures to increase, and increases in organic matter and bacteria, and over abundant algae. |
| pH | Most aquatic life is adapted to live within a narrow pH range. Different organisms can live and adjust to differing pH ranges, but all fish die if pH is below 4 (the acidity of orange juice) or above 12 (the pH of ammonia). | Industrial and wastewater discharge, runoff from quarry operations, and accidental spills. |
| Ammonia | Elevated levels of ammonia in the environment can adversely affect fish and invertebrate reproductive capacity and reduce growth of the young. | Ammonia is excreted by animals and is produced during the decomposition of plants and animals. It is an ingredient in many fertilizers and is also present in sewage, storm water runoff, certain industrial wastewaters, and runoff from animal feedlots. |
| Nutrients<br>Nitrates<br>Total phosphorus | These nutrients increase plant and algae growth. When plants and algae die, the bacteria that decompose them use oxygen so that it is no longer available for fish and other living aquatic life. The more dead plants in the water, the more bacteria are produced to decompose the dead leaves. High levels of nitrate and nitrites can produce Nitrite Toxicity, or "brown blood disease," in fish. This disease reduces the ability of blood to transport oxygen throughout the body. | Nutrients are found in effluent released from WWTFs, fertilizers, and agricultural runoff carrying animal waste from farms and ranches. Soil erosion and runoff from farms, lawns, and gardens can add nutrients to the water. |
| Chlorophyll-*a* | Chlorophyll-*a* is the photosynthetic pigment found in all green plants, algae, and cyanobacteria. Elevated levels indicate abundant plant growth which could lead to reduced DO levels. | Modifications to the riparian zone, human activity that causes increased organic matter and bacteria, and over abundant algae. |
| Chloride<br>Sulfate<br>TDS | High levels of these parameters may affect the aesthetic quality of water, interfering with washing clothes and corroding plumbing fixtures. They can also affect the permeability of ions in aquatic organisms. | Mineral springs, carbonate deposits, salt deposits, and sea water intrusion are natural sources of these parameters. Other sources can be attributed to oil exploration, drinking water treatment chemicals, storm water and agricultural runoff, and wastewater discharges. |

Impairments are identified when parameters do not meet the water quality standards. The calculations to determine impairments depend on the parameter:

- DO – 10% of the samples are below the minimum for grab samples, 24-Hr minimum, or 24-Hr average
- pH – 10% of the samples are below or above the criteria
- *E. coli* and Enerococcus – geometric mean is greater than the criteria or 25% of samples are above the grab sample criteria
- Chloride, sulfate, and TDS – average of samples are above the criteria

Concerns for ammonia, nitrates, total phosphorus, and chlorophyll-*a* are identified when 20% of the samples are above the screening level criteria. This is a numeric reference for those parameters, primarily nutrients, that only have a narrative criteria. These levels were developed by the State by calculating the 85$^{th}$ percentile for all water quality data in the TCEQ's water quality database over a 10 year period. DO concerns are also identified with 10% of the samples are below the grab screen level.

Data for the analyses were extracted from the SQWMIS database using the TCEQ's Data Viewer (http://www80.tceq.texas.gov/SwqmisWeb/public/index.faces) . The SQWMIS database consists of data that has been collected under approved Quality Assurance Project Plans and have been screened for accuracy.

The graphs of the flow data are of the daily mean flows, for January 1, 2000 through December 31, 2011, downloaded from the USGS website. They are plotted on a logarithmic scale due to the extreme range of values. Zero values were changed to 0.001 in order to plot those values on the graph and differentiate between no flow and no data.

Parameters are represented in SWQMIS by five-digit numeric codes. A parameter may be represented by multiple codes depending on the analysis method under which a water quality sample was analyzed. The parameter codes, in order of priority, used for this analysis are:

DO: 00300
*E. coli*: 31699, 31700, 31648
Enterococcus: 31701, 31649
Water temperature: 00010
pH: 00400
Ammonia: 00610, 00608
Chlorophyll-*a*: 70953, 32211
Nitrates: 00620, 00621, 00630, 00593, 00631
Total Phosphorus: 00665
Chloride: 00940, 00941
Sulfate: 00945
TDS: 70300, 70294, 47004, 70301, 00094*, 00095*

*00094 and 00095 are conductivity readings, multiplied by 0.65

For each parameter reviewed, the data from December 1, 2003 through November 30, 2010 were imported into an Excel spreadsheet. The data were scanned, and duplicates and same-day measurements were removed. Data recorded as a "<" value indicates that the parameter was not present in concentrations greater than the limit of quantitation (LOQ) for that analysis. This < value differs based on the lab doing the analysis and the detection limits at that time. It does not necessarily mean that it is not present at a lower concentration. But for review purposes, all of these values are considered "non-detects." For analysis and graphing, all of these values were reduced to the lowest non-detect value of the data set.

For the trend analysis, the available data from January 1, 2000 through December 31, 2011 were imported into an Excel spreadsheet developed by Dave Bass at the Lower Colorado River Authority. The data were entered into the TWorkingData worksheet and criteria values were updated on the TStats worksheet. Once all the data were entered and the calculations run, (the automatic Excel calculations were turned off), the TStats worksheet displayed the results of the trend analysis (t-ratio and p-value) and graphs of the data were created on the Charts worksheet.

Titles were added to the graphs for parameters with impairments, concerns, and/or trends. These are the graphs displayed in this report. Solid red lines on the graphs represent the water quality standard for that parameter for that segment. Dashed red lines represent screening level criteria as described above. Trend lines are shown in black.

The results of the analysis are presented in tables, which vary slightly based on the parameter. Since the graphs display the parameter values for the longer trend analysis time period than for the assessment analysis, the minimum and maximum values reported in the tables do not necessarily match the minimum and maximum values displayed on the graphs.

The following table explains the data and information represented in the data analysis tables.

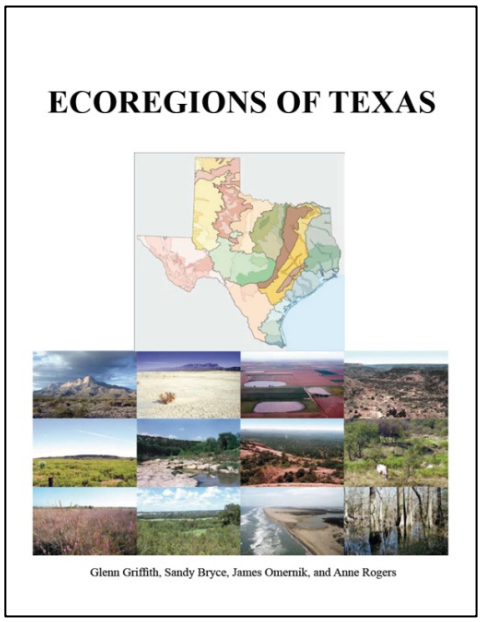
| **Data Analysis Result Tables Explanation** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter Name** | | **Status** | **# samples** | **Min** | **Max** | **Median Geomean Average** | **ND < #** | **>#** |
| AU | Water quality standard*<br><br>or<br><br>screening level criteria* | 2012 IR assessment result** | Total number of samples in the dataset | The minimum value in the dataset.<br><br>If preceded by "<", this is minimum value in the dataset reported below the (LOQ) | The maximum value in the dataset. | Median of all values<br><br>or<br><br>Geomean of bacteria<br><br>or<br><br>Average value for chloride, sulfate, and TDS | # of non-detects<br><br>or<br><br>values below the criteria value | # of values above the criteria value |

* See the list of acronyms for unit explanations

**NC – No concern, FS – Fully supporting, **CS – Screening level concern**, **CN – Use concern**, **NS – Non-supporting** (Impairment)

# ECOREGIONS

Ecoregions (ecological regions) denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by its probable response to disturbance (Bryce and others, 1999). These general purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas. Information used to compile ecoregion maps includes information about geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. Ecoregions are classified using a hierarchical level using Roman numerals. Level I is the coarsest level with each level higher indicating a refinement of the previous level (Omernik and others, 2000).




In Texas, there are a total of 12 Level III ecoregions. The Nueces-San Antonio Coastal Basin, Nueces River Basin, and the Nueces-Rio Grande Coastal Basin flows through five of these Level III ecoregions including: Edwards Plateau in the Upper Nueces River Basin, South Texas Plains in the western portion of the Nueces River Basin, Texas Blackland Prairie in the Nueces River Basin near the Atascosa River, East Central Texas Plains in the Nueces and Nueces- San Antonio River Basin, and the Western Gulf Coastal Plains in the Nueces-Rio Grande Coastal Basin.

The maps included in this report are Level IV ecoregion maps and are located in the Watershed Summary section. Level IV ecoregion maps are available for the Nueces-San Antonio Coastal Basin, Nueces River Basin, and the Nueces-Rio Grande Coastal Basin.

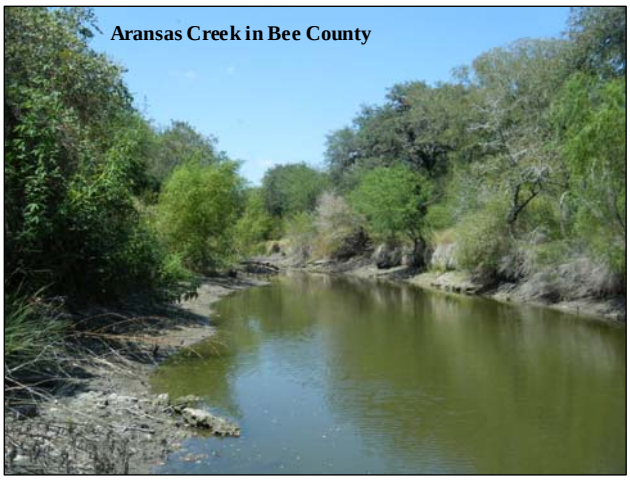
## WATERSHED SUMMARIES OF THE SAN ANTONIO – NUECES COASTAL BASIN

The San Antonio – Nueces Coastal Basin is approximately 3,100 square miles, covering all or part of seven counties including: Aransas, Bee, Goliad, Karnes, Live Oak, Refugio, and San Patricio. The basin is bordered by: the San Antonio River Basin to the north; the Lavaca-Guadalupe Coastal Basin to the northeast; bays, estuaries, and the Gulf of Mexico to the east; the Nueces-Rio Grande Coastal Basin to the south; and the Nueces River Basin to the northwest. There are two minor rivers in the watershed, the Mission River and the Aransas River, but no watercourses that maintain significant stream flow. Runoff from the basin drains into Nueces Bay, Port Bay, Mission Bay, Copano Bay, St. Charles Bay, Aransas Bay, and Hynes Bay.

Being a coastal area, the basin is naturally host to several state-operated recreational areas. These include Goose Island State Park near Rockport, Copano Bay State Fishing Pier along State Highway (SH) 35 north of Fulton, Fulton Mansion State Historic Park in Fulton, and the Aransas National Wildlife Refuge in Aransas County.

### Water Quality Overview of the San Antonio – Nueces Coastal Basin

The headwaters for the San Antonio – Nueces coastal basin arise in Southern Post Oak Savannah/Claypan of the East Central Texas Plains ecoregion. Terrain consists of flat to rolling irregular hills becoming increasingly more flat to the southeast towards the coast. In the upper reaches of the basin, creeks are largely ephemeral, only flowing in conjunction with a storm event. Streams are often very turbid and have elevated concentrations of nutrients (nitrogen and phosphorus) and bacteria when flowing.


Aransas Creek in Bee County

In the central portion of the watershed, creeks travel through the Western Gulf Coastal Plains ecoregion. Perennial pools capable of sustaining aquatic life become more frequent. During wet years, stream flow is more consistent and waterways are capable of maintaining sufficient flow between rain events. Water quality in Aransas River, located in the


Mission River in Refugio

western portion of the basin, typically has elevated levels of bacteria and nutrients (nitrogen and phosphorus) and low DO. Water in the Mission River, located in the central portion of the basin, meets the standards set for water quality much of the time.

In the tidally influenced reaches of the basin, water in the Aransas and Mission River Tidal both have elevated bacteria concentrations that do not meet water quality standards.


Aransas River Tidal in Refugio County

## Aransas Creek RUAA

Aransas Creek (Segment 2004A) is an unclassified segment located in Bee County. The creek extends from the confluence with the Aransas River to the headwaters of the stream about 10 km upstream of US Highway 59. The watershed for this segment is largely rural ranchland with no major communities and no regulated discharges to the creek. It was discovered that beginning in 1998, samples that were supposed to be taken at Station 12952 on the Aransas River were mistakenly being collected on Aransas Creek and assigned to Station 17592. The 2006 assessment identified this segment as exceeding the bacteria standard and therefore non-supporting contact recreation and placed on the 303(d) List. Additional information on the stream was needed in order for TCEQ and TSSWCB to make a recommendation on assigning the most appropriate recreational standard for the creek. In 2010, TSSWCB agreed to take a lead role in conducting an RUAA for Aransas Creek and in 2011 contracted NRA to conduct the data collection and solicit stakeholders input. The RUAA for Segment 2004A consisted of four main tasks:

- conducting two field surveys of Aransas Creek,
- public participation and stakeholder interaction,
- evaluation of historical bacterial water quality data and survey of possible bacteria sources, and
- compilation of Geographic Information System (GIS) data pertaining to the Aransas Creek watershed.

Public meetings were held on May 29, 2012, September 27, 2012 and April 30, 2013 at the Skidmore-Tynan High School. The two field surveys were conducted August 31 through September 1, 2012 and on September 28, 2012.

Interviewees reported that Aransas Creek was likely seldom used for primary contact recreation but was used for secondary contact recreation, primarily fishing when there is sufficient water. However, drought conditions plagued the watershed during the entire study period resulting in zero flow conditions. Significant refuge pools were observed at several locations. Drought conditions likely had much to do with the lack of observed recreational activities in the segment.

During both field surveys, NRA personnel never observed anyone recreating in the stream at any of the eight monitoring sites. However, evidence indicating some recreational use include a fishing pier, structures built in the trees adjacent to the creek, dirt roads, foot trails, a pool float, an aluminum boat, fishing poles, and a fishing light mounted in a tree over the creek.

Additional information and the final report are available on the project website http://www.tsswcb.texas.gov/managementprogram/aransaruaa.

## Copano Bay, Mission River Tidal, and Aransas River Tidal middleTMDL

Copano Bay (Segment 2472) is the receiving body of the Aransas and Mission Rivers. In 2004, the bay was placed on the 303(d) List for being impaired for bacteria (fecal coliform) in oyster waters, and Mission River Tidal (Segment 2001) and Aransas River Tidal (Segment 2003) were listed as being impaired for bacteria (Enterococcus) for contact recreation.

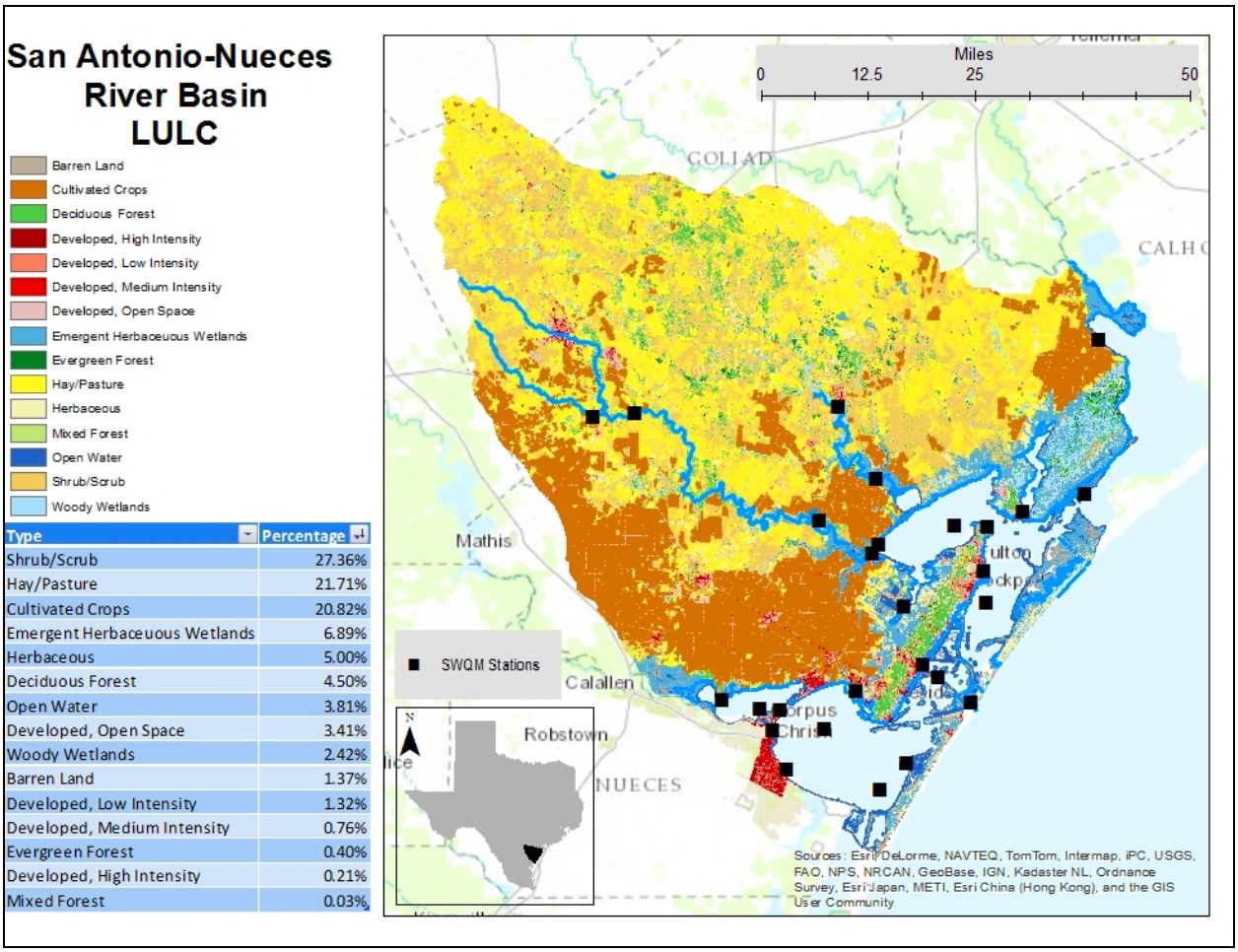
From February 2008 through January 2011, NRA, with TSSWCB funding, conducted additional water quality sampling throughout the watershed to support the TMDL.

Texas Water Resources Institute (TWRI), a division of the Texas AgriLife Extension Service, is working with local stakeholders to implement a TMDL project that will determine how much bacteria can enter each water body on a daily basis and still meet water quality standards. Under TWRI's direction, workgroups were formed to focus on specific issues and to draft recommendations to the stakeholders.

Workgroups for the project include Agriculture and Wildlife, Wastewater, Technical Advisory, and Education and Outreach. Concurrently, TWRI and the local stakeholders are working to develop an Implementation Plan (I-Plan). This plan will include strategies and best management practices (BMP) to address the impairment.

Additional information is available on the project website: http://copanobay-wq.tamu.edu/.

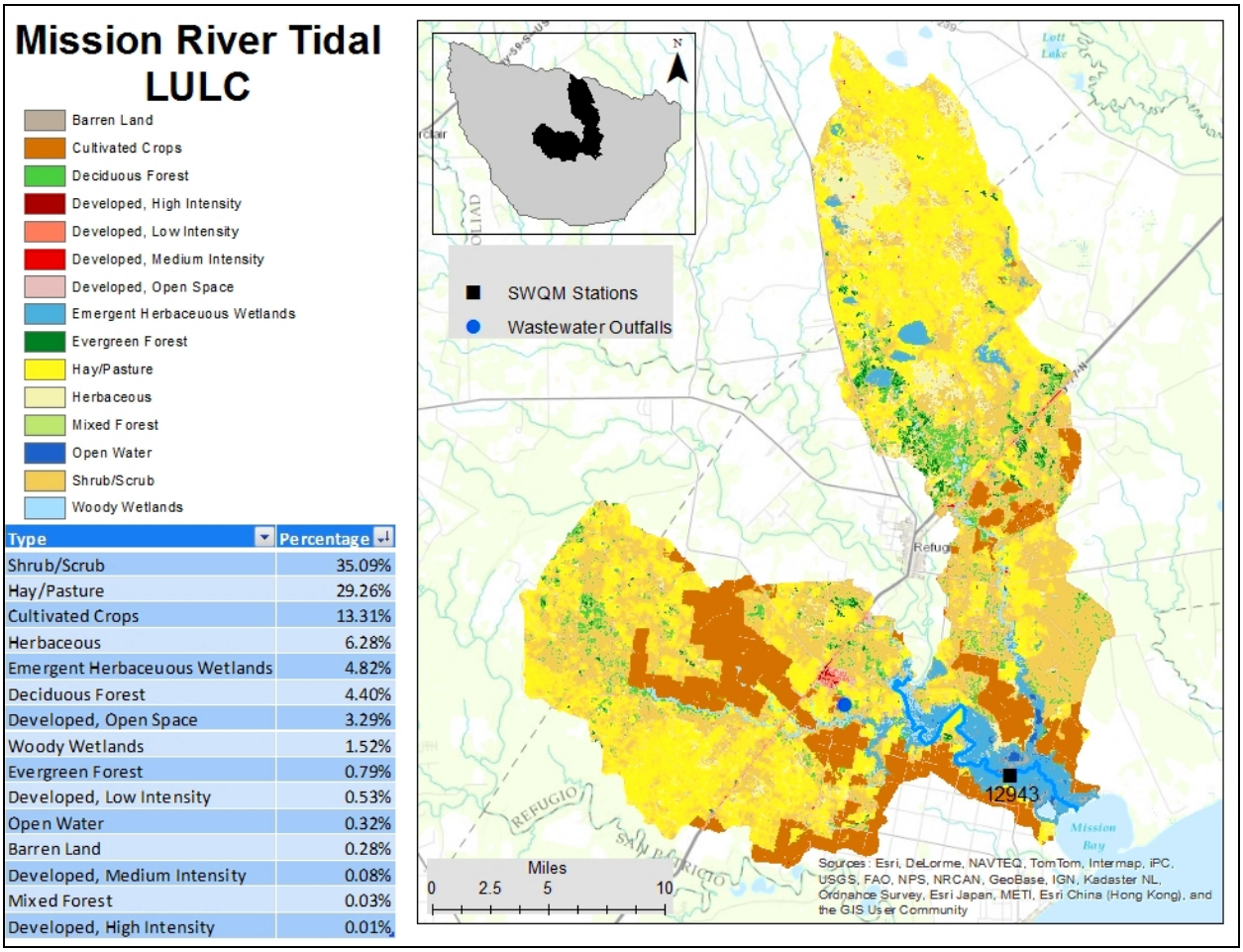
The map below shows all the Surface Water Quality Monitoring (SWQM) sites that are being monitored in Fiscal Year (FY) 2013 within the basin and adjacent bays.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 27.36% |
| Hay/Pasture | 21.71% |
| Cultivated Crops | 20.82% |
| Emergent Herbaceuous Wetlands | 6.89% |
| Herbaceous | 5.00% |
| Deciduous Forest | 4.50% |
| Open Water | 3.81% |
| Developed, Open Space | 3.41% |
| Woody Wetlands | 2.42% |
| Barren Land | 1.37% |
| Developed, Low Intensity | 1.32% |
| Developed, Medium Intensity | 0.76% |
| Evergreen Forest | 0.40% |
| Developed, High Intensity | 0.21% |
| Mixed Forest | 0.03% |

## MISSION RIVER TIDAL WATERSHED – SEGMENT 2001

The 19 mile segment extends from the confluence with Mission Bay in Refugio County to a point 4.6 miles downstream of US 77 in Refugio County and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 35.09% |
| Hay/Pasture | 29.26% |
| Cultivated Crops | 13.31% |
| Herbaceous | 6.28% |
| Emergent Herbaceuous Wetlands | 4.82% |
| Deciduous Forest | 4.40% |
| Developed, Open Space | 3.29% |
| Woody Wetlands | 1.52% |
| Evergreen Forest | 0.79% |
| Developed, Low Intensity | 0.53% |
| Open Water | 0.32% |
| Barren Land | 0.28% |
| Developed, Medium Intensity | 0.08% |
| Mixed Forest | 0.03% |
| Developed, High Intensity | 0.01% |

| | |
|---|---|
| **Drainage area** | 199,798 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Woodsboro |
| **Counties** | Bee, Goliad, Refugio |
| **EcoRegions** | Floodplains and Low Terraces, Coastal Sand Plain, Mid-Coast Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Average** | Rain: 37" - 39"; Low: 59° F - 62° F; High - 80° F - 82° F; |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0010156-001 – Town of Woodsboro: 250,000 gpd via Willow Creek<br>WQ0012013-001 – Texas Department of Transportation (TxDOT): - Refugio County Rest Area: 3,200 gpd via evaporation and irrigation |

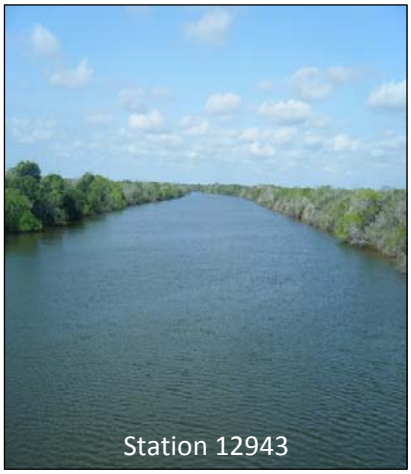
### Special Studies

The Mission River Tidal watershed was included in the targeted monitoring to support the Copano Bay TMDL as described in the San Antonio – Nueces Basin write-up on Page 8.

## Water Quality Analysis

The analysis is based on data from **Station 12943,** immediately downstream of the Farm-to-Market (FM) 2678 bridge between Refugio and Bayside. Trend analysis was conducted on data from January 2000 to September 2011. NRA is responsible for quarterly routine monitoring at this site.

The segment has been listed as having a **bacteria impairment** since 2004. Being a tidal segment, this segment is on the receiving end of the entire Mission River watershed, and therefore likely to see increased concentrations of various pollutants. The river also exchanges water with Mission Bay, a secondary bay of Copano Bay, which is also impaired for bacteria.

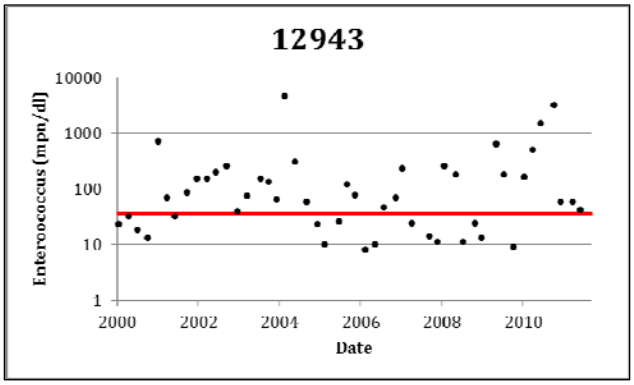

Station 12943

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 29 | 1.9 | 12.9 | 6.7 | 1 | 2 |
| Screening Level 4.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | **NS** | **28** | **8** | **4600** | **66.70** | **0** | **11** |




The Enterococcus geomean, although still well above the standard, did decrease slightly from 67.95 cfu/100 ml in the 2010 IR. Enterococcus analysis began with the FY 2000 routine monitoring. This impairment is being addressed in Copano Bay TMDL study discussed above.

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 29 | 10.0 | 31.6 | 22.7 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 29 | 7.1 | 8.4 | 8.1 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 28 | <0.02 | 0.224 | 0.02 | 16 | 0 |

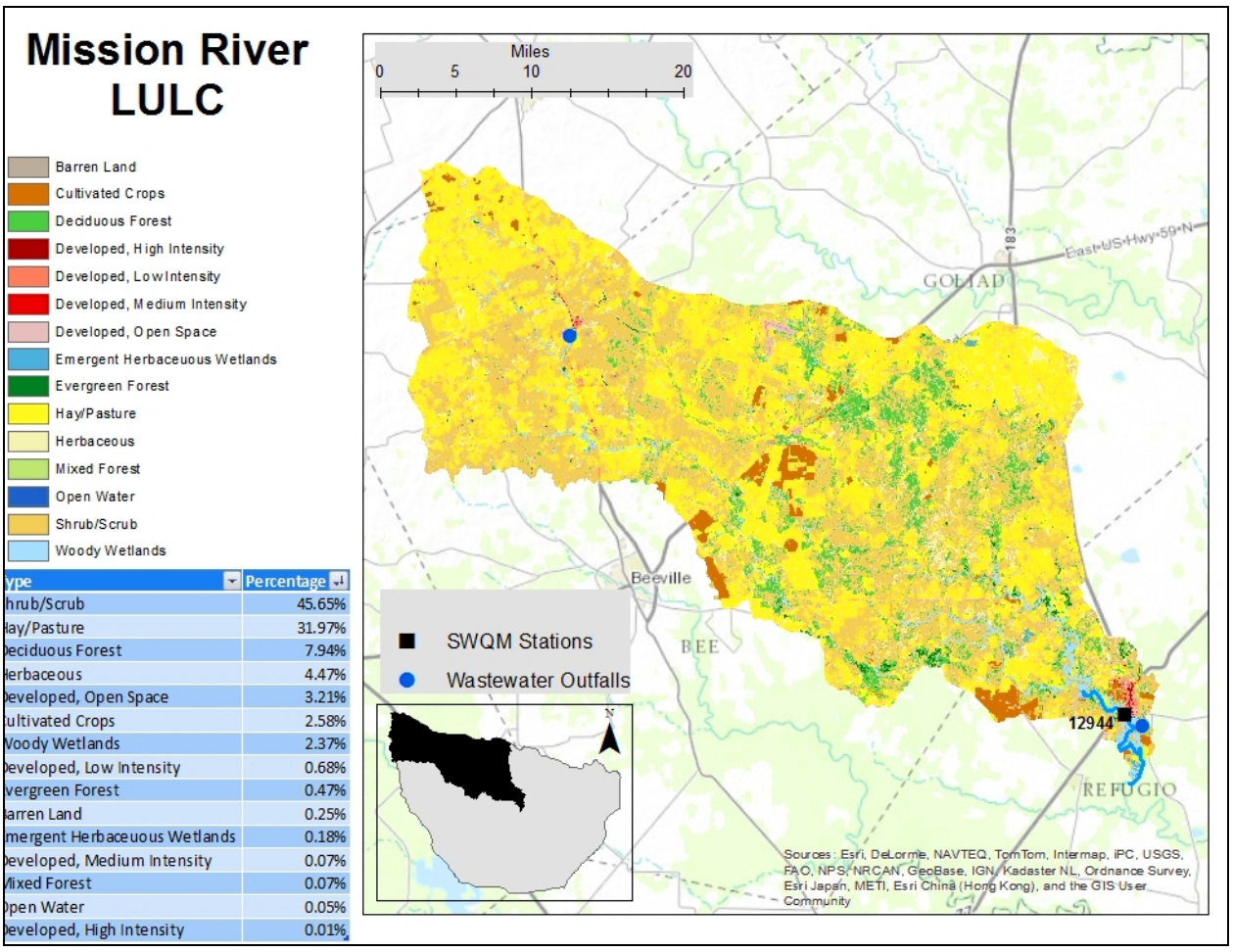
| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >21.0 |
|---|---|---|---|---|---|---|---|
| 21.0 µg/l | NC | 28 | <2 | 47 | 10.95 | 4 | 7 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | NC | 28 | <0.01 | 0.81 | 0.01 | 20 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | NC | 28 | 0.052 | 0.247 | 0.1 | 2 | 0 |

## MISSION RIVER ABOVE TIDAL WATERSHED – SEGMENT 2002

The 9 mile segment extends from a point 4.6 miles downstream of US 77 in Refugio County to the confluence of Blanco Creek and Medio Creek in Refugio County and is a single AU.



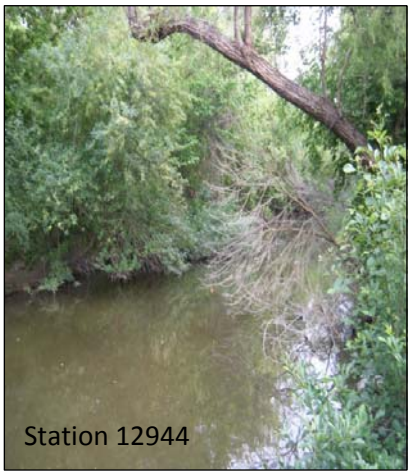

| | |
|---|---|
| **Drainage area** | 452,172 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Refugio |
| **Counties** | Refugio |
| **EcoRegions** | Southern Post Oak Savanna, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 31" – 37"; Low: 58° F - 60° F; High: 81° F - 82° F |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0010255-001 – Town of Refugio: 576,000 gpd with provision for beneficial land application<br>WQ0010748-001 – Pettus Municipal Utility District (MUD): 105,000 gpd via Medio Creek |

### Special Studies

The Mission River Above Tidal watershed was included in the target monitoring to support the Copano Bay TMDL as described in the San Antonio – Nueces Basin write-up on Page 8.

## Water Quality Analysis

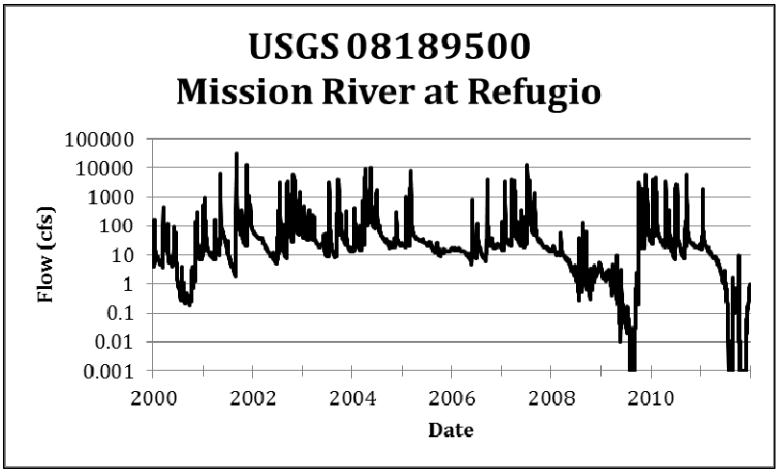
The analysis is based on data from **Station 12944,** upstream of the US 77 bridge at Refugio. Trend analysis was conducted on data from January 2000 to October 2011. NRA is responsible for quarterly routine monitoring at this site.


Station 12944

The segment has been listed as having a **bacteria concern** first identified in the 2012 IR. The watershed for this segment also includes the watersheds of Blanco and Medio Creeks, and therefore is likely to see increased concentrations of various pollutants.

The USGS flow gauge at the Mission River at Refugio is located at the same location as Station 12944. Zero values were changed to 0.001 in order to plot the flow values on a logarithmic scale. The annual mean flows are:

2000 – 18 cfs
2001 – 415 cfs
2002 – 188 cfs
2003 – 101 cfs
2004 – 320 cfs,
2005 – 109 cfs
2006 – 41 cfs
2007 – 331 cfs
2008 – 7.0 cfs
2009 – 101 cfs
2010 – 209 cfs
2011 – 17 cfs

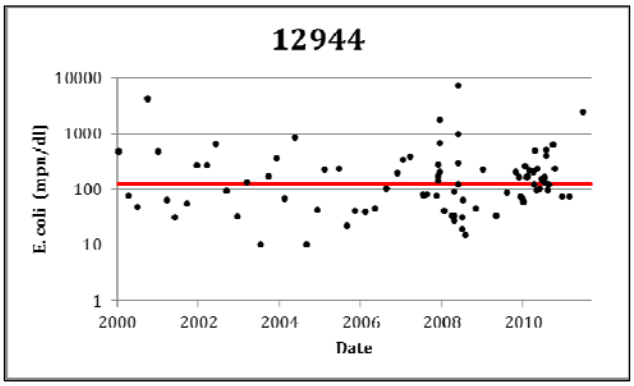



### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 47 | 1.8 | 12.6 | 7 | 1 | 3 |
| Screening Level 5.0 mg/l | NC | | | | | | |
| 24-Hr Minimum 3.0 mg/l | NC | 4 | 5.7 | 6.5 | 6.4 | 0 | NA |
| 24-Hr Average 5.0 mg/l | NC | | 6.8 | 7.0 | 6.9 | NA | 0 |

### Recreation Use

| *E. coli* | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|
| Geomean 126 cfu/100 ml | **CN** | **46** | **10** | **827** | **113.10** | **0** | **4** |




The 2012 IR shows a geomean of 127.66 based on 50 samples, and therefore the concern for this parameter. This impairment is being addressed in Copano Bay TMDL study discussed above.

**General Use**

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 47 | 13.1 | 30.1 | 21.1 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 47 | 6.3 | 7.8 | 7.7 | 1 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|
| 0.33 mg/l | NC | 28 | <0.02 | 0.154 | 0.0225 | 10 | 0 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|
| 14.1 µg/l | NC | 28 | <2 | 50.7 | 2 | 16 | 2 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|
| 1.95 mg/l | NC | 28 | <0.02 | 0.53 | 0.0285 | 12 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|
| 0.69 mg/l | NC | 20 | <0.06 | 0.127 | 0.06 | 14 | 0 |

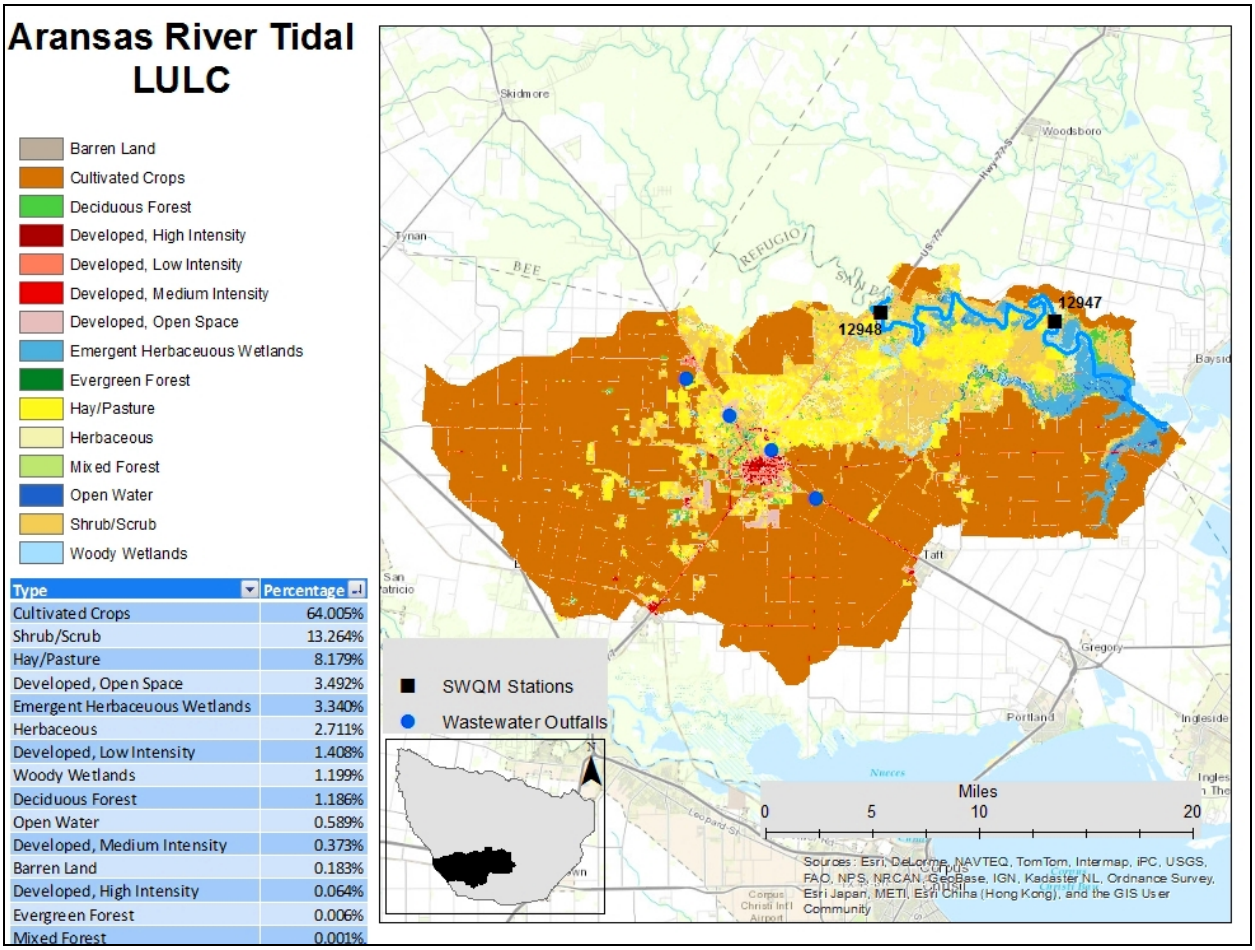
| Chloride | Status | # samples | Min | Max | Average | >850 |
|---|---|---|---|---|---|---|
| 850 mg/l | FS | 28 | 14.6 | 5340 | 288.5 | 5 |

| Sulfate | Status | # samples | Min | Max | Average | >100 |
|---|---|---|---|---|---|---|
| 100 mg/l | FS | 28 | 5 | 152 | 36.1 | 1 |

| TDS | Status | # samples | Min | Max | Average | >2,000 |
|---|---|---|---|---|---|---|
| 2,000 mg/l | FS | 67 | 194 | 5780 | 910 | 9 |

## ARANSAS RIVER TIDAL WATERSHED – SEGMENT 2003

The 6 mile segment extends from its confluence with Copano Bay in Refugio/San Patricio/Aransas County to a point 1.0 mile upstream of US 77 in Refugio/San Patricio County and is a single AU.




| | |
|---|---|
| **Drainage area** | 208,031 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Sinton, Taft, Odem |
| **Counties** | Refugio, San Patricio |
| **EcoRegions** | Floodplains and Low Terraces, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 33" – 37"; Low: 60° F - 62° F; High: 79° F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0010055-001 – City of Sinton: 800,000 gpd via Chiltipin Creek<br>WQ0010237-001 – City of Odem: 273,000 gpd<br>WQ0013412-001 – TxDOT: 380 gpd via Chiltipin Creek<br>WQ0013641-001 – City of Sinton Rob and Bessie Welder Park: 15,000 gpd via Chiltipin Creek<br>WQ0014119-001 – St. Paul Water Supply Corporation (WSC): 50,000 gpd via Chiltipin Creek |

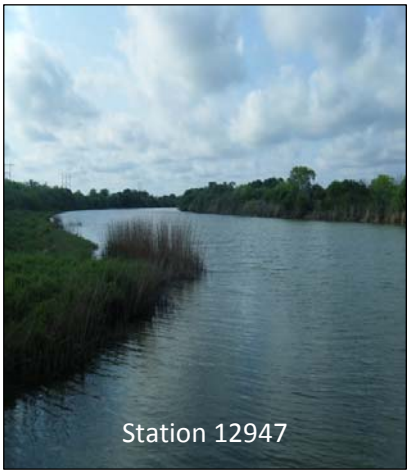
### Special Studies

The Aransas River Tidal watershed was included in the target monitoring to support the Copano Bay TMDL as described in the San Antonio – Nueces Basin write-up on Page 8.

## Water Quality Analysis

The analysis is based on data from **Station 12947,** at the boat ramp at FM 629 south of Bonnie View. Beginning in FY 2004, the routine monitoring site was moved from Station 12948, located at the upper end of the segment, to Station 12947, a location more representative of the segment. There is insufficient data for trend analysis. NRA is responsible for quarterly routine monitoring at this site.

The segment has been listed as having a **bacteria impairment** since 2004. Being a tidal segment, this segment is on the receiving end of the entire Aransas River watershed, and therefore likely to see increased concentrations of various pollutants. The river also exchanges water with Copano Bay, which is also impaired for bacteria.

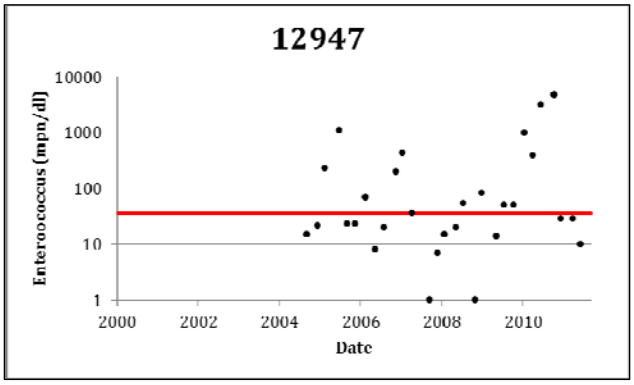



### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 25 | 3.5 | 11.6 | 6.9 | 0 | 2 |
| Screening Level 4.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | **NS** | **25** | **1** | **3,100** | **47.02** | **0** | **7** |




The Enterococcus geomean, although still well above the standard, did decrease slightly from 65.8 cfu/100 ml assessed for the 2010 IR. This impairment is being addressed in the Copano Bay TMDL study discussed above.

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 25 | 8.8 | 32.2 | 22.4 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 25 | 7.3 | 8.7 | 8.4 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 25 | <0.02 | 0.151 | 0.02 | 15 | 0 |

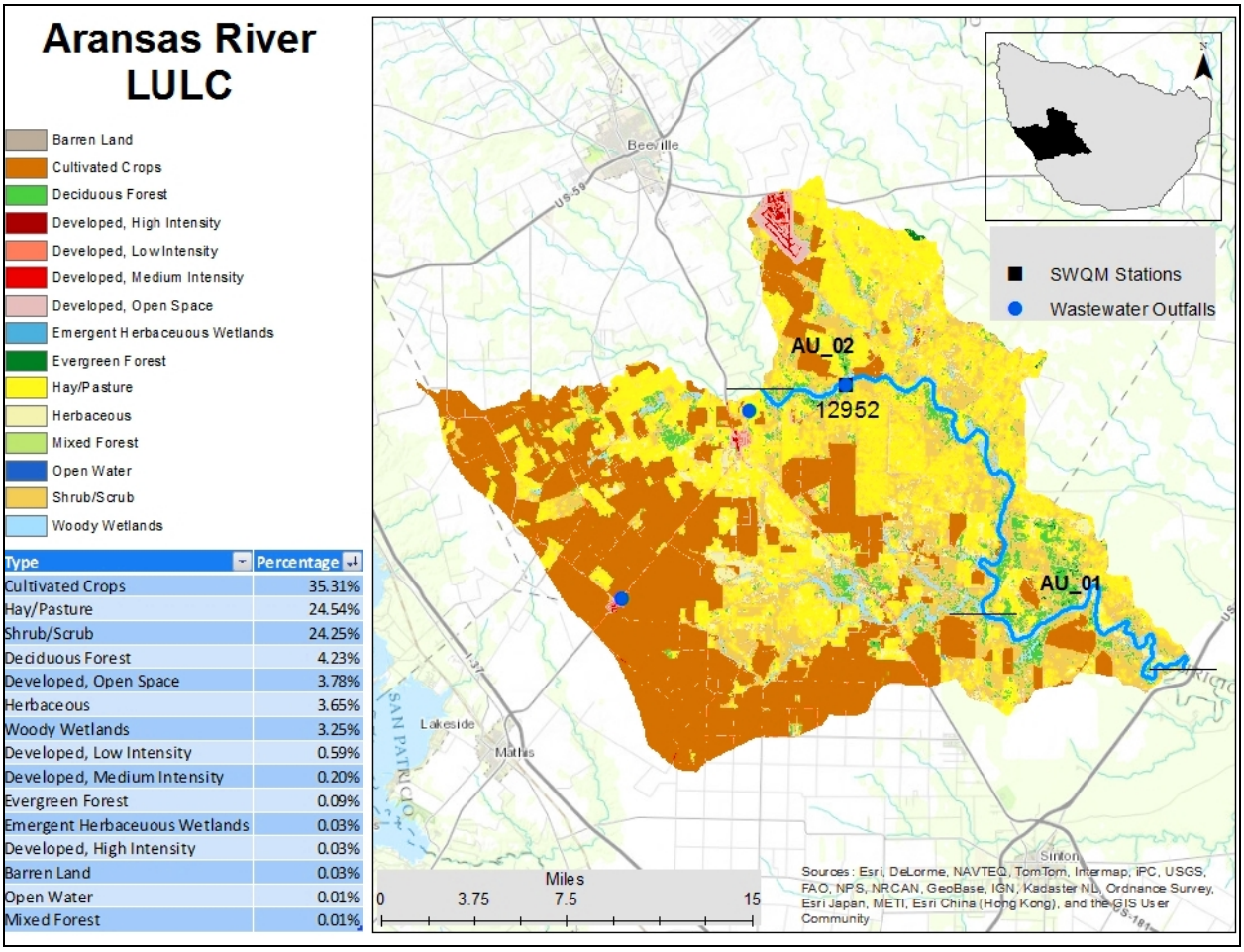
| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >21.0 |
|---|---|---|---|---|---|---|---|
| 21.0 µg/l | NC | 25 | <2 | 54 | 15 | 4 | 5 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | NC | 25 | <0.02 | 0.433 | 0.02 | 18 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | NC | 25 | 0.208 | 1.8 | 4.429 | 0 | 3 |

## ARANSAS RIVER ABOVE TIDAL WATERSHED – SEGMENT 2004

The 35 mile segment extends from a point 1.0 mile upstream of US 77 in Refugio/San Patricio County the confluence of Poesta Creek and Aransas Creek in Bee County and is divided into two AUs.



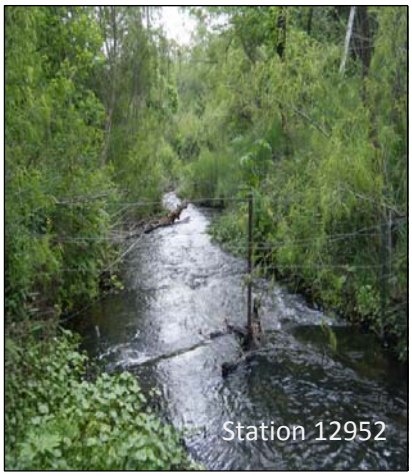

| | |
|---|---|
| **Drainage area** | 178,807 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Beeville, Refugio, Woodsboro |
| **Counties** | San Patricio, Refugio, Bee |
| **EcoRegions** | Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Average** | Rain: 33" – 35"; Low: 60° F - 61° F; High: 81°F - 82° F |
| **Water Body Uses** | General, Aquatic Life, Recreation |
| **Permitted WWTFs** | WQ0010124-004 – City of Beeville, Chase Field: 2,500,000 gpd<br>WQ0014112-001 – Skidmore WSC: 131,000 gpd via unnamed tributary<br>WQ0014123-001 – Tynan WSC: 45,000 gpd via Papalote Creek |

### Special Studies

The Aransas River Tidal watershed was included in the target monitoring to support the Copano Bay TMDL as described in the San Antonio – Nueces Basin write-up on Page 8.

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Papalote Creek just upstream of the Refugio/Bee county line**. AU_02** is the reach from the upstream end of AU_01 to the upstream end of the segment.



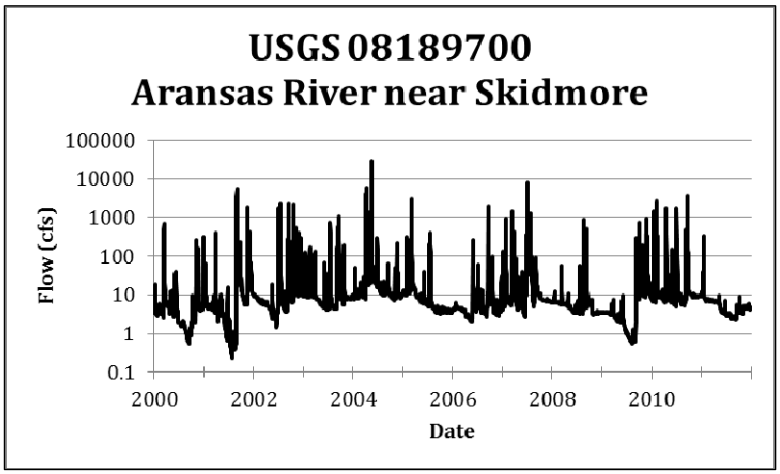

There are no sampling stations on AU_01.

The analysis for AU_02 is based on data from **Station 12952,** located at the county road east of Skidmore**. Low DO, total phosphorus, nitrate,** and **E. coli** are concerns on AU-02. Trend analysis was conducted on data from February 2000 to October 2011. NRA is responsible for quarterly routine monitoring at this site.

The watershed for this segment also includes the watershed of Papalote Creek. The confluence of this creek with the Aransas River is below the sampling site, and therefore does not influence the measured values.

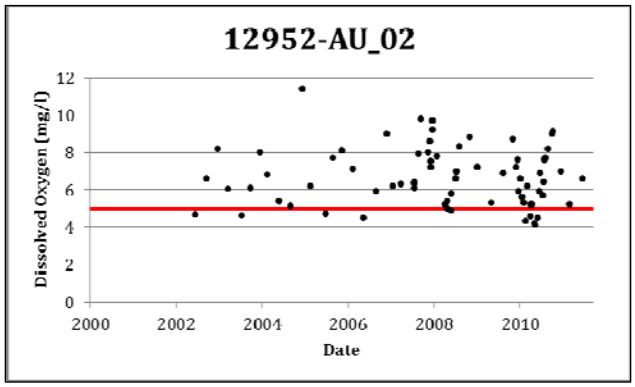
The USGS flow gauge at the Aransas River near Skidmore is located at the same location as Station 12952. The annual mean flows are:

| | |
|---|---|
| 2000 – 13 cfs | 2006 – 15 cfs |
| 2001 – 63 cfs | 2007 – 89 cfs |
| 2002 – 59 cfs | 2008 – 12 cfs |
| 2003 – 28 cfs | 2009 – 15 cfs |
| 2004 – 161 cfs | 2010 – 65 cfs |
| 2005 – 34 cfs | 2011 – 6.6 cfs |




## Aquatic Life Use Assessment

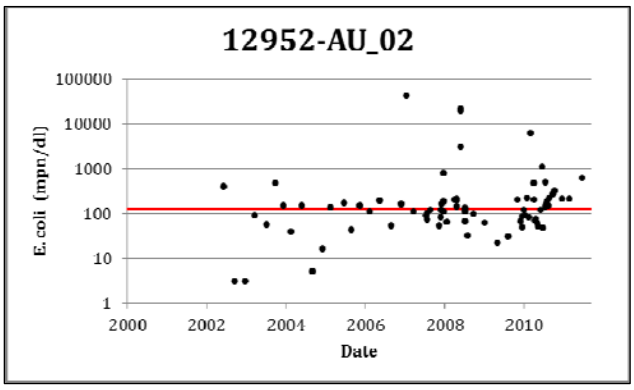
| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU_02 | Minimum 3.0 mg/l | FS | **47** | **4.1** | **11.4** | **6.3** | **1** | **7** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | NC | 7 | 3.7 | 9.3 | 4.6 | 0 | NA |
| | 24-Hr Average 5.0 mg/l | NC | | 4.8 | 11.1 | 5.8 | NA | 1 |




The low DO concern based on grab samples being < 5 mg/l was further evaluated by 24-Hr DO measurements which do not seem to indicate any significant problems with low DO.

## Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU_02 | Geomean 126 cfu/100 ml | **CS** | **47** | **5** | **41,000** | **116.37** | **0** | **5** |




The 2012 IR shows a geomean of 137.61 based on 44 samples, and therefore the concern for this parameter. Some of the samples were collected during high flow events for the special study in support of the Copano Bay TMDL. These biased data possibly resulted in a higher geomean than would have been calculated had all samples been collected during routine monitoring.

## General Use

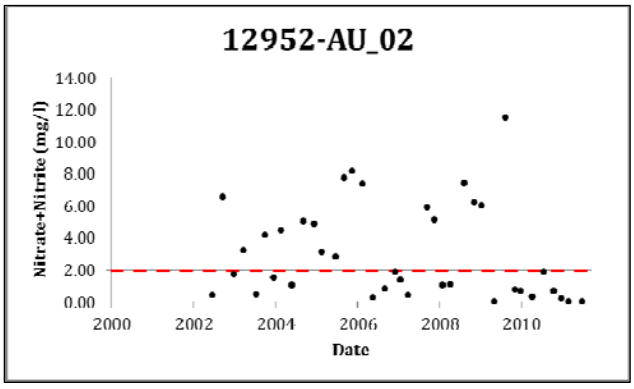
| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU_02 | 35 °C | FS | 47 | 11.5 | 29.6 | 20.8 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU_02 | 6.5 – 9.0 su | FS | 47 | 7.2 | 8.2 | 7.7 | 0 | 0 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU_02 | 0.33 mg/l | NC | 28 | <0.02 | 0.203 | 0.054 | 4 | 0 |

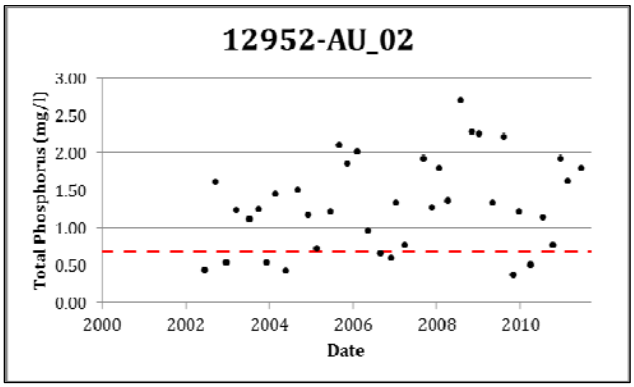
| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU_02 | 14.1 µg/l | NC | 28 | <2 | 6.9 | 2 | 20 | 0 |

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU_02 | 1.95 mg/l | **CS** | **28** | **<0.02** | **11.5** | **2.341** | **1** | **14** |




The elevated levels may be related to discharge from WWTFs into the river above the sampling location and /or agricultural runoff.

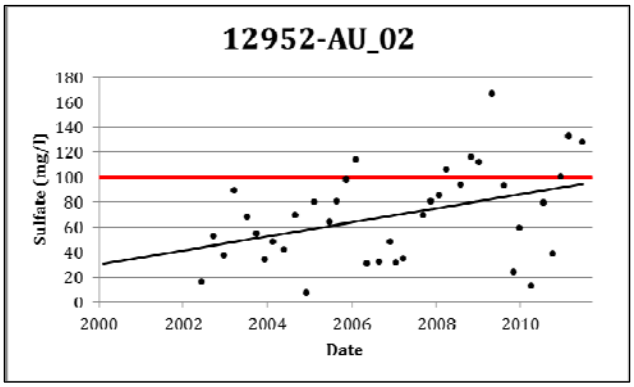
| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU_02 | 0.69 mg/l | **CS** | **28** | **0.373** | **2.7** | **1.3** | **0** | **22** |




The elevated levels may be due to three WWTFs that discharge to the river above the sampling location and /or agricultural runoff.

| Chloride | Status | # samples | Min | Max | Average | >450 |
|---|---|---|---|---|---|---|
| 450 mg/l | FS | 28 | 35.2 | 566 | 276.5 | 1 |

| Sulfate | Status | # samples | Min | Max | Average | >100 |
|---|---|---|---|---|---|---|
| 100 mg/l | FS | 28 | 7.38 | 167 | 69.55 | 5 |

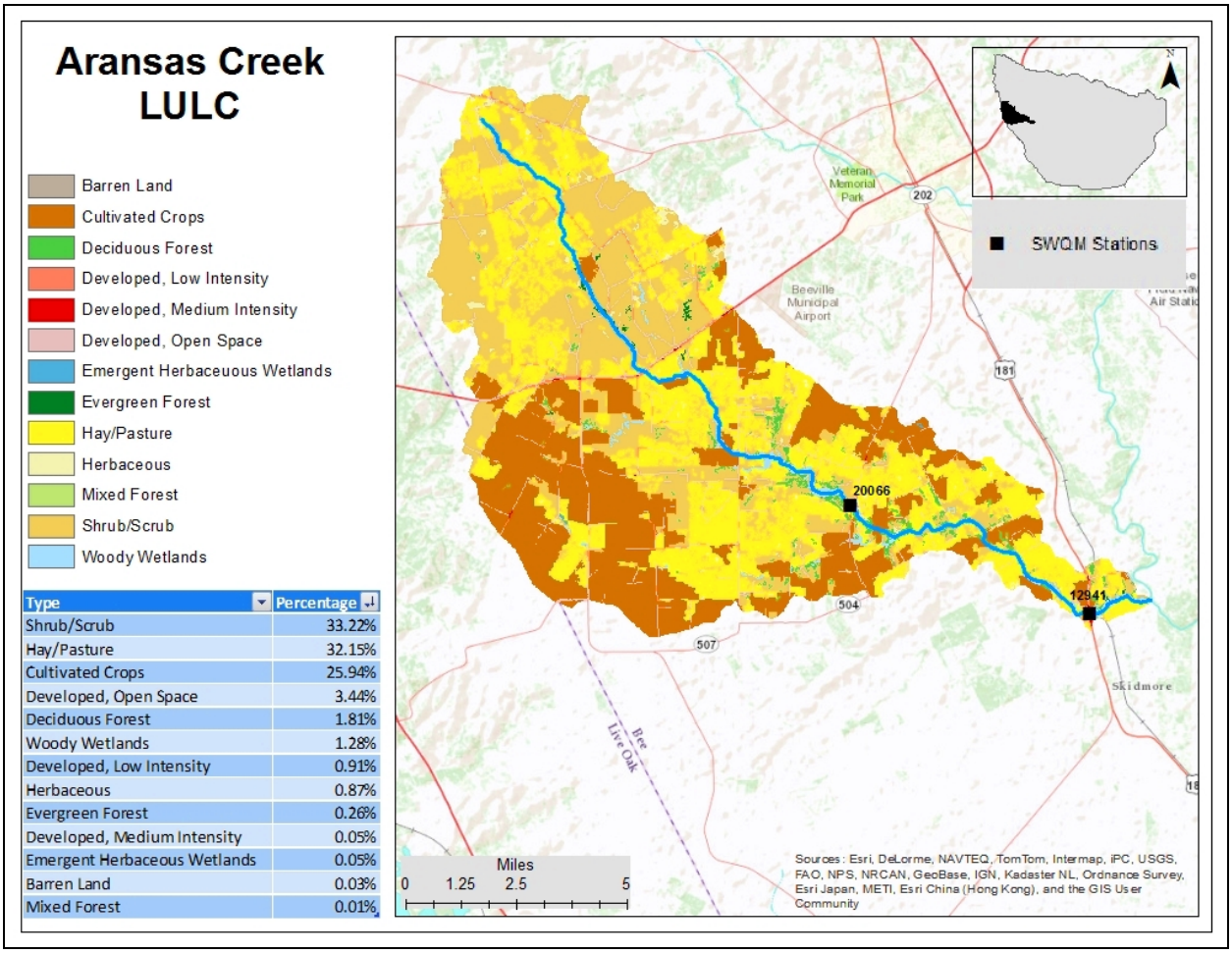



Statistical analysis indicates that there is an increasing trend in sulfate values with a **t-stat of 2.68** and a **p-value of 0.01.** The increasing levels may be due to three WWTFs that discharge to the river above the sampling location. The highest levels occur during dry times when the water in the stream is effluent dominated.

| TDS | Status | # samples | Min | Max | Average | >1,700 |
|---|---|---|---|---|---|---|
| 1,700 mg/l | FS | 47 | 253 | 2160 | 991 | 2 |

## ARANSAS CREEK WATERSHED – SEGMENT 2004A

The 20 mile segment extends from its confluence with Aransas River to stream headwaters west of Beeville, just south of FM 799 and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 33.22% |
| Hay/Pasture | 32.15% |
| Cultivated Crops | 25.94% |
| Developed, Open Space | 3.44% |
| Deciduous Forest | 1.81% |
| Woody Wetlands | 1.28% |
| Developed, Low Intensity | 0.91% |
| Herbaceous | 0.87% |
| Evergreen Forest | 0.26% |
| Developed, Medium Intensity | 0.05% |
| Emergent Herbaceous Wetlands | 0.05% |
| Barren Land | 0.03% |
| Mixed Forest | 0.01% |

| | |
|---|---|
| **Drainage area** | 45,196 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Skidmore |
| **Counties** | Bee |
| **EcoRegions** | Southern Post Oak Savanna, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Average** | Rain: 31” – 33”; Low: 58° F - 60° F; High: 81° F - 82° F |
| **Water Body Uses** | Aquatic Life, Recreation |
| **Permitted WWTFs** | None |

### Special Studies

The Aransas Creek watershed is the subject of the RUAA described in the San Antonio – Nueces Basin write-up on Page 8, and was included in the target monitoring to support the Copano Bay TMDL described on Page 8.

## Water Quality Analysis

The analysis is based on data from **Station 12941** at US 181. For several years, 1998 – 2002, this site was accidently monitored instead of Station 12952 on the Aransas River. An ***E. coli* impairment** and **low DO concern** are being carried forward from previous assessments as there is an insufficient number of data points for a full assessment. However, the low DO concern was further evaluated by 24-Hr DO measurements.


The watershed is nearly entirely rural. The only town located within the watershed is Skidmore, which is located at the lower end. No WWTFs discharge into this segment, therefore the bacteria is from either wildlife, livestock and / or faulty on-site sewage facilities (OSSFs).

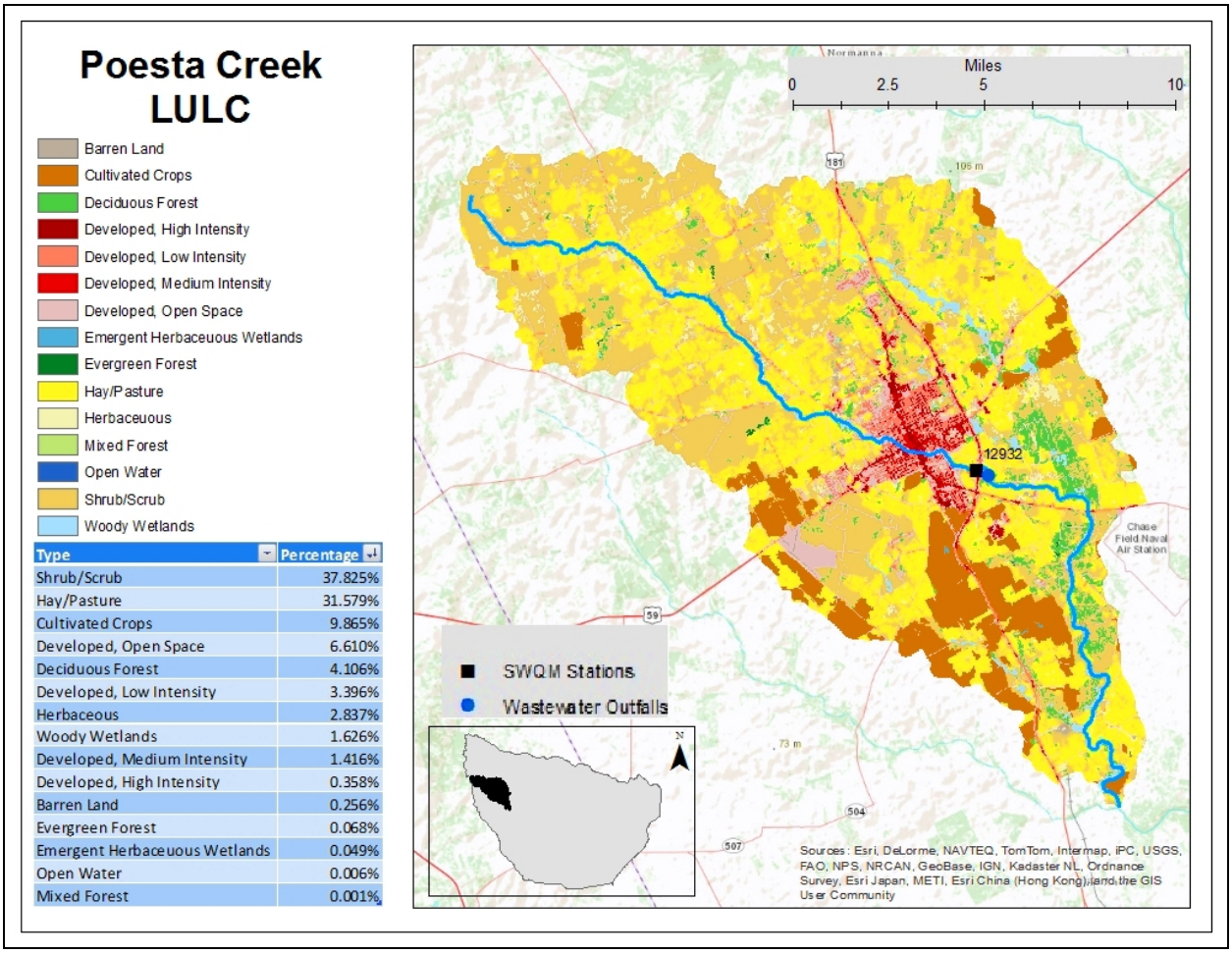
## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <2 | <3 |
|---|---|---|---|---|---|---|---|
| 24-Hr Minimum 2.0 mg/l | NC | 5 | 4.1 | 8.5 | 7 | 0 | NA |
| 24-Hr Average 3.0 mg/l | NC | | 6.9 | 8.6 | 7.3 | NA | 0 |

The 24-Hr DO measurements do not seem to indicate any significant problems with low DO.

## POESTA CREEK WATERSHED – SEGMENT 2004B

The 24 mile segment extends from its confluence with Aransas River to stream headwaters approximately 7.5 km upstream of FM 673 and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 37.825% |
| Hay/Pasture | 31.579% |
| Cultivated Crops | 9.865% |
| Developed, Open Space | 6.610% |
| Deciduous Forest | 4.106% |
| Developed, Low Intensity | 3.396% |
| Herbaceous | 2.837% |
| Woody Wetlands | 1.626% |
| Developed, Medium Intensity | 1.416% |
| Developed, High Intensity | 0.358% |
| Barren Land | 0.256% |
| Evergreen Forest | 0.068% |
| Emergent Herbaceuous Wetlands | 0.049% |
| Open Water | 0.006% |
| Mixed Forest | 0.001% |

| | |
|---|---|
| **Drainage area** | 78,921 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Beeville |
| **Counties** | Bee |
| **EcoRegions** | Southern Post Oak Savanna |
| **Climate** | Rain: 29” – 33”; Low - 58° F - 59° F; High: 81°F |
| **Water Body Uses** | Aquatic Life, Recreation |
| **Permitted WWTFs** | WQ0010124-002 – City of Beeville: 3,000,000 gpd with provision for irrigation |

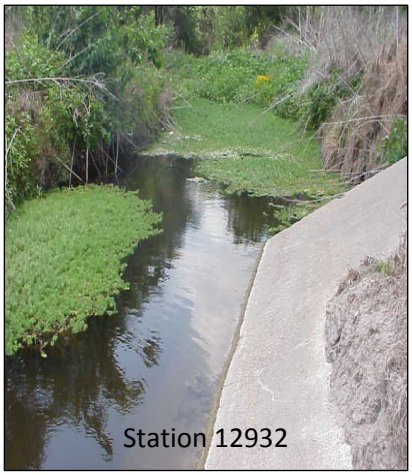
### Special Studies

The Poesta Creek watershed was included in the target monitoring to support the Copano Bay TMDL as described in the San Antonio – Nueces Basin write-up on Page 8.

## Water Quality Analysis

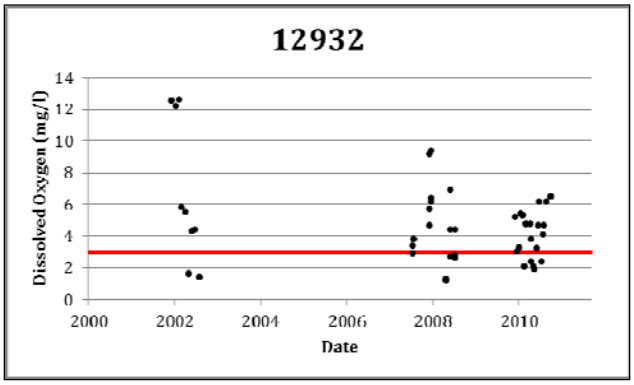
The analysis is based on data from **Station 12932**, at the US 181 bypass, was used for the 2012 IR to assess DO and *E. coli*. **An *E. coli* concern,** based on limited data, and a **low DO concern** were identified. The data analyzed were collected during non-biased monitoring for the special study from March to November 2010. NRA will resume quarterly routine monitoring for bacteria, flow, and field parameters in FY 2014.

The watershed is mainly rural, but includes the city of Beeville. One of Beeville's two WWTFs discharges into this segment. Bacteria data collected at this WWTF during the special study were all well below the single sample criteria. Therefore the bacteria contribution is from either wildlife, livestock and / or faulty OSSFs.




### Aquatic Life Use Assessment

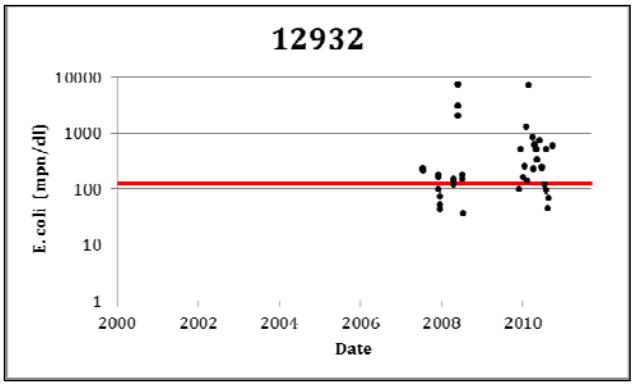
| DO | Status | # samples | Min | Max | Median | <2 | <3 |
|---|---|---|---|---|---|---|---|
| Minimum 2.0 mg/l | FS | **18** | **1.9** | **6.2** | **4.0** | **1** | **5** |
| Screening Level 3.0 mg/l | **CS** | | | | | | |




The DO measurements in 2001 and 2002 were taken during a flow monitoring study, and the 2007 and 2008 data were taken during the targeted monitoring of the special study**.**

### Recreation Use

| *E. coli* | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|
| Geomean 126 cfu/100 ml | **CS** | **18** | **93** | **7,200** | **363.39** | **0** | **8** |




Given the extreme range of *E. coli* values, one might surmise that they may be related flow. However, the only flow data available was taken in 2001 and 2002, so any relationship to flow cannot be statistically supported at this time.

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | NA | 18 | 13.1 | 28.7 | 24.2 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | NA | 18 | 7.2 | 7.7 | 7.4 | 0 | 0 |

| TDS | Status | # samples | Min | Max | Average | >1,700 |
|---|---|---|---|---|---|---|
| 1,700 mg/l | NA | 18 | 132 | 1716 | 1,339 | 1 |

# WATERSHED SUMMARIES OF THE NUECES RIVER BASIN

The Nueces River Basin originates in Edwards County and extends approximately 315 miles to Nueces Bay near Corpus Christi. The basin is bordered by: the Colorado, Guadalupe, and San Antonio River Basins to the north; the San Antonio – Nueces Coastal Basin to the southeast; the Nueces – Rio Grande Coastal Basin to the south, and the Rio Grande River basin to the south and southwest. The total basin drainage area covers approximately 17,000 square miles, encompassing all or part of 23 counties in South-Central Texas. Rivers within the basin include the Atascosa River, the Frio River and its tributaries (San Miguel Creek, Hondo Creek, Sabinal River, and Leona River), and the Nueces River and its tributaries.

Throughout the basin, the rivers are used for water supply and recreational purposes. The basin is home to numerous state-operated recreational areas including: Choke Canyon State Park on the south side of Choke Canyon Reservoir near Three Rivers, Lake Corpus Christi State Park on the southeast bank of Lake Corpus Christi near Mathis, Garner State Park north of Concan, Tips State Recreational Area on the Frio River in Three Rivers, Lipantitlan State Historic Park State Historic Park near Sandia, Lost Maples State Natural Area north of Vanderpool, and Hill Country State Natural Area north of Hondo.

## Water Quality Overview of the Nueces River Basin

The headwaters of the Nueces River Basin begin in Edwards, Real, and Bandera counties in the Edwards Plateau and include several spring fed creeks and rivers including the Nueces, Frio, and Sabinal rivers. Very few water quality concerns or impairments exist in this area. As the Nueces and its tributaries flow through the Southern Texas Plains flows become increasingly dependent on precipitation events to sustain river flows. Soils become finer and sediment loads build increasing turbidity. Salts and other minerals increase in concentration under low stream flow conditions. In times of moderate or extreme drought conditions, flows in the Nueces and Frio rivers may stop completely. Biological communities survive in isolated pools until flows resume. DO concentrations can be very low, especially in the summer months where high temperatures decrease available oxygen to fish and other aquatic species.


Montell Creek in Uvalde County


Frio River in McMullen County


Choke Canyon Reservoir

During flood events, water that originates near the headwaters can take several weeks to travel to the two main reservoirs in the lower half of the river basin. Choke Canyon Reservoir, located in McMullen and Live Oak Counties, is capable of impounding 695,271 AF of water from the Frio River and San Miguel creek. Lake Corpus Christi, located in Live Oak, San Patricio, and Jim Wells counties, is capable of impounding 257,260 AF of water from the Nueces, Frio, and Atascosa rivers. Water from Choke Canyon can be used to supplement Lake Corpus Christi in times of extreme drought. Together, both Lake Corpus

Christi and Choke Canyon are known as the Reservoir System and supply water to many of the communities and cities in the region. Water in the Reservoir System is subject to the effects of evaporation in between rain events. Dissolved minerals concentrations tend to increase as water levels decrease.

### Lower Nueces River WPP

The Choke Canyon Reservoir / Lake Corpus Christi Reservoir System supplies water for municipal and industrial use in the Coastal Bend area of South Texas. The City of Corpus Christi is the primary water supplier. Nearly 500,000 people rely on this source for their drinking water supply. The water is released from Lake Corpus Christi and delivered to water treatment plants (WTP) via the Nueces River below Lake Corpus Christi (Segment 2102).

In November 2009, a turbidity spike (from 20 NTU to 1,900 NTU) resulted in a drinking water violation at the City of Corpus Christi O.N. Stevens WTP. A USGS study concluded that the primary cause was a very large rain event (4"-6") in the Bayou Creek watershed. This watershed is primarily agricultural fields, and they had recently been harvested and plowed. This resulted in a large amount of sediment in the river.

The City of Corpus Christi asked the NRA to develop a source water protection plan to be proactive and prevent further violations. NRA approached the task with the intent to ultimately develop a WPP for the segment. From August of 2009 to July 2011, NRA brought together stakeholders form the watershed and formed the Nueces River Watershed Partnership. With their guidance, a list of any and all possible studies and BMPs, along with estimated costs, was developed.

When the project was started, the 2010 IR listed chlorophyll-*a* as a concern in the lower AU, and TDS was increasing. With the 2012 IR, chlorophyll-*a* is a concern for both AUs, and the segment is impaired for TDS.

The fact that this project was initiated prior to an official impairment, the TSSWCB continued the funding for the development of the WPP after the City of Corpus Christi specific project was completed. In addition to the usual WPP components such as watershed characteristics and modeling of parameter loading, a survey of large, submerged debris, will be conducted using a side-scan sonar. This information will be used to develop a management plan to prioritize removal of these items, as long the removal is beneficial and does not cause any harm.

More information on the development of the Lower Nueces River WPP is available at www.nuecesriverpartnership.org.

### Nueces River Above Frio River TMDL

The 25 miles surrounding SH 16 of the Nueces River above Frio River (Segment 2104) was included on the 1999 303(d) List as impaired for aquatic life due to low DO levels. A TMDL was conducted by the Conrad Blucher Institute for Surveying and Science at Texas A&M University – Corpus Christi (TAMUCC) between 2002 and 2004 at three sampling stations. However, the number of 24-Hr DO samples collected was not sufficient to make a determination of support of aquatic life use. Additional 24-Hr DO monitoring was completed by NRA staff which resulted in the delisting of the DO impairment. An Aquatic Life Use Attainability Analysis (ALUAA) was also conducted as part of the TDML studies. Even though the DO impairment was removed, the ALUAA resulted in the designation of an impaired macrobenthic community.

### Atascosa River TMDL and RUAA

The Atascosa River (Segment 2107) flows approximately 103 miles from just south of Lytle in Atascosa County to the Frio River, downstream of Choke Canyon Reservoir and west of Three Rivers, in Live Oak County. The Atascosa River has been on the 303(d) List since 2004 for elevated levels of bacteria for contact recreation and low levels of dissolved oxygen for aquatic life use. In 2008, the TCEQ contracted with TIAER to conduct an RUAA and ALUAA to evaluate contact recreation and aquatic life use standards.

The *Technical Aquatic Life Use-Attainability Analysis Report: Atascosa River (Segment 2107)* (http://www.tceq.texas.gov/assets/public/waterquality/tmdl/31atascosa/31-atascosa_aluaa_chaps1-5.pdf)

concluded that the data collected "confirm occasional departures from DO criteria and minor impairment to aquatic life but the remarkable stability of fish and invertebrate populations in the stream, in spite of highly variable flow conditions, demonstrates that the biotic community is well adapted to the variability. Climate, flow regime, and metabolic processes interact to impact DO levels in the river. The region receives only 29" of rainfall a year, on average, and has hot summers that strain water resources, especially during periods of drought such as in late 2010 through 2011. Rain events are infrequent but often torrential, especially during fall when tropical moisture drives the weather activity. Much of the upper Atascosa River is intermittent or ephemeral. If flows were not augmented by effluent from the Pleasanton WWTF the whole river might be classified as intermittent, perhaps with the exception of the lowermost AU. Even the lower reaches of the Atascosa River go dry once or twice every decade according to hydrographs and eye-witness accounts. Frequent breaks in flow continuity and pooling during warm summers severely depress DO and this problem is exacerbated at locations with abundant algae and aquatic plants where production and respiration cycles become more energetic creating 24-Hr DO swings of increased magnitude."

The RUAA determined that no primary contact recreation is occurring on the river. There were instances of secondary contact recreation occurring. The stakeholders that attended the presentation of the RUAA findings want to see the river reclassified as secondary contact recreation, which would raise the criteria to a geomean of 630 cfu. If and when this happens, every AU should become fully supporting

### Leona River RUAA

The Leona River (Segment 2109) is a tributary of the Frio River. The river flows 85 miles from US 83 in Uvalde County, through Zavala County, then to its confluence with the Frio River in Frio County. Historically, the Leona River was a popular place for swimming, canoeing, and fishing. Based on an editorial to the Uvalde Leader News on July 13, 2003, degradation began in the late 1960s. In 2006, based on routine water quality monitoring, the Leona River was placed on the 303 (d) List for a bacteria impairment for contact recreation. It has also had a concern tor nitrate since 2002. TIAER, with funds provided through a State General Revenue Nonpoint Source Grant by TSSWCB, conducted an RUAA to either confirm primary contact recreation or provide information that might support changing the recreational use category of the Leona River.

Water quality at nine main stem sampling sites along with seven tributary and three WWTF outfalls were monitored. TIAER created a comprehensive GIS database, conducted bacteria source tracking data analysis, and watershed modeling.

*The Leona River Recreational Use Attainability Analysis* draft report, (http://www.leonariver.org/pdfs/June_2013_RUAA2.pdf), summary includes the following: "No aquatic recreational activities (either primary or secondary) were observed by TIAER field staff during the surveys on 2012. Within the City of Uvalde, several areas did provide easy access to the river, including the Uvalde City Park. Within the Uvalde City Park, a city ordinance prohibits swimming, wading, and fishing, because these activities may cause damage to the impoundment liner at this location and also because the water within the river at the Uvalde City Park includes recycled wastewater from the Uvalde WWTF. Outside the City of Uvalde, fences, locked gates, and distance available to recreate at road crossings limited recreational opportunities along large sections of the Leona River. Within the Fort Inge Historical Park (AU_03), no recreational activities were observed, but interviewees indicated that swimming, fishing, and boating had occurred at this location and access to the water was relatively easy. Information shared by landowners and other people within the segment revealed fishing, swimming, hunting, and some boating had occurred within this AU."

Although no contact recreation was confirmed, in large part due to the drought, the stakeholders would like to be able use the river for recreational purposes when there is sufficient flow. Therefore, they are not in favor of changing the standard from primary contact recreation to secondary contact recreation.

### Lower Sabinal Nitrate-Nitrite TMDL

The Lower Sabinal River (Segment 2110) begins near the city of Sabinal in Uvalde County and flows approximately 27 miles to its confluence with the Frio River in Frio County. In 2002, the segment was listed on 303(d) List as being impaired for nitrates. The TCEQ conducted a TMDL and concluded that the source of the nitrate was from the Sabinal WWTF and its lagoons located in the 100-year floodplain. The subsequent I-Plan recommended a new WWTF located outside of the floodplain. Plant construction

began in early March in 2010 and the plant came online July 27, 2011. The old plant is sitting idle and will be decommissioned. Nitrate samples will continue to be taken and it is expected that the values will begin to come down as the result of the new WWTF.

### Upper Nueces River and Upper Frio River Arundo Removal

Pull. Kill. Plant.

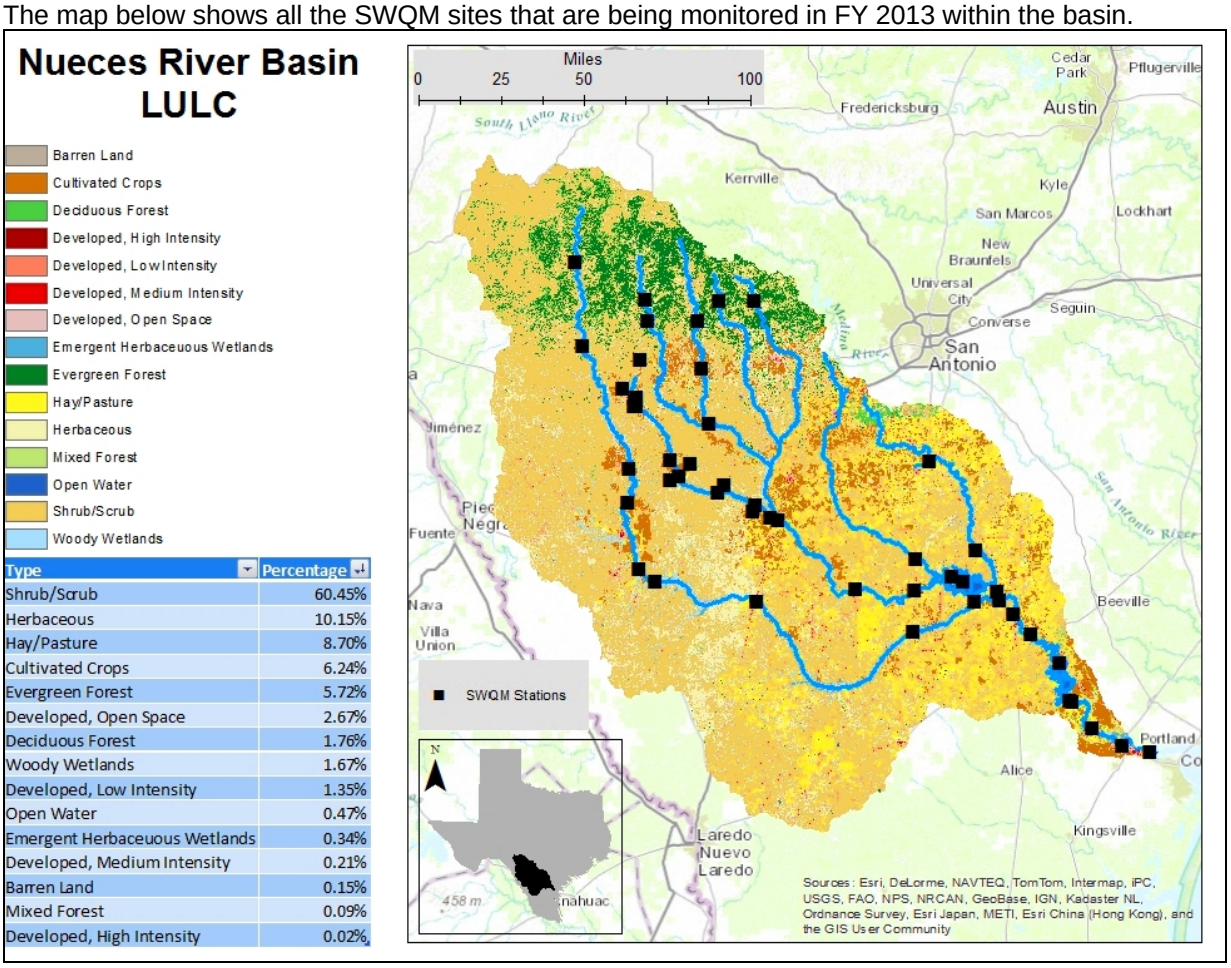
Arundo control & Riparian restoration in the Nueces Basin.

Giant cane (*Arundo donax*) is a tall perennial cane native to Asia. Growing up to 10 meters (33 feet), *Arundo* is very similar in appearance to common reed (*Phragmites*) or bamboo. *Arundo* is a vigorous plant that, once established, can create dense patches that out compete native vegetation in both wet and dry areas. *Arundo* is found on the Upper Nueces River (Segment 2112) and the Upper Frio River (Segment 2113) where it has exhibited explosive growth and disrupted riparian function in the pristine headwater streams. In response to the rapid colonization of Arundo, NRA staff and landowners banded together and formed an alliance know as Pull.Kill.Plant. The project's aim is to stop the spread of the plant while restoring native riparian plant communities. The process includes the physical removal the plants and aerial application of a herbicide. The project has aligned landowners with state and federal agencies under a common cause.

### Upper Frio River TMDL

The Upper Frio River (Segment 2113) is located in the Edwards Plateau in the Upper Nueces River basin. Segment 2113 was included on the 1999 303(d) List as impaired for aquatic life due to low DO levels. Similar to the Nueces River above the Frio River, a DO study resulted in the removal of that impairment, but resulted in designation of impaired macrobenthic and fish communities. TCEQ's SWQM team is in the process of conducting biological monitoring. One sampling event occurred in April 2010, and two sampling events are scheduled for calendar year 2013.

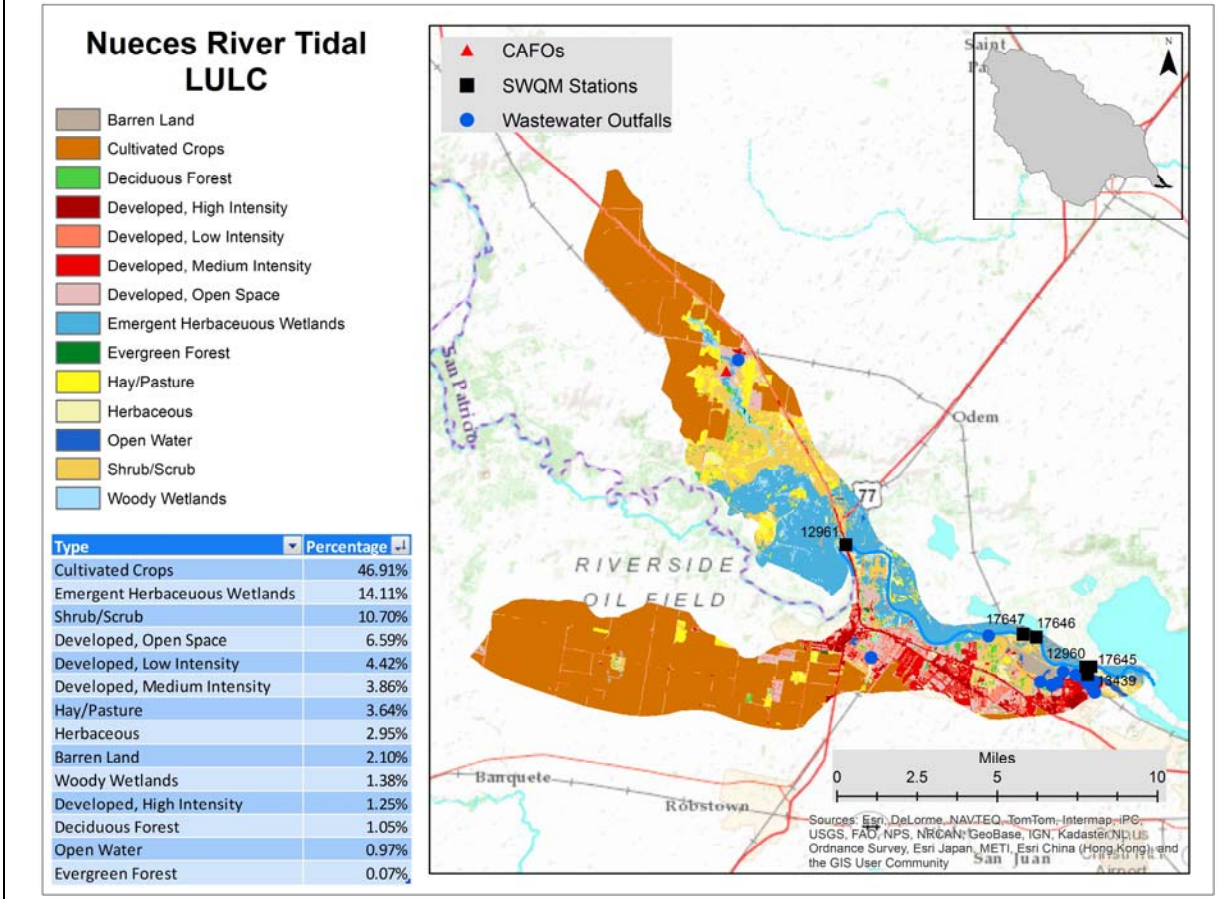
The map below shows all the SWQM sites that are being monitored in FY 2013 within the basin.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 60.45% |
| Herbaceous | 10.15% |
| Hay/Pasture | 8.70% |
| Cultivated Crops | 6.24% |
| Evergreen Forest | 5.72% |
| Developed, Open Space | 2.67% |
| Deciduous Forest | 1.76% |
| Woody Wetlands | 1.67% |
| Developed, Low Intensity | 1.35% |
| Open Water | 0.47% |
| Emergent Herbaceuous Wetlands | 0.34% |
| Developed, Medium Intensity | 0.21% |
| Barren Land | 0.15% |
| Mixed Forest | 0.09% |
| Developed, High Intensity | 0.02% |

## NUECES RIVER TIDAL WATERSHED – SEGMENT 2101

The 12 mile segment extends from its confluence with Nueces Bay in Nueces County to the Saltwater Barrier Dam in Nueces/San Patricio County and is a single AU.




| Type | Percentage |
|---|---|
| Cultivated Crops | 46.91% |
| Emergent Herbaceuous Wetlands | 14.11% |
| Shrub/Scrub | 10.70% |
| Developed, Open Space | 6.59% |
| Developed, Low Intensity | 4.42% |
| Developed, Medium Intensity | 3.86% |
| Hay/Pasture | 3.64% |
| Herbaceous | 2.95% |
| Barren Land | 2.10% |
| Woody Wetlands | 1.38% |
| Developed, High Intensity | 1.25% |
| Deciduous Forest | 1.05% |
| Open Water | 0.97% |
| Evergreen Forest | 0.07% |

| | |
|---|---|
| **Drainage area** | 175,301 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Robstown, Calallen, Corpus Christi |
| **Counties** | Nueces, San Patricio |
| **EcoRegions** | Floodplains and Low Terraces, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Average** | Rain: 31" – 33"; Low: 61° F - 63° F; High: 81° F - 82° F |
| **Water Body Uses** | Aquatic, Recreation, General |
| **Permitted WWTFs** | WQ0000531-000 – Flint Hill Resources Limited Partnership (LP): storm water<br>WQ0001255-000 – Lon C Hill: 1,098,000 gpd<br>WQ0004934-000 – City of Corpus Christi: WTP sludge<br>WQ0010401-006 – City of Corpus Christi (Allison Plant): 5,000,000 gpd<br>WQ0013644-001 – San Patricio County MUD No. 1: 75,000 gpd via Hondo Creek |

## Water Quality Analysis

The analysis is based on data from **Station 12960,** north of Viola Turning Basin. Trend analysis was conducted on data from May 2000 to November 2011. TCEQ is responsible for quarterly routine monitoring at this site.

There has been a **chlorophyll-a concern** in this segment since 2008. The saltwater barrier dam at the upper end of this segment not only protects the four freshwater intakes in the Calallen Pool, but also restricts the freshwater inflow into this tidal segment of the river. During periods with minimal pass through requirements, there is virtually no flushing of the tidal stream allowing for the buildup of chlorophyll-*a*.

The watershed immediately north of the river is comprised primarily of wetlands within the Nueces Delta. The City of Corpus Christi lies directly south. Away from the river itself, agricultural fields are the predominant land use.

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 39 | 4.4 | 12.1 | 7.5 | 0 | 0 |
| Screening Level 4.0 mg/l | NC | | | | | | |
| 24-Hr Minimum 3.0 mg/l | NC | 4 | 2.5 | 7.5 | 5.7 | 1 | NA |
| 24-Hr Average 4.0 mg/l | NC | | 4.9 | 8.3 | 6.6 | NA | 0 |

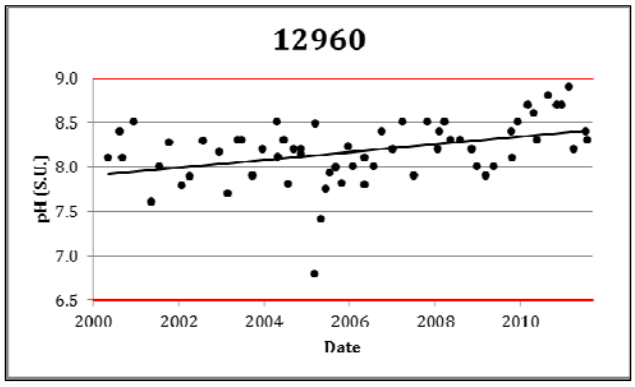
### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 22 | <10 | 2400 | 28.0 | 11 | 5 |

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 39 | 10.2 | 32.1 | 23.7 | 0 |

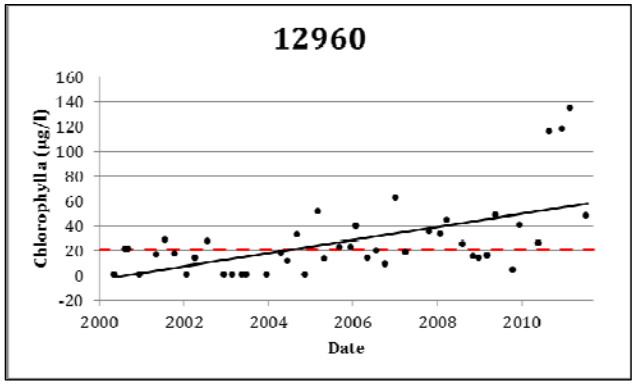
| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 39 | 6.8 | 8.7 | 8.1 | 0 | 0 |




Statistical analysis indicates that there is an increasing trend in pH values with a **t-stat of 3.34** and a **p-value of 0.00**. The station is below the WWTF outfall locations, so the increasing levels could be related to the discharges.

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 27 | <0.01 | 0.2 | 0.01 | 23 | 0 |

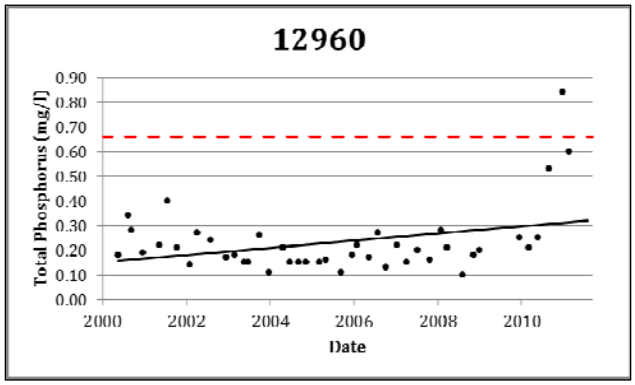
| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >21.0 |
|---|---|---|---|---|---|---|---|
| 21.0 µg/l | **CS** | **25** | **<1** | **63** | **23** | **1** | **13** |




In addition to the concern, statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with **a t-stat of 4.56** and a **p-value of 0.00.** One possible explanation is that the tidal portion is not flushed on a regular basis. In general, the amount of water released from Lake Corpus Christi for freshwater inflows into the Nueces Estuary is based on the amount of water that has flowed into the reservoir system. Except during times of major flooding, the water more or less sloshes back and forth with the tides. The Rincon Bayou Pipeline diverts some of the freshwater inflows to the upper delta instead of being passed down the river. This may also contribute to less frequent flushing of the river. The highest values were measured during the extremely dry 2011.

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | NC | 27 | <0.01 | 0.44 | 0.01 | 20 | 0 |

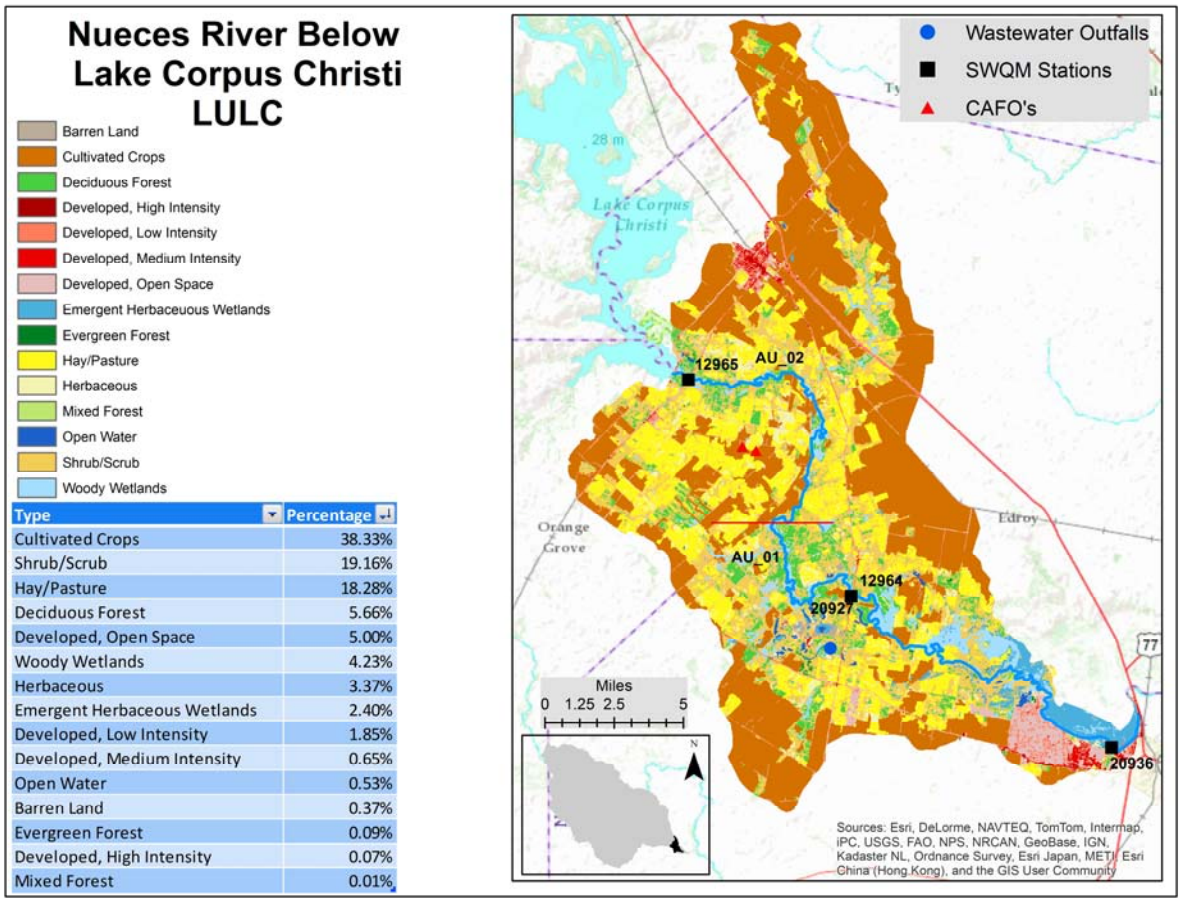
| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | NC | 24 | 0.1 | .028 | 0.18 | 0 | 0 |




Statistical analysis indicates that there is an increasing trend in total phosphorus values with a **t-stat of 2.29** and a **p-value of 0.03.** The lack of fresh water in 2011 is contributing to increased levels. Without the 2011 data, there is no significant trend.

## NUECES RIVER BELOW LAKE CORPUS CHRISTI WATERSHED – SEGMENT 2102

The 39 mile segment extends from the Saltwater Barrier Dam in Nueces/San Patricio County to Wesley E. Seale Dam in Jim Wells/San Patricio County and is divided into two AUs.




| Type | Percentage |
|---|---|
| Cultivated Crops | 38.33% |
| Shrub/Scrub | 19.16% |
| Hay/Pasture | 18.28% |
| Deciduous Forest | 5.66% |
| Developed, Open Space | 5.00% |
| Woody Wetlands | 4.23% |
| Herbaceous | 3.37% |
| Emergent Herbaceous Wetlands | 2.40% |
| Developed, Low Intensity | 1.85% |
| Developed, Medium Intensity | 0.65% |
| Open Water | 0.53% |
| Barren Land | 0.37% |
| Evergreen Forest | 0.09% |
| Developed, High Intensity | 0.07% |
| Mixed Forest | 0.01% |

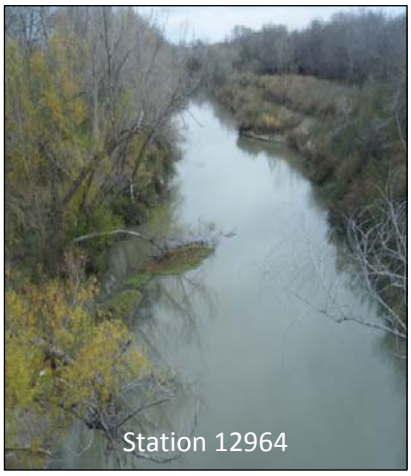
| | |
|---|---|
| **Drainage area** | 116,863 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Mathis, Corpus Christi, Calallen, Sandia |
| **Counties** | Jim Wells, San Patricio, Nueces |
| **EcoRegions** | Floodplains and Low Terraces, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Average** | Rain: 31" – 33"; Low: 61° F – 62° F; High: 81° F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Public Water Supply |
| **Permitted WWTFs** | WQ0002027-000 – Wright Materials, Inc.: no-discharge permit |

### Special Studies

The Lower Nueces River watershed is the subject of the WPP described in the Nueces Basin write-up on Page 26.

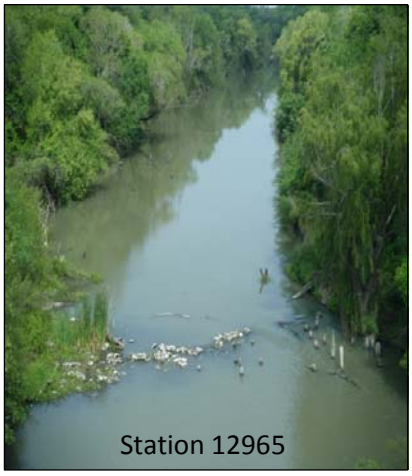
## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Javelin Creek just downstream of the Jim Wells/Nueces county line**. AU_02** is the reach from the upstream end of AU_01 to the upstream end of the segment.


Station 12964

The analysis for AU_01 is based on data from **Station 12964,** at FM 666. Trend analysis was conducted on data from January 2000 to October 2011. NRA is responsible for quarterly routine monitoring at this site.

The analysis for AU_02 is based on data from **Station 12965,** at SH 359. Trend analysis was conducted on data from January 2000 to October 2011. NRA is responsible for quarterly routine monitoring at this site.


Station 12965

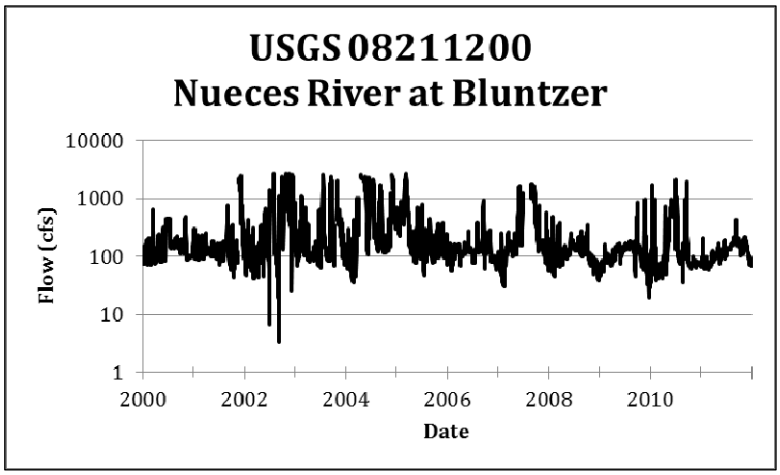
Both Stations 12964 and 12965 are located at the upstream end of their respective AUs. **Station 20936,** located near the downstream end of AU_01, was added as a NRA routine site in October 2011 so that when enough data have been collected at this site, it will be used to assess AU_01 since Station 12964 is more representative of AU_02.

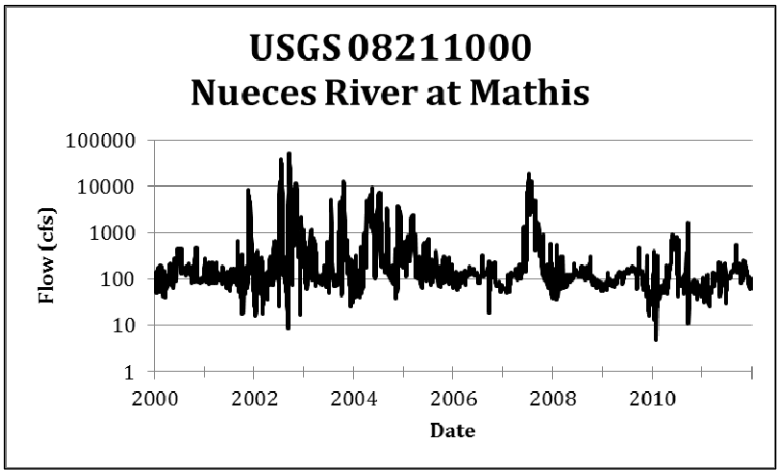
There has been a **chlorophyll-a concern** in AU_01 since 2008 and in AU_02 as of the 2012 assessment. Average TDS values have been increasing since 2006 and a **TDS impairment** was identified in the 2012 assessment.

The watershed is primarily rural crop lands. The City of Corpus Christi lies at the downstream end, and the City of Mathis is near the upstream end. Several small communities are located in between along the river

The USGS flow gauge at the Nueces River at Bluntzer is located at the same location as Station 12964. The annual mean flows are:

2000 – 171 cfs
2001 – 190 cfs
2002 – 336 cfs
2003 – 304 cfs
2004 – 467 cfs
2005 – 357 cfs
2006 – 130 cfs
2007 – 318 cfs
2008 – 115 cfs
2009 – 120 cfs
2010 – 200 cfs
2011 – 124 cfs






The USGS flow gauge at the Nueces River at Mathis is located at the same location as Station 12965. It is a short distance downstream of the Lake Corpus Christi dam, and therefore records not only the release from the lake but also inflow from below the dam. The annual mean flows are:

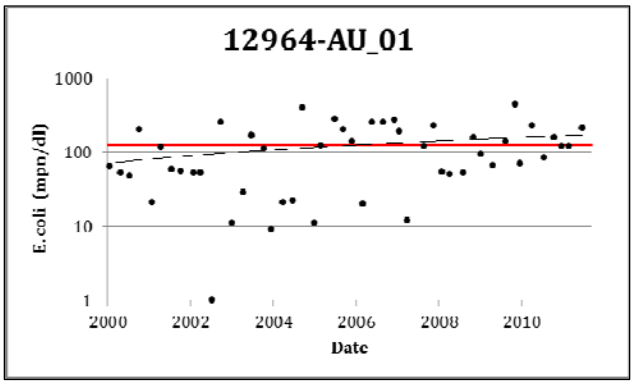
2000 – 159 cfs
2001 – 357 cfs
2002 – 3,086 cfs
2003 – 702 cfs
2004 – 1,237 cfs
2005 – 310 cfs
2006 – 116 cfs
2007 – 1,479 cfs
2008 – 109 cfs
2009 – 109 cfs
2010 – 150 cfs
2011 – 119 cfs

**Aquatic Life Use Assessment**

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 28 | 4.8 | 10.3 | 7.4 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 28 | 7.6 | 11.4 | 8.8 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

**Recreation Use**

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | FS | 28 | 9 | 440 | 85.55 | 0 | 2 |
| AU-02 | | FS | 28 | <1 | 200 | 19.16 | 3 | 0 |



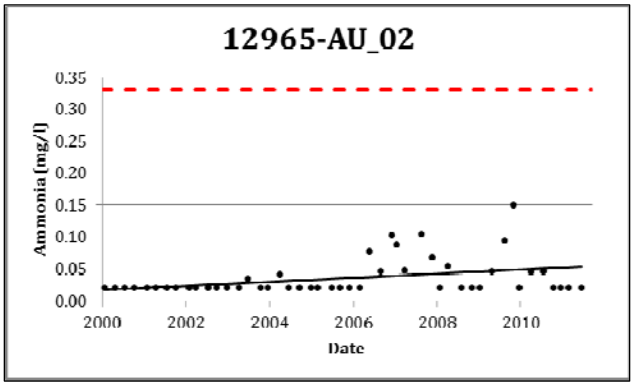

Statistical analysis indicates that there is an increasing trend in *E. coli* values in AU_01 with a **t-stat of 2.09** and a **p-value of 0.04**. The sampling location is located just below three small communities along the river that rely on OSSFs: one in Jim Wells County and two in San Patricio County. There could be an increasing number of OSSF failures.

**General Use**

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.8 °C | FS | 28 | 13.6 | 30.4 | 22.0 | 0 |
| AU-02 | | FS | 28 | 11.6 | 30.7 | 21.7 | 0 |

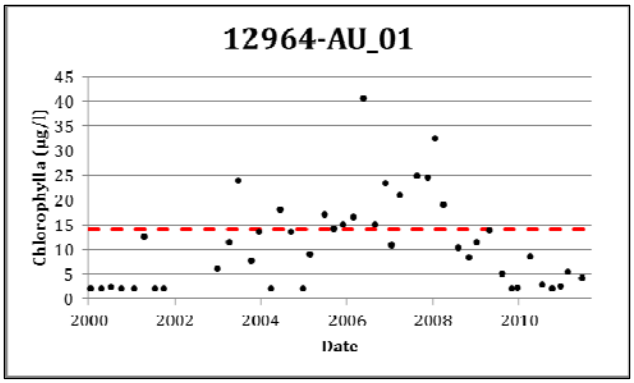
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 28 | 7.6 | 8.4 | 8.1 | 0 | 0 |
| AU-02 | | FS | 28 | 7.9 | 8.5 | 8.3 | 0 | 0 |

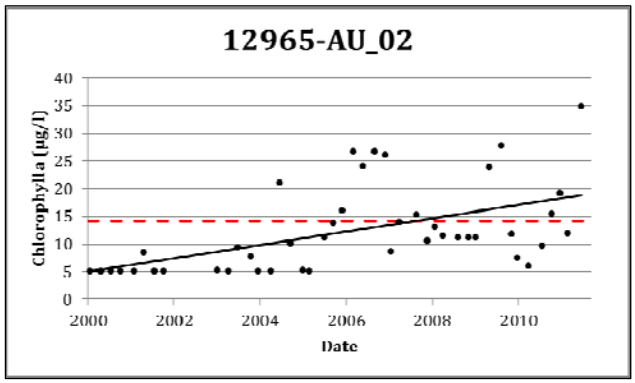
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 28 | <0.02 | 0.082 | 0.02 | 17 | 0 |
| AU-02 | | NC | 28 | <0.02 | 0.149 | 0.03 | 14 | 0 |




Statistical analysis indicates that there is an increasing trend in ammonia values in AU_02 with a **t-stat of 2.63** and a **p-value of 0.01.** The values are still well below the screening level, and the trend may be attributed to the fact that most of the data values for the first six years of the analysis were non-detects.

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | **CS** | **28** | **<2** | **40.5** | **13.7** | **3** | **13** |
| AU-02 | | **CS** | **28** | **<5** | **27.7** | **11.4** | **2** | **9** |



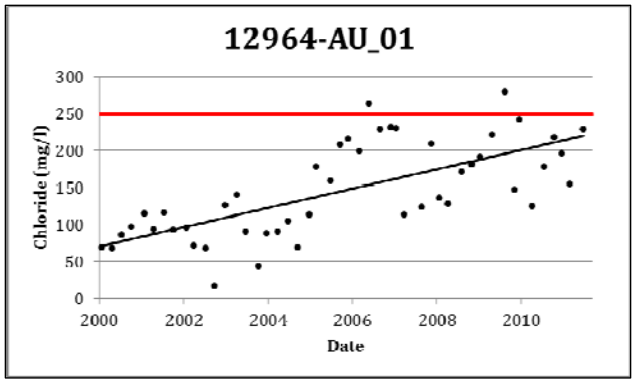



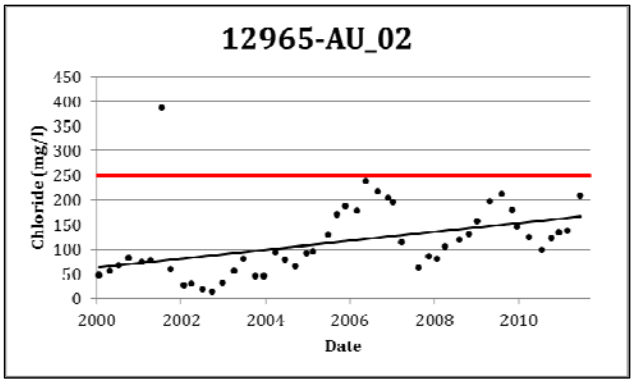

In addition to the concern for the entire segment, statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values in AU_02 with a **t-stat of 3.98** and a **p-value of 0.00**. There have been reports of increasing water hyacinth infestation on the river, especially in AU_02. The source of the elevated values in AU_01 appears to have been removed. Subsequent data collected in 2012 and 2013 are below the screening level at the sampling location.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | FS | 28 | <0.02 | 0.315 | 0.063 | 5 | 0 |
| AU-02 | | FS | 28 | <0.02 | 0.215 | 0.022 | 14 | 0 |

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 28 | <0.04 | 0.339 | 0.126 | 2 | 0 |
| AU-02 | | NC | 28 | 0.041 | 0.206 | 0.128 | 0 | 0 |

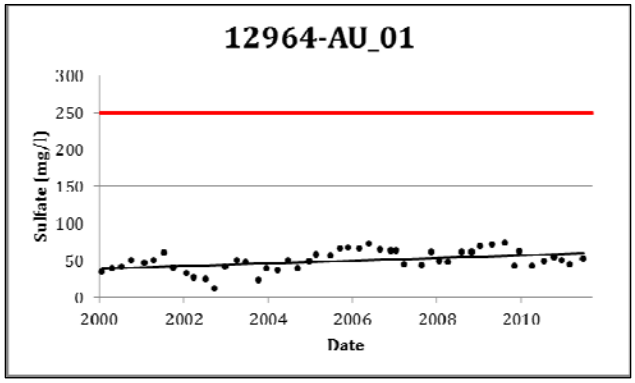
| Chloride | Status | # samples | Min | Max | Average | >250 |
|---|---|---|---|---|---|---|
| 250 mg/l | FS | 56 | 45 | 279 | 154 | 2 |

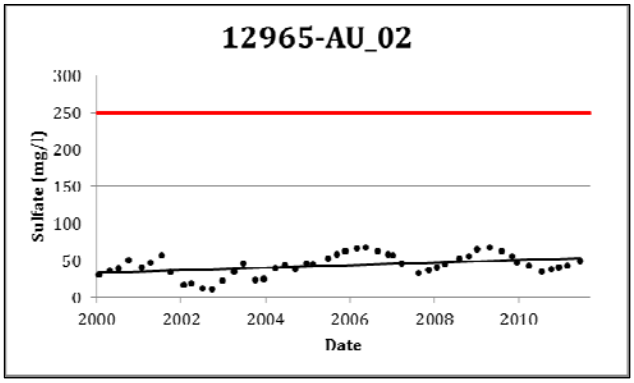



Statistical analysis indicates that there is an increasing trend in chloride values in AU_01 with a **t-stat of 6.47** and a **p-value of 0.00** and in AU_02 with a **t-stat of 3.15** and a **p-value of 0.00.** The higher values tend to correlate to dry periods. The increasing trends may be due to increasing frequencies of dry periods that south Texas has been experiencing.

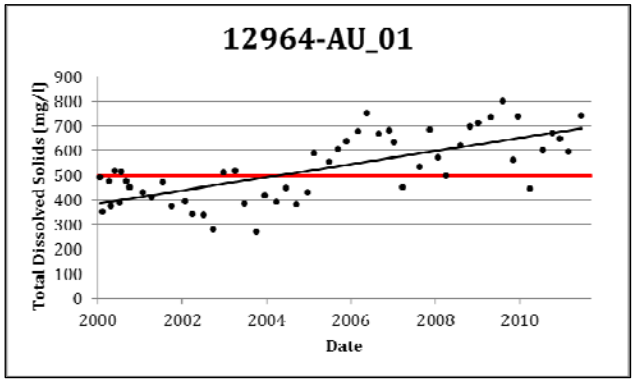
| Sulfate | Status | # samples | Min | Max | Average | >250 |
|---|---|---|---|---|---|---|
| 250 mg/l | FS | 56 | 25 | 74 | 53 | 0 |

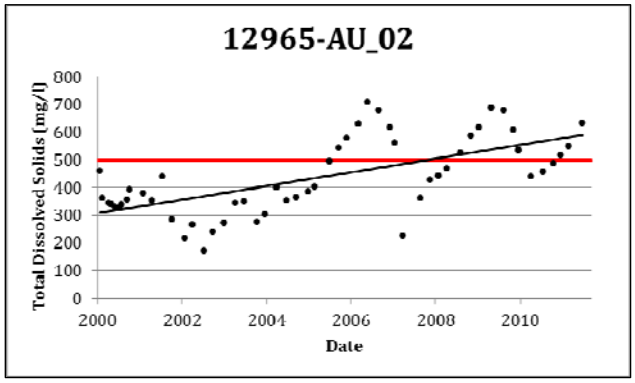



Statistical analysis indicates that there is an increasing trend in sulfate values in AU_01 with a **t-stat of 3.54** and a **p-value of 0.00** and in AU_02 with a **t-stat of 3.07** and a **p-value of 0.00**. These trends are also most likely related to the chloride trends. However, the actual values are well below the criteria level and no apparent concern in the near future.

| TDS | Status | # samples | Min | Max | Average | >500 |
|---|---|---|---|---|---|---|
| 500 mg/l | NS | 56 | 226 | 801 | 546 | 34 |




Statistical analysis indicates that there is also an increasing trend in TDS values in AU_01 with a **t-stat of 7.05** and a **p-value of 0.00** and in AU_02 with a **t-stat of 36.94 and a p-value of 0.00.** These trends are also most likely related to the chloride trends, but in this case, the values are such that the segment is now listed as having a TDS impairment.

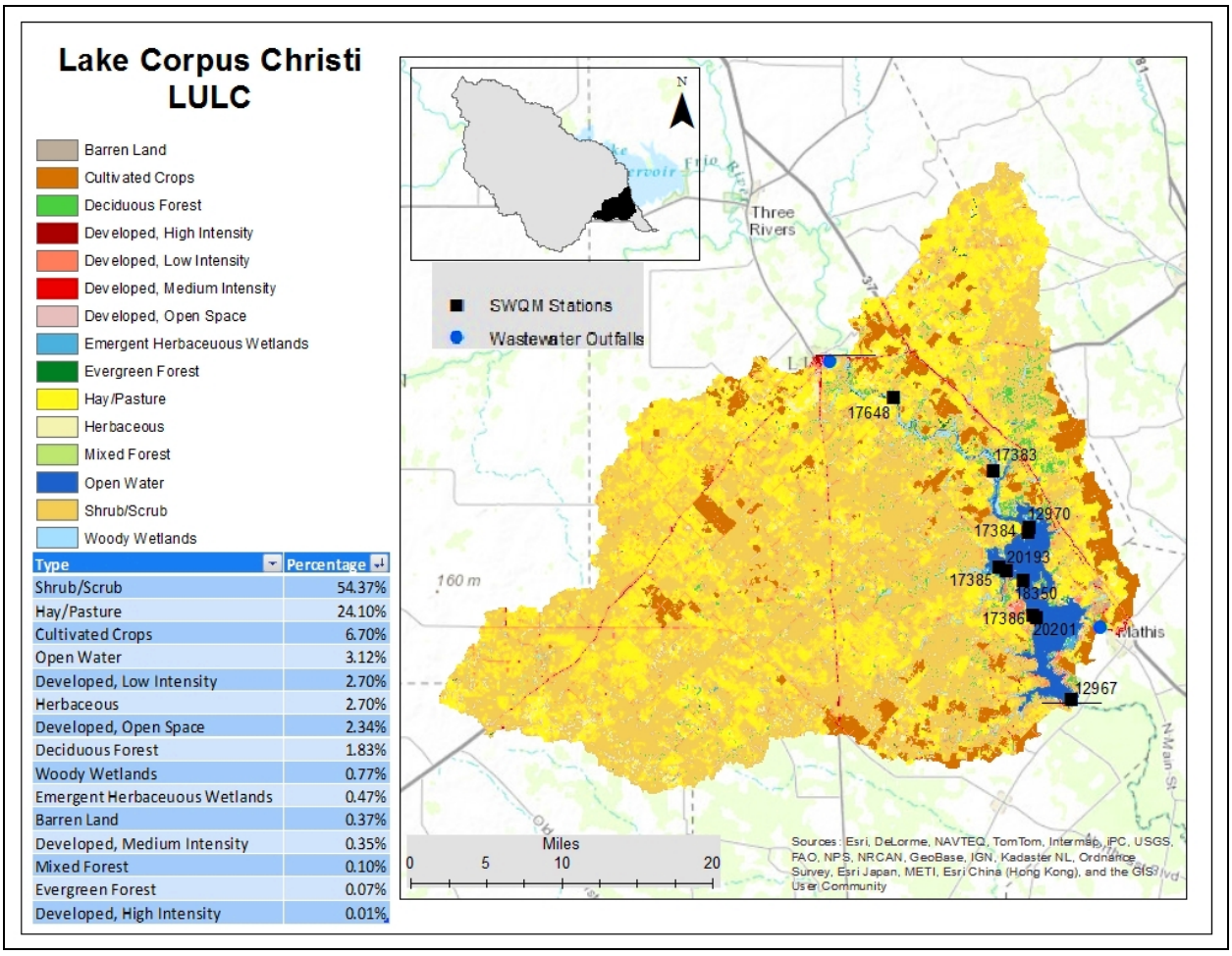
### Public Water Supply Use

Both AUS are fully supporting public water supply use.

# LAKE CORPUS CHRISTI WATERSHED – SEGMENT 2103

Lake Corpus Christi is formed by Wesley E. Seale Dam in Jim Wells/San Patricio County and impounds the Nueces River. It is defined by the 94' above MSL elevation with a surface area of 18,256 acres. The lake covers portions of Live Oak, Jim Wells, and San Patricio Counties. The segment extends upstream to a point 100 m (110 yards) upstream of US 59 in Live Oak County. It is divided into six AUs.

Lake Corpus Christi is one of two reservoirs in the basin that supplies drinking water for the Coastal Bend area. It is owned and operated by the City of Corpus Christi.

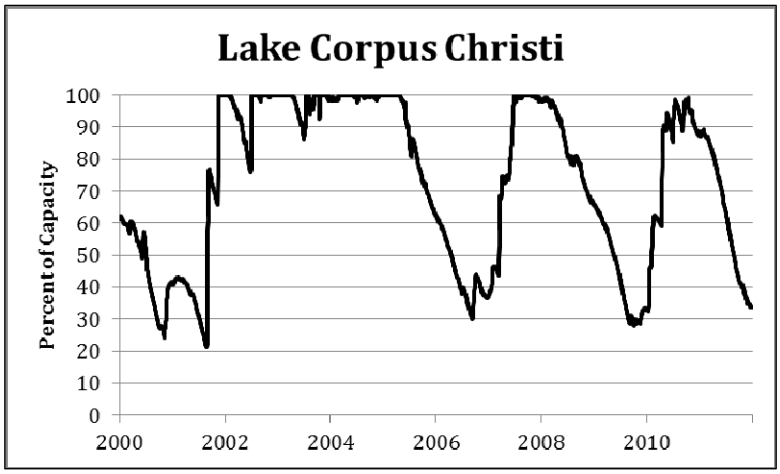



| Type | Percentage |
|---|---|
| Shrub/Scrub | 54.37% |
| Hay/Pasture | 24.10% |
| Cultivated Crops | 6.70% |
| Open Water | 3.12% |
| Developed, Low Intensity | 2.70% |
| Herbaceous | 2.70% |
| Developed, Open Space | 2.34% |
| Deciduous Forest | 1.83% |
| Woody Wetlands | 0.77% |
| Emergent Herbaceuous Wetlands | 0.47% |
| Barren Land | 0.37% |
| Developed, Medium Intensity | 0.35% |
| Mixed Forest | 0.10% |
| Evergreen Forest | 0.07% |
| Developed, High Intensity | 0.01% |

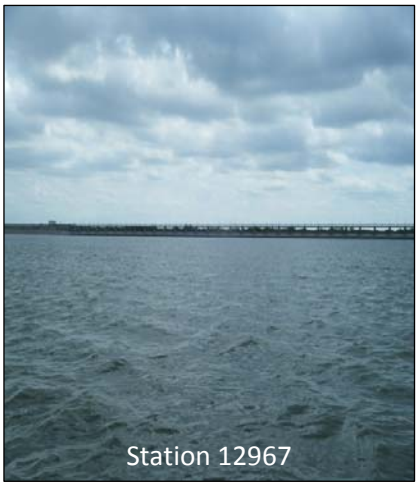
| | |
|---|---|
| **Drainage area** | 505,550 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | George West, Sandia, Mathis |
| **Counties** | Jim Wells, San Patricio, Live Oak, Bee, McMullen |
| **EcoRegions** | Texas-Tamaulipan Thornscrub, Southern Post Oak Savanna |
| **Climate Annual Average** | Rain: 27" – 31"; Low: 58° F - 60° F; High: 81° F – 83° F |
| **Water Body Uses** | Aquatic, Recreation, General, Fish Consumption, Public Water Supply |
| **Permitted WWTFs** | WQ0004859-000 – Bar Ranch: WWTF sludge and domestic septic<br>WQ0010015-001 – City of Mathis: 947,000 gpd via unnamed tributary<br>WQ0010455-002 – City of George West: 539,000 gpd via Nueces River<br>WQ0011165-001 – Texas Parks and Wildlife Department (TPWD) – Lake Corpus Christi State Park: 67,000 gpd via evaporation and surface irrigation |

## Water Quality Analysis

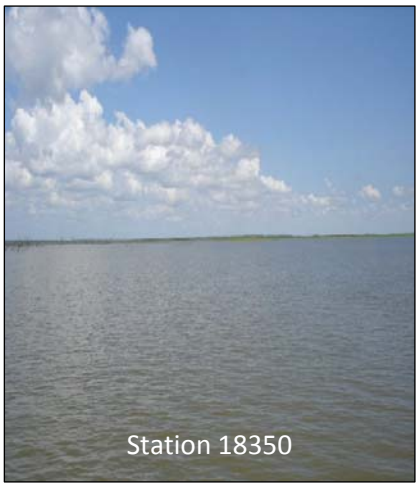
**AU_01** is defined as mid-lake near the dam**. AU_02** is an area approximately 4 miles southeast of the FM 3162 and FM 534 intersection near the western shore. **AU_03** is the eastern arm of the lake near the Lagarto Creek inlet. **AU_04** is the upper portion of the lake on the opposite shore from Hideaway Hill. **AU_05** is the upper arm of the lake in the more riverine section surrounding FM 534. **AU_06** is the uppermost riverine part of the lake upstream of FM 534 to the upper end of the segment just upstream of US 59.




The analysis for AU_01 is based on data from **Station 12967,** located mid-lake near the dam. Trend analysis was conducted on data from January 2000 to September 2011. NRA is responsible for quarterly routine monitoring at this site for CRP. USGS also conducts sampling at this location.

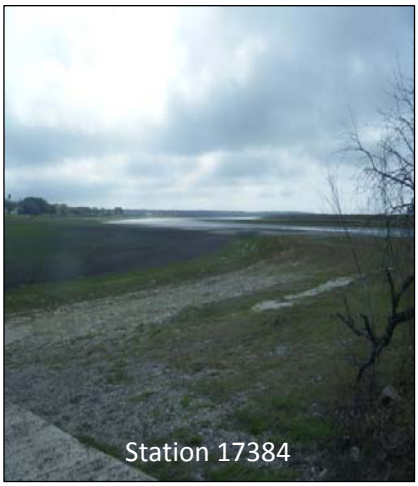

Station 12967

The analysis for AU_02 is based on the combined data for **Station 17386,** located off of the north side of the Arrowhead Subdivision, **Station 18350,** located mid-lake east of the Lagarto Subdivision, and **Station 20201,** located off the point of the Arrowhead Subdivision.


Station 18350

Stations 17386 and 20201 are USGS sites. NRA conducted quarterly routine monitoring at Station 18350 from November 2004 through October 2006, but discontinued after the boat ramp used to access the site became private and no longer available for NRA's use. Combining the data from these three sites resulted in sufficient data for trend analysis for DO, water temperature, and pH from January 2001 through June 2010.

The analysis for AU_03 is based on data from USGS **Station 20193,** located near the Lagarto Creek arm of the lake. Data from USGS **Station 17385,** located near Ramireno Creek, was also used for the chloride, sulfate, and TDS analysis. The time period of the data from March 2002 through June 2010 was insufficient for trend analysis.


Station 17384

The analysis for AU_04 is based on data from **Station 17384,** located west of Hideaway Hill. Trend analysis was conducted for DO, water temperature, pH, and TDS from March 2002 through June 2011. NRA is responsible for quarterly routine monitoring at this site.

The analysis for AU_05 is based on data from USGS **Station 17383,** located at FM 534. Trend analysis was conducted for DO, water temperature, pH, and TDS from February 2000 through June 2010.

The analysis for AU_06 is based on data from **Station 17648,** located at County Road (CR) 151 near River Creek Acres. Trend analysis was conducted for DO, water temperature, and pH from October 2002 through October 2011.

There is a **chlorophyll-a concern** in AU_02 and AU_06. There was no chlorophyll-*a* data in AU_03. There is a **total phosphorus concern** in AU_04 and AU_06. There was no total phosphorus data in AU_03. There is a **TDS impairment** for the entire segment.

The watershed is predominantly brush and pasture lands. However, there are numerous small communities surrounding the lake.

### Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 48 | 5 | 13.2 | 7.8 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 29 | 5.5 | 11.6 | 8.0 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-03 | Minimum 3.0 mg/l | FS | 12 | 6.1 | 9.9 | 8.5 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-04 | Minimum 3.0 mg/l | FS | 17 | 5.0 | 11 | 7.6 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-05 | Minimum 3.0 mg/l | FS | 12 | 3.8 | 10.7 | 6.6 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-06 | Minimum 3.0 mg/l | FS | 28 | 5.2 | 14.8 | 8.9 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

AU_01 and AU_06 are fully supporting or have no concerns for all analyzed metals in water for aquatic life use. AU_01 has no concerns for all analyzed metals in sediment for aquatic life use.

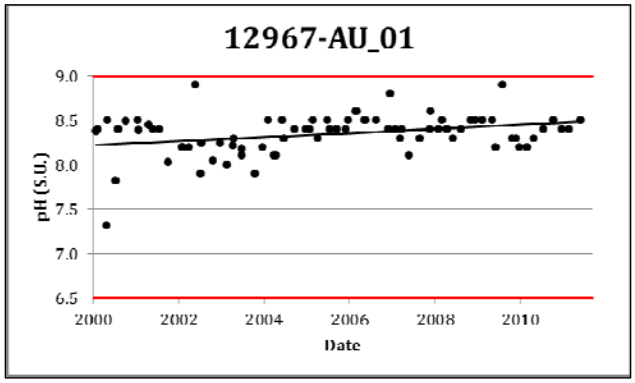
### Recreation Use

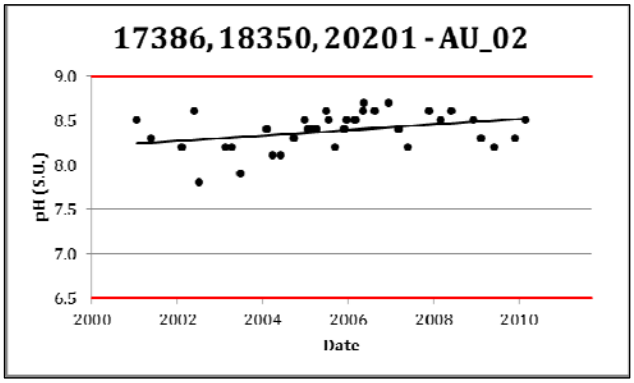
| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | FS | 28 | <1 | 22 | 1.66 | 6 | 0 |
| AU-02 | | NC | 8 | <1 | 51 | 3.61 | 2 | 0 |
| AU-04 | | FS | 14 | <1 | 200 | 4.607 | 2 | 0 |
| AU-06 | | FS | 28 | 2 | 2900 | 15.931 | 0 | 1 |

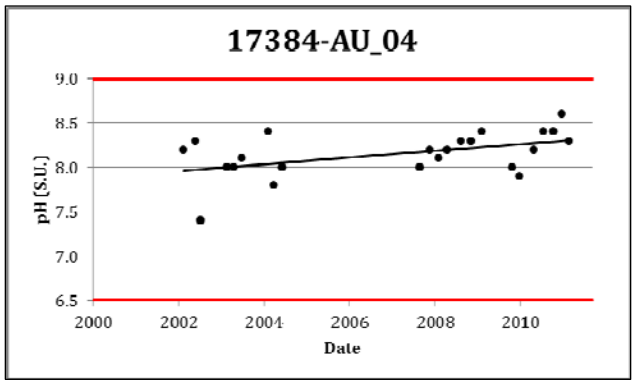
### General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >33.9 |
|---|---|---|---|---|---|---|---|
| AU-01 | 33.9 °C | FS | 48 | 11.9 | 31.5 | 24.3 | 0 |
| AU-02 | | FS | 29 | 14.1 | 31.5 | 25.5 | 0 |
| AU-03 | | FS | 12 | 16.5 | 34.0 | 29.1 | 1 |
| AU-04 | | FS | 17 | 12.4 | 32.0 | 23.0 | 0 |
| AU-05 | | FS | 12 | 17.0 | 32.5 | 30.0 | 0 |
| AU-06 | | FS | 28 | 14.7 | 32.2 | 23.2 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 48 | 8.1 | 8.9 | 8.4 | 0 | 0 |
| AU-02 | | FS | 29 | 8.1 | 8.7 | 8.5 | 0 | 0 |
| AU-03 | | FS | 11 | 8.0 | 8.7 | 8.4 | 0 | 0 |
| AU-04 | | FS | 17 | 7.8 | 8.6 | 8.2 | 0 | 0 |
| AU-05 | | FS | 12 | 7.6 | 8.3 | 8.0 | 0 | 0 |
| AU-06 | | FS | 28 | 7.4 | 8.7 | 8.2 | 0 | 0 |



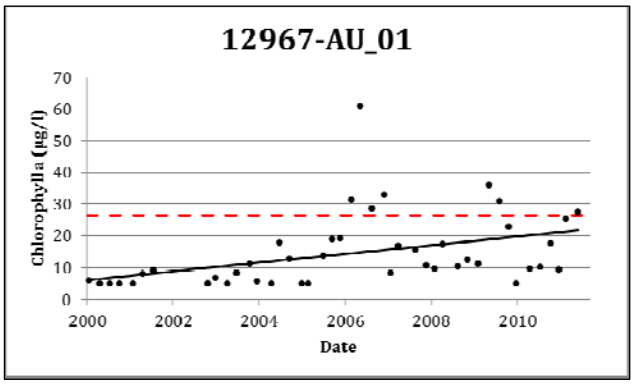



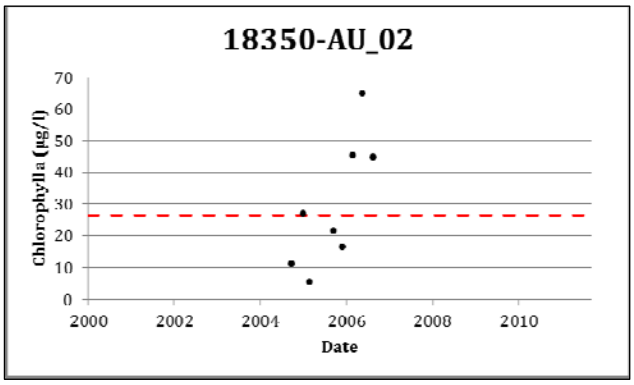



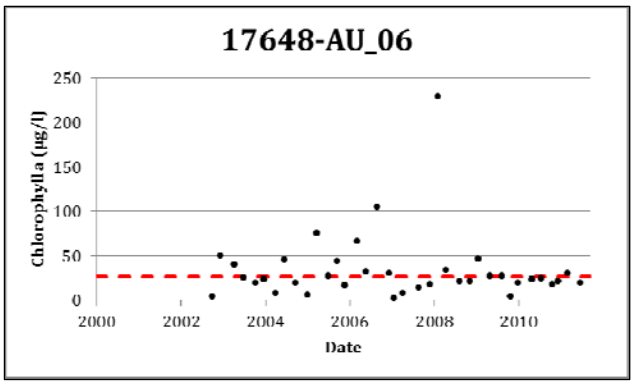

Statistical analysis indicates that there is an increasing trend in pH values in AU_01 with a **t-stat of 2.97** and a **p-value of 0.00,** in AU_02 with a **t-stat of 2.12** and a **p-value of 0.04,** and in AU_04 with a **t-stat of 2.48** and a **p-value of 0.02.** The values are all within the accepted pH range. There is no obvious correlation between the lake levels and pH values and no obvious explanation for the trends.

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.11 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.11 mg/l | NC | 28 | <0.02 | 0.074 | 0.02 | 21 | 0 |
| AU-02 | | NC | 8 | <0.02 | 0.044 | 0.02 | 7 | 0 |
| AU-04 | | NC | 14 | <0.02 | 0.061 | 0.02 | 11 | 0 |
| AU-06 | | NC | 28 | <0.02 | 0.107 | 0.02 | 19 | 0 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >26.7 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 26.7 µg/l | NC | 28 | <5 | 60.9 | 13.35 | 4 | 6 |
| AU-02 | | **CS** | **8** | **5.4** | **64.9** | **24.3** | **0** | **4** |
| AU-04 | | NC | 14 | 8.3 | 28.3 | 14.4 | 0 | 2 |
| AU-06 | | **CS** | **28** | **2.0** | **229** | **23.6** | **1** | **12** |



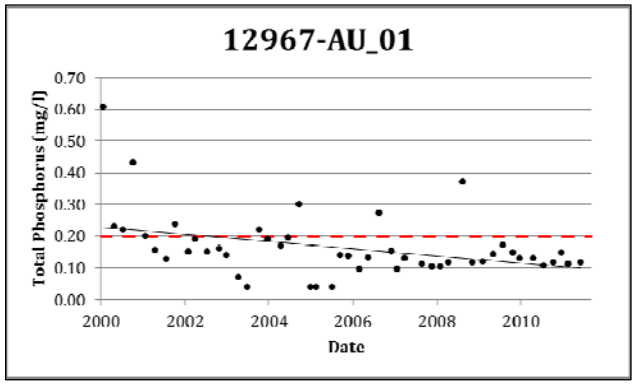



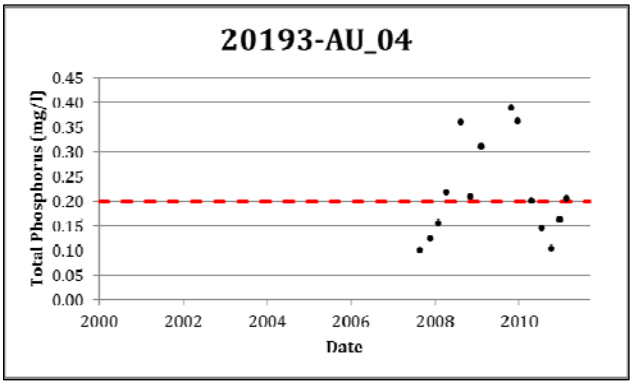



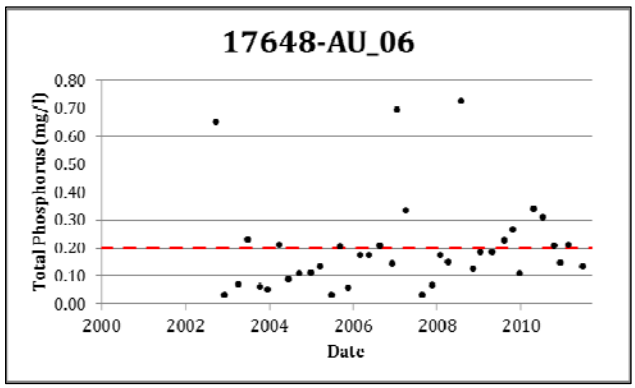

In addition to the concerns in AU_02 and AU_06, statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values in AU_01 with a **t-stat of 2.86** and a **p-value of 0.01.** The higher values may be related to low lake levels. These fluctuations will probably continue as lake levels rise with significant inflow events and falls without them.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >0.37 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.37 mg/l | NC | 28 | <0.02 | 0.25 | 0.02 | 16 | 0 |
| AU-02 | | NC | 8 | <0.02 | 0.22 | 0.02 | 4 | 0 |
| AU-04 | | NC | 14 | <0.02 | 0.1 | 0.02 | 13 | 0 |
| AU-06 | | NC | 28 | <0.02 | 0.81 | 0.02 | 18 | 2 |

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.2 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.2 mg/l | NC | 28 | <0.04 | 0.37 | 0.13 | 3 | 3 |
| AU-02 | | NC | 8 | <0.04 | 0.24 | 0.166 | 2 | 2 |
| AU-04 | | **CS** | **14** | **0.1** | **0.388** | **0.202** | **0** | **7** |
| AU-06 | | **CS** | **28** | **<0.04** | **0.723** | **0.172** | **2** | **0** |

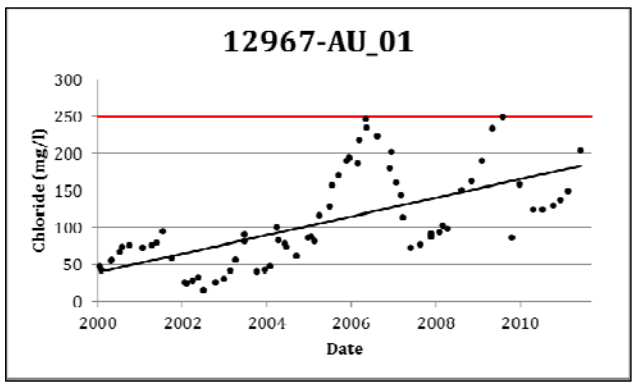


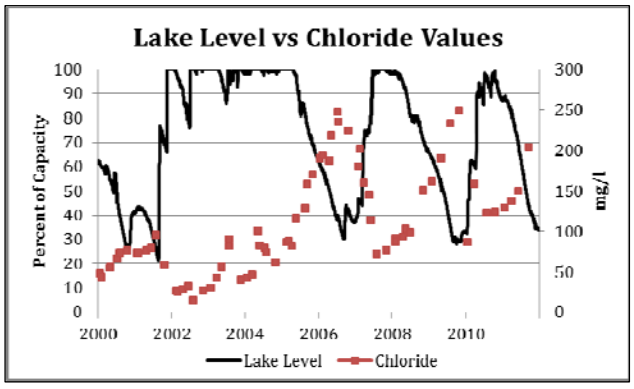




In addition to concerns in AU_04 and AU_06, statistical analysis indicates that there is a decreasing trend in total phosphorus values in AU_01 with a **t-stat of -2.27** and a **p-value of 0.03.** Elevated total phosphorus values are sometimes associated with agricultural runoff. Since the concerns are occurring in the upper portion of the lake, the more shallow nature of this area may result in less dilution and therefore higher concentrations. Since the highest values in AU_01 are during a prolonged low period in 2000 and 2001, the decreasing trend may be the result of more water in the deeper portion of the lake resulting in better dilution.

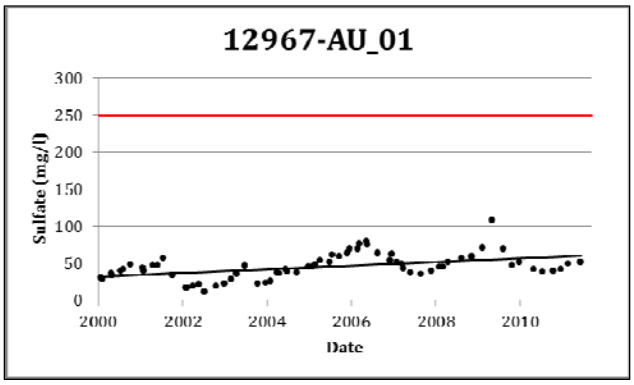
| Chloride | Status | # samples | Min | Max | Average | >250 |
|---|---|---|---|---|---|---|
| 250 mg/l | FS | 96 | 27.5 | 316 | 161 | 9 |



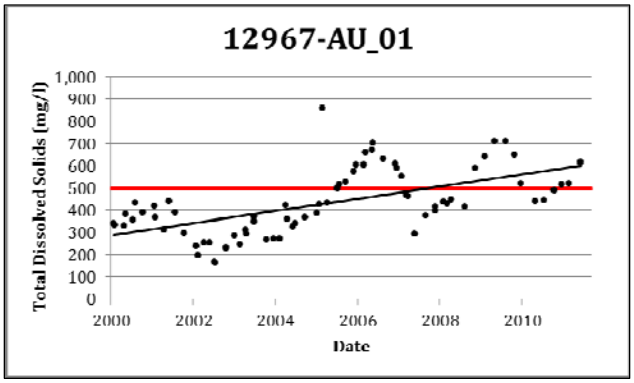

Statistical analysis indicates that there is an increasing trend in chloride values in AU_01 with a **t-stat of -5.75** and a **p-value of 0.00.** Chloride levels are also related to the lake level, with concentrations increasing as the level falls.

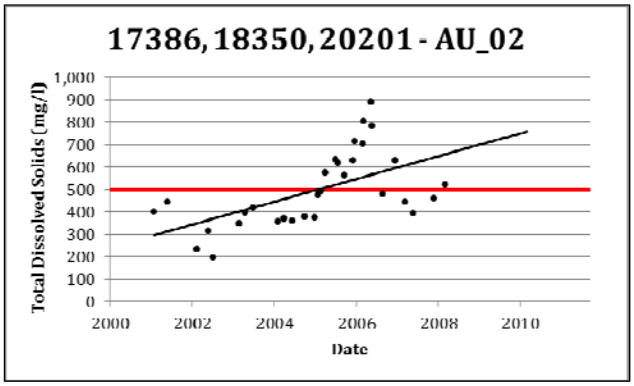
| Sulfate | Status | # samples | Min | Max | Average | >250 |
|---|---|---|---|---|---|---|
| 250 mg/l | FS | 96 | 15.2 | 216 | 62.7 | 0 |

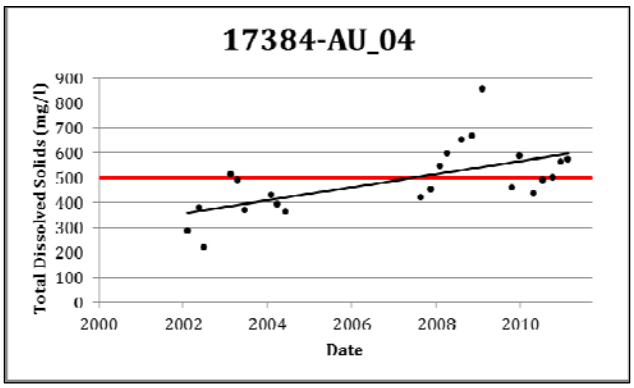



Statistical analysis indicates that there is an increasing trend in sulfate values in AU_01 with a **t-stat of 4.48** and a **p-value of 0.00.** Sulfate levels are also related to the lake level, with concentration increasing as the level falls, but not as dramatically as for chloride and TDS.

| TDS | Status | # samples | Min | Max | Average | >500 |
|---|---|---|---|---|---|---|
| 500 mg/l | FS | 134 | 262 | 1100 | 567 | 77 |




Statistical analysis indicates that there is an increasing trend in TDS values in AU_01 with a **t-stat of 6.17** and a **p-value of 0.00,** in AU_02 with a **t-stat of 3.72** and a **p-value of 0.00, a**nd in AU_04 with a **t-stat of 3.60** and a **p-value of 0.00.** TDS levels are also related to the lake level, with concentrations increasing as the level falls.

### Fish Consumption Use

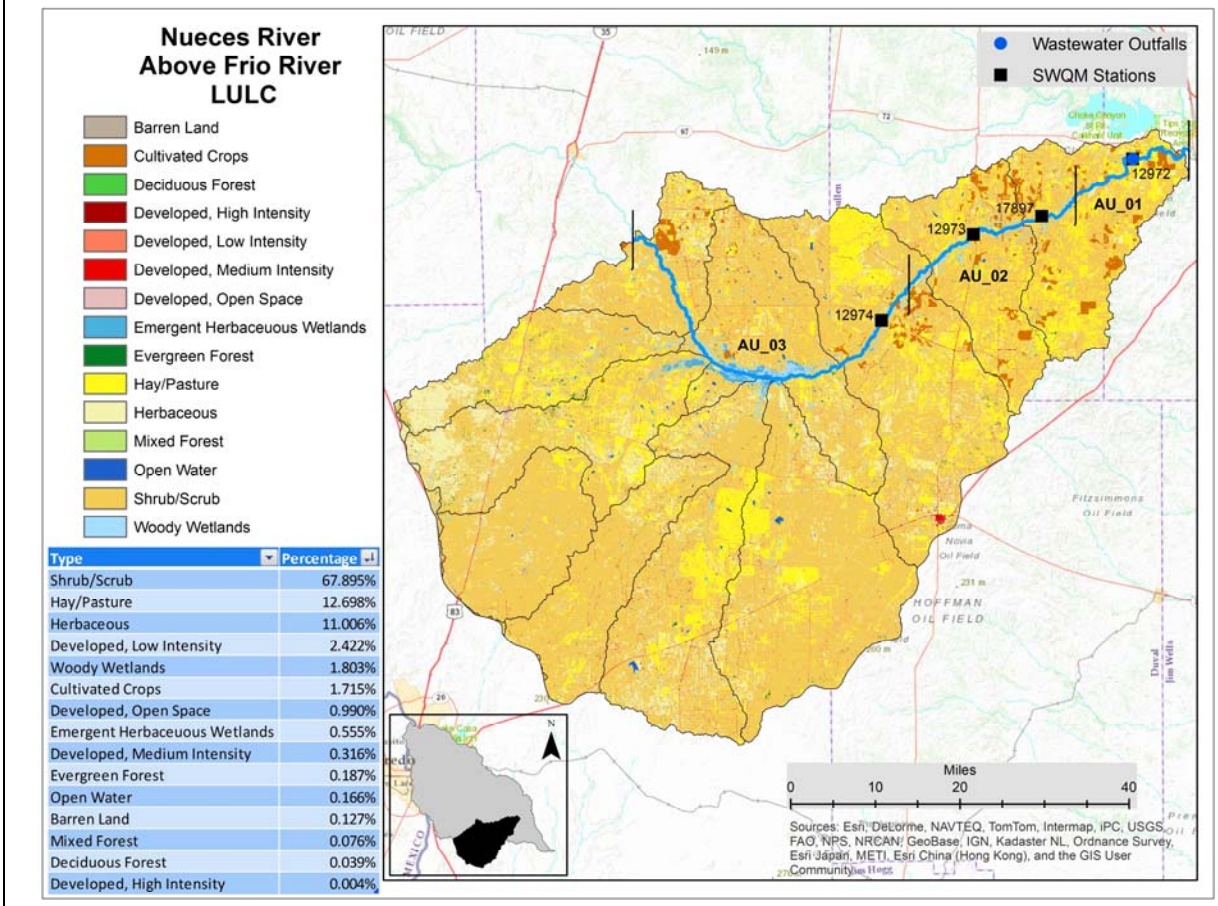
All 6 AUS are fully supporting for bioaccumulation of all analyzed metals in water for fish consumption use.

### Public Water Supply Use

All 6 AUS are fully supporting for all analyzed metals in water for public water supply use.

## NUECES RIVER ABOVE FRIO RIVER WATERSHED – SEGMENT 2104

The 91 mile segment extends from its confluence with the Frio River in Live Oak County to Holland Dam in La Salle County and is divided into three AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 67.895% |
| Hay/Pasture | 12.698% |
| Herbaceous | 11.006% |
| Developed, Low Intensity | 2.422% |
| Woody Wetlands | 1.803% |
| Cultivated Crops | 1.715% |
| Developed, Open Space | 0.990% |
| Emergent Herbaceuous Wetlands | 0.555% |
| Developed, Medium Intensity | 0.316% |
| Evergreen Forest | 0.187% |
| Open Water | 0.166% |
| Barren Land | 0.127% |
| Mixed Forest | 0.076% |
| Deciduous Forest | 0.039% |
| Developed, High Intensity | 0.004% |

| | |
|---|---|
| **Drainage area** | 1,876,877 acres |
| **Major Aquifers** | Carrizo, Gulf Coast, Yegua Jackson |
| **Cities** | Three Rivers, Calliham, Simmons, Freer, Encinal |
| **Counties** | McMullen, Live Oak, Duval, Webb, LaSalle |
| **EcoRegions** | Texas-Tamaulipan Thornscrub |
| **Climate Annual Average** | Rain: 23" – 25"; Low: 58° F - 59° F; High: 83° F - 84° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Public Water Supply, Fish Consumption |
| **Permitted WWTFs** | WQ0004184-000 – Webb County – Colorado Acres Water Plant: 28,800 gpd via evaporation<br>WQ0010088-001 - Freer Water Control and Improvement District (WCID) : 280,000 gpd via surface irrigation on nonpublic access agriculture land<br>WQ0013461-001 – US Department of Justice (DOJ): 300,000 gpd<br>WQ0013943-001 – Encinal WSC: 95,000 gpd via irrigation |

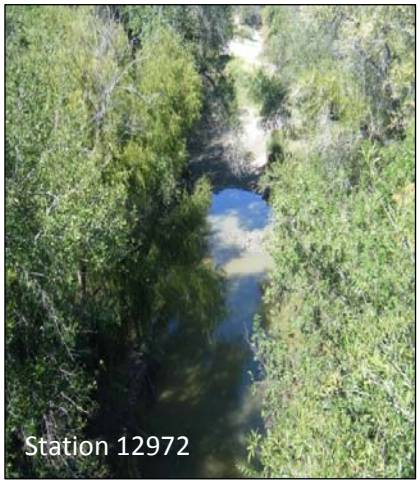
### Special Studies

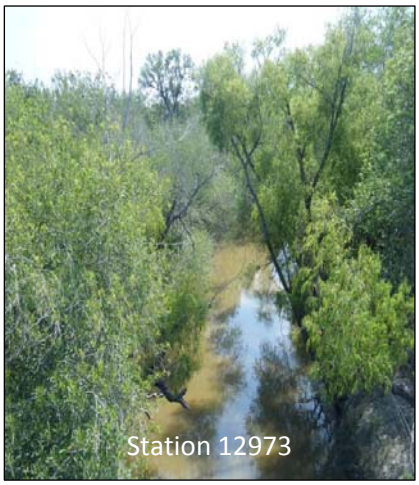
A TMDL for low DO was conducted on the Nueces River Above Frio River as described in the Nueces River Basin write-up on Page 26.

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Dragon Creek**.** **AU_02** is the reach from the upstream end of AU_01 to the confluence with Guadalupe Creek**. AU_03** is the reach from the upstream end of AU_02 to the upstream end of the segment.

The analysis for AU_01 is based on data from **Station 12972,** located at FM 1042 north of Simmons. Trend analysis was conducted on data from March 2002 through October 2011. NRA is responsible for quarterly routine monitoring at this site.




The analysis for AU_02 is based on data from **Station 12973** located at SH 16. Trend analysis was conducted on data from January 2000 through September 2011. NRA is responsible for quarterly routine monitoring at this site. Data from **Station 17897,** located on Smith Lease downstream of SH 16, was also used for the 24-Hr DO analysis.

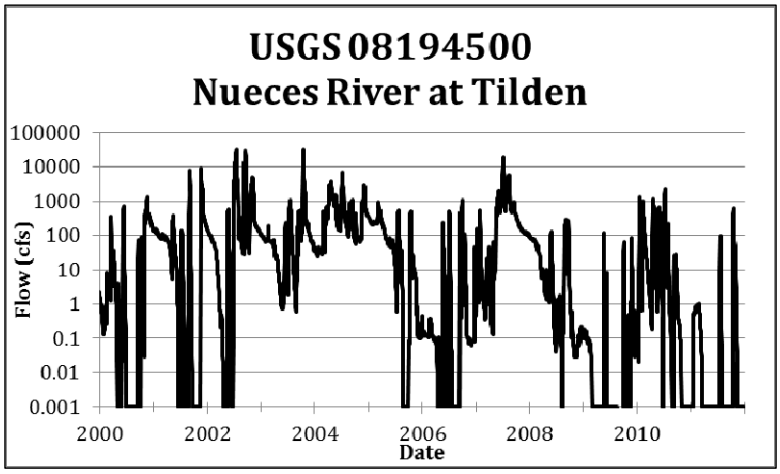
The analysis for AU_03 is based on data from **Station 12974** located at FM 624. The last time data were collected at this location was in 2004, therefore, there is insufficient data for trend analysis and very limited data for the analysis.

There is a **screening level low DO concern** for AU_01, AU_02, and AU_03. Even though the 24-Hr DO data is fully supporting for aquatic life use, the data collected during the TMDL to address the low DO concern resulted in an **impaired macrobenthic community concern** for AU_01, AU_02, and AU_03 and an **impaired fish community concern** for AU_02.

The watershed is predominantly brush and pasture lands. There are a few small cities and towns located throughout the watershed. This segment contains a section of the river known as the braided reach. The reach is comprised of many smaller channels that meander across the broad floodplain.

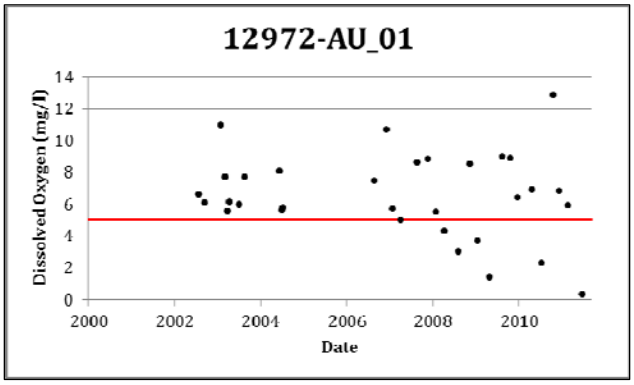
The USGS flow gauge at the Nueces River at Tilden is located at the same location as Station 12973. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 81.6 cfs
2001 – 290 cfs
2002 – 1,701 cfs
2003 – 438 cfs
2004 – 652 cfs
2005 – 119 cfs
2006 – 23.8 cfs
2007 – 914 cfs
2008 – 23.7 cfs
2009 – 1.90 cfs
2010 – 113 cfs
2011 – 9.50 cfs



## Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | **20** | **1.4** | **10.7** | **6.1** | **2** | **5** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 6 | 4.6 | 7.3 | 5.7 | 0 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 5.0 | 7.6 | 5.8 | NA | 0 |
| AU-02 | Minimum 3.0 mg/l | FS | 44 | **2.6** | **10.0** | **6.7** | **2** | **9** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 6 | 0.5 | 6.9 | 5.6 | 1 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 1.2 | 7.2 | 5.9 | NA | 1 |
| AU-03 | Minimum 3.0 mg/l | FS | **4** | **5.9** | **6.9** | **6.5** | **0** | **0** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | NC | 4 | 5.6 | 6.6 | 6.4 | 0 | NA |
| | 24-Hr Average 5.0 mg/l | NC | | 5.8 | 6.5 | 6.4 | NA | 0 |




The concern for DO levels below the screening level in AU_03 as per the 2012 IR is based on 12 samples, only four of which were in the database at the time of this analysis**.**

AU_02 is fully supporting for all analyzed metals in water for aquatic life use.

## Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | FS | 18 | 9 | 260 | 60.76 | 0 | 0 |
| AU-02 | | FS | 27 | <2 | 280 | 32.82 | 2 | 0 |

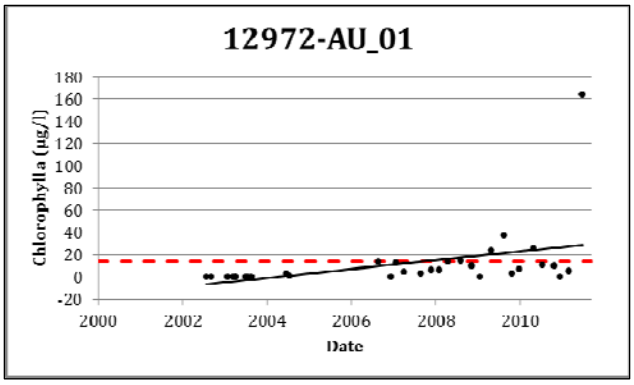
## General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 20 | 9.0 | 29.7 | 21.0 | 0 |
| AU-02 | | FS | 44 | 12.3 | 30.3 | 21.1 | 0 |
| AU-03 | | NC | 4 | 27.7 | 29.2 | 28.6 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 19 | 7.4 | 8.0 | 7.8 | 0 | 0 |
| AU-02 | | FS | 44 | 7.3 | 8.3 | 7.8 | 0 | 0 |
| AU-03 | | NC | 4 | 7.5 | 8.2 | 8.1 | 0 | 0 |

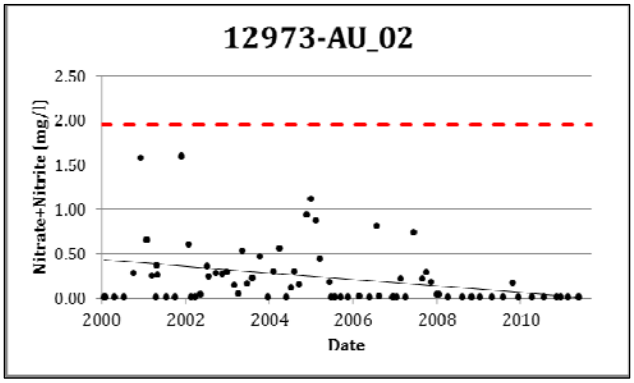
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 19 | <0.02 | 0.164 | 0.02 | 13 | 0 |
| AU-02 | | NC | 41 | <0.02 | 0.109 | 0.02 | 27 | 0 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 19 | <2 | 37 | 6.5 | 3 | 4 |
| AU-02 | | NC | 27 | <2 | 37.5 | 5 | 9 | 5 |



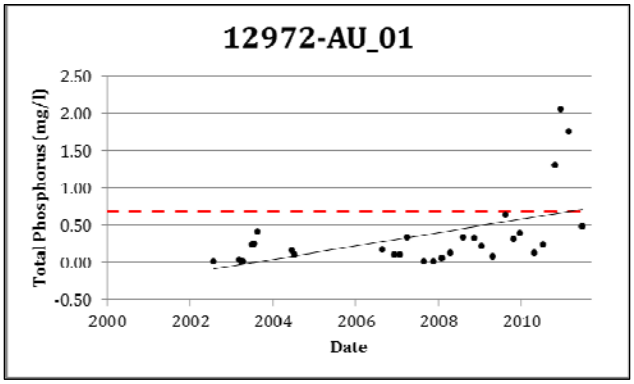

Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values in AU_01 with a **t-stat of 2.44** and a **p-value of 0.02.** (The trend still exists even if the extreme value at the end of the dataset is removed.) The higher values occurred during the droughts of 2009 and 2011 and may be related to samples being taken from pools during times of no flow.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | NC | 19 | <0.02 | 12.7 | 0.03 | 10 | 2 |
| AU-02 | | NC | 41 | <0.02 | 1.109 | 0.06 | 20 | 0 |



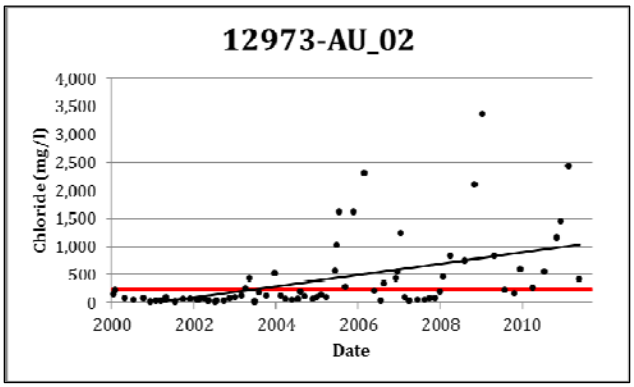

Statistical analysis indicates that there is a decreasing trend in nitrate values in AU_02 with a **t-stat of -2.75** and a **p-value of 0.01.** This may be attributed to lack of runoff due to lack of rain.

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 19 | <0.06 | 0.64 | 0.16 | 2 | 0 |
| AU-02 | | NC | 27 | <0.04 | 0.448 | 0.082 | 10 | 0 |




Statistical analysis indicates that there is an increasing trend in total phosphorus values in AU_01 with a **t-stat of 3.18** and a **p-value of 0.00.** Although total phosphorus and nitrate are associated with the same possible sources, the drought of 2011 had the opposite effect of concentrating the phosphorus that did make its way into the river.

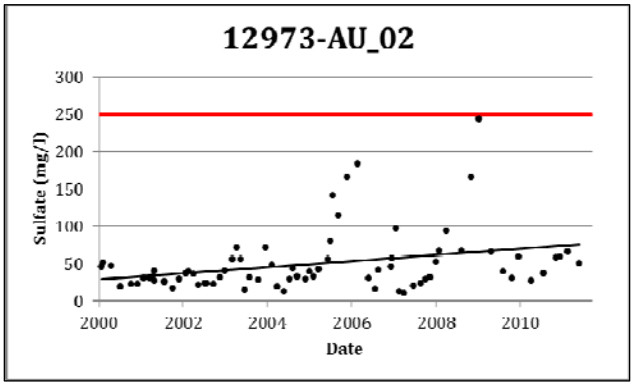
| Chloride | Status | # samples | Min | Max | Average | >700 |
|---|---|---|---|---|---|---|
| 700 mg/l | FS | 63 | 27.5 | 3370 | 467 | 13 |




Statistical analysis indicates that there is an increasing trend in chloride values in AU_02 with a **t-stat of 4.89** and a **p-value of 0.00.** Chloride levels are inversely related to the flow, with concentrations increasing as flows decrease. The higher values tend to correlate to dry periods. The increasing trends may be due to increasing frequencies of dry periods that south Texas has been experiencing.

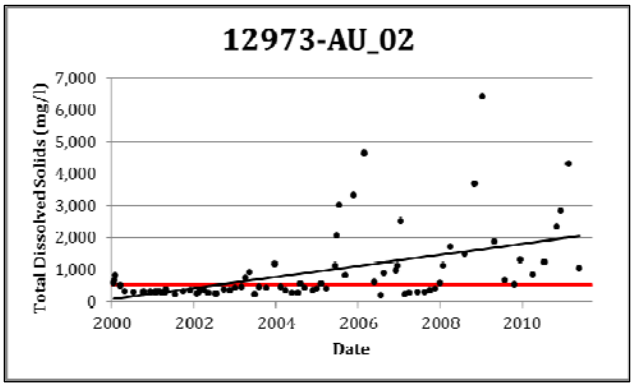
There has also been increased oil and gas activity in this area associated with the Eagle Ford over the past few years. There has been speculation of illicit discharge of produced waters which, if it is occurring, would affect chloride, sulfate, and TDS values.

| Sulfate | Status | # samples | Min | Max | Average | >300 |
|---|---|---|---|---|---|---|
| 300 mg/l | FS | 63 | 10 | 244 | 56.7 | 0 |




Statistical analysis indicates that there is an increasing trend in sulfate values in AU_02 with a **t-stat of 2.79** and a **p-value of 0.01.** This trend is also most likely related to the chloride trends. However, the actual values are generally well below the criteria level and no apparent concern in the near future.

| TDS | Status | # samples | Min | Max | Average | >1,500 |
|---|---|---|---|---|---|---|
| 1,500 mg/l | FS | 65 | 187 | 6420 | 1,060 | 12 |




Statistical analysis indicates that there is an increasing trend in TDS values in AU_02 with a **t-stat of 5.08** and a **p-value of 0.00.** This trend is also most likely related to the chloride trends. If the droughts continue, a future impairment for this parameter is likely.

### Fish Consumption Use

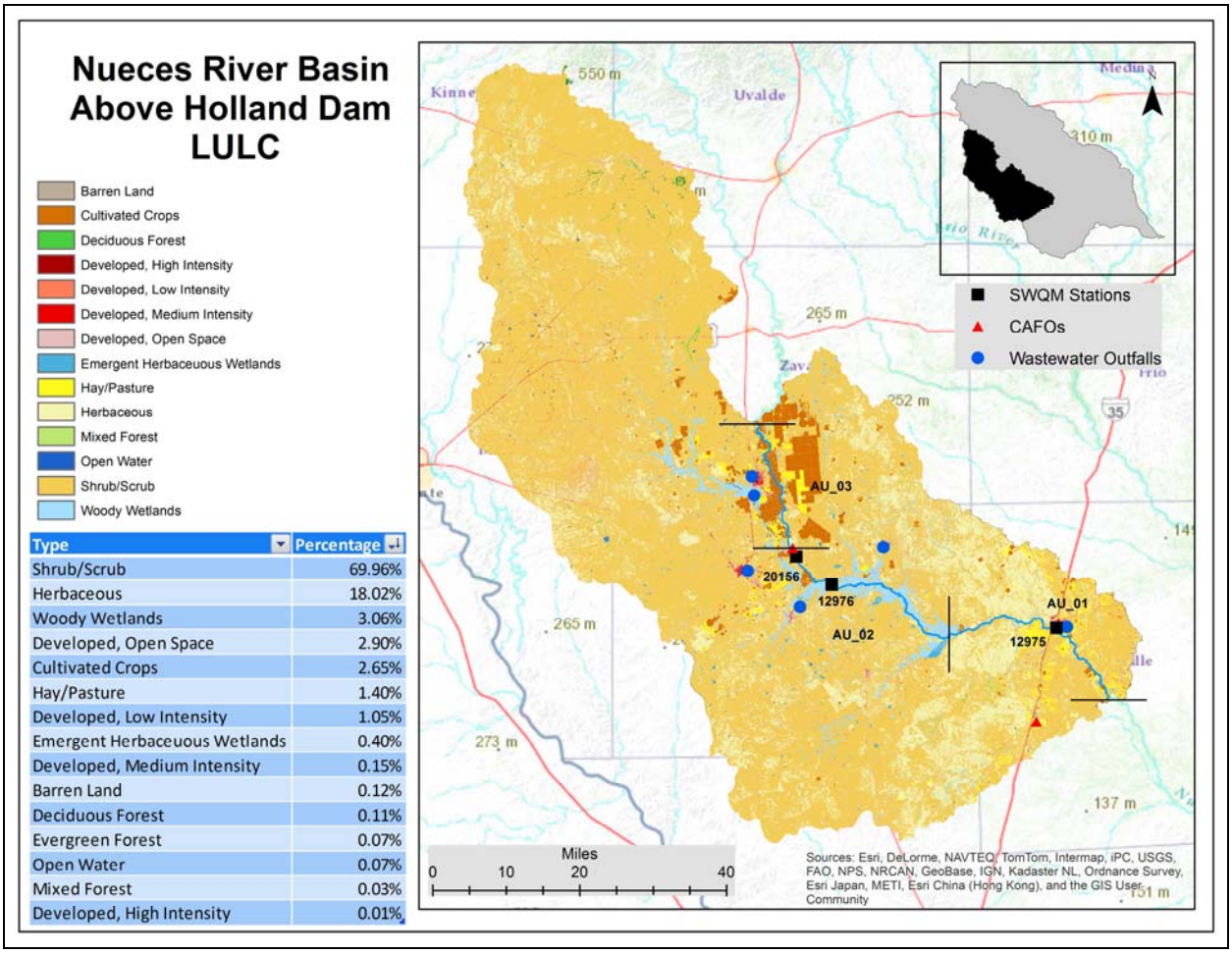
All 3 AUs are fully supporting for bioaccumulation of toxics in water for fish consumption use.

### Public Water Supply Use

All 6 AUS are fully supporting for all analyzed metals in water for public water supply use.

## NUECES RIVER ABOVE HOLLAND DAM WATERSHED – SEGMENT 2105

The 78 mile segment extends from Holland Dam in La Salle County to FM 1025 in Zavala County and is divided into three AUs.




| | |
|---|---|
| **Drainage area** | 2,200,065 acres |
| **Major Aquifers** | Carrizo, Edwards |
| **Cities** | Artesia Wells, Catarina, Valley Wells, Cotulla, Asherton, Carrizo Springs, Crystal City, Big Wells |
| **Counties** | La Salle, Dimmit, Zavala |
| **EcoRegions** | Northern Nueces Alluvial Plains, Texas-Tamaulipan Thornscrub |
| **Climate Annual Average** | Rain: 21" – 23"; Low: 58° F - 59° F; High: 82° F - 84° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Public Water Supply |
| **Permitted WWTFs** | WQ0000546-000 – Del Monte Foods (Crystal City Plant) 1,800,000 gpd via irrigation<br>WQ0010098-001 – City of Crystal City: 1,200,000 gpd via Line Oak Slough<br>WQ0010145-001 – City of Carrizo Springs: 950,000 gpd via Soldier Slough<br>WQ0010153-001 – City of Cotulla: 990,000 gpd via Mustang Creek<br>WQ0013746-001 – City of Asherton: 200,000 gpd via Soldier Slough<br>WQ0013782-001 – City of Big Wells: 150,000 gpd via Arroyo Negro<br>WQ0014006-001 – Zavala County (Crystal City Land Fill): 50,000 gpd via Soldier Slough<br>WQ0015047-001 – MacBain Properties Inc.: 14,000 gpd via irrigation<br>WQ0015049-001 – South Central Water Supply Company: 300,000 gpd (pending)<br>WQ0015058-001 – New Way Land Development, LLC: 200,000 gpd |

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment at Holland Dam to the confluence with Sauz Mocho Creek**. AU_02** is the reach from the upstream end of AU_01 to the confluence Line Oak Slough. **AU_03** is the reach from the upstream end of AU_02 to the upstream end of the segment at RR 1025.

The analysis for AU_01 is based on data from **Station 12975**, located at Business IH 35 south of Cotulla. Trend analysis was conducted on data from January 2000 through March 2011. TCEQ Region 16 is responsible for quarterly routine monitoring at this site.

The analysis for AU_02 is based on data from **Station 12976**, located at FM 190 north of Asherton. There is a gap in sampling from August 2001 through October 2006, and therefore insufficient data for trend analysis. TCEQ Region 16 is responsible for quarterly routine monitoring at this site.

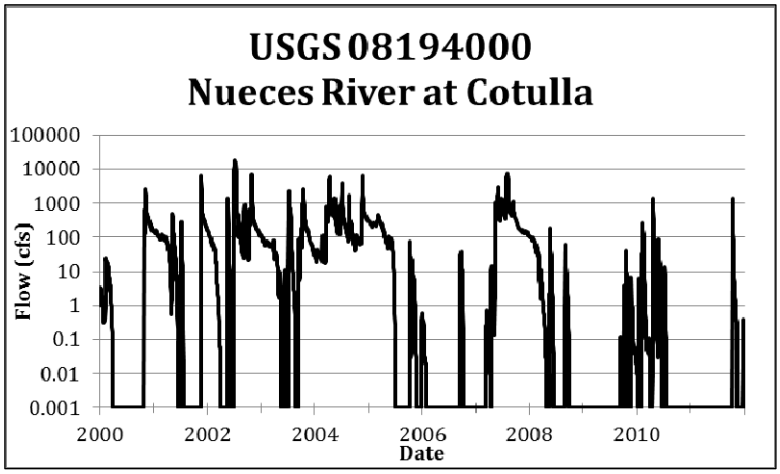
There are no monitoring sites in AU_03.

There is a **screening level low DO concern** for AU_01 and a **minimum DO impairment** for AU_02. There is a **chlorophyll-*a* concern** for AU-02.

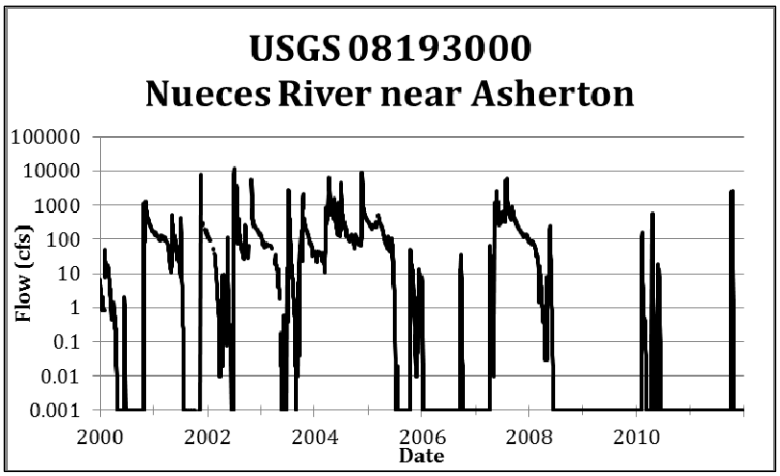
The watershed is predominantly brush lands, the exception being a small area of cropland along the upper portion of the segment. There are a number of small cities and towns located throughout the watershed.

The USGS flow gauge at the Nueces River at Cotulla is located at the same location as Station 12975. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 45.7 cfs
2001 – 133 cfs
2002 – 771 cfs
2003 – 126 cfs
2004 – 462 cfs
2005 – 89.2 cfs
2006 – 0.40 cfs
2007 – 531 cfs
2008 – 15.7 cfs
2009 – 0.28 cfs
2010 – 19.8 cfs
2011 – 12.5 cfs



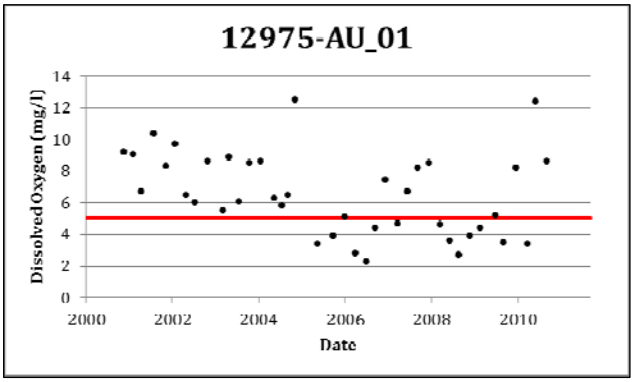

The USGS flow gauge at the Nueces River near Asherton is located at the same location as Station 12976. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

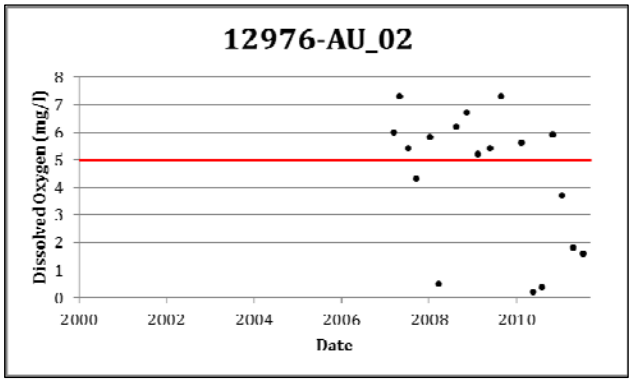



2000 – 56.8 cfs
2001 – 152 cfs
2002 – 367 cfs
2003 – 106 cfs
2004 – 483 cfs,
2005 – 90.7 cfs
2006 – 0.68 cfs
2007 – 420 cfs
2008 – 14.5 cfs
2009 – 0.00 cfs
2010 – 4.08 cfs
2011 – 24.5 cfs

## Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 26 | 2.3 | 12.5 | 4.9 | 3 | 13 |
| | Screening Level 5.0 mg/l | CS | | | | | | |
| AU-02 | Minimum 3.0 mg/l | NS | 18 | 0.2 | 7.3 | 5.4 | 5 | 7 |
| | Screening Level 5.0 mg/l | CS | | | | | | |




The low DO in AU_01 seems to occur during times of extended low and no-flow periods. In AU_02 in 2009, no flow was recorded for the entire year, so the water quality samples were most likely taken from pools.

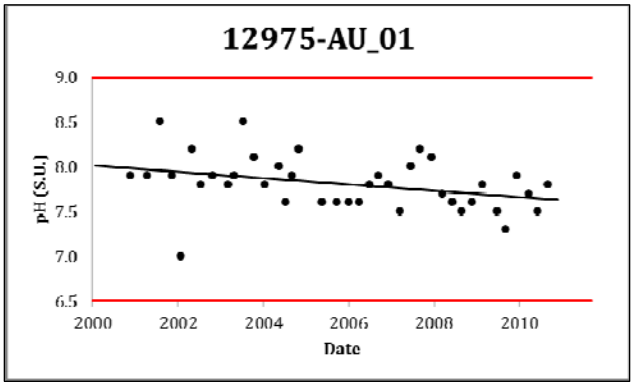
## Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean | FS | 25 | <10 | 1000 | 56.99 | 0 | 1 |
| AU-02 | 126 cfu/100 ml | FS | 14 | <10 | 1400 | 27.84 | 1 | 1 |

## General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 26 | 11.8 | 29.5 | 23.8 | 0 |
| AU-02 | | FS | 19 | 10.5 | 31.7 | 20.7 | 0 |

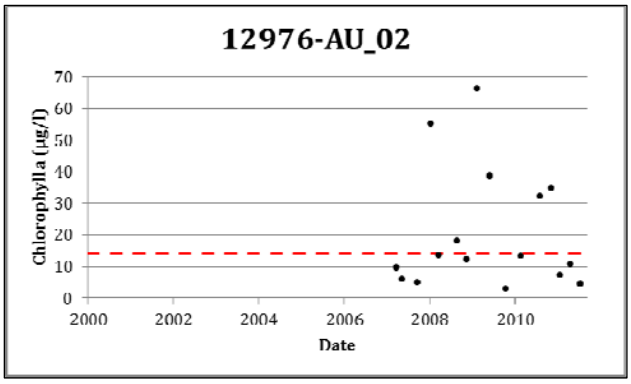
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 26 | 7.3 | 8.2 | 7.7 | 0 | 0 |
| AU-02 | | FS | 17 | 7.0 | 8.4 | 7.8 | 0 | 0 |




Statistical analysis indicates that there is a decreasing trend in pH values over time in AU_01 with a **t-stat of -4.41** and a **p-value of 0.00.** The values are well within the pH range and not a concern.

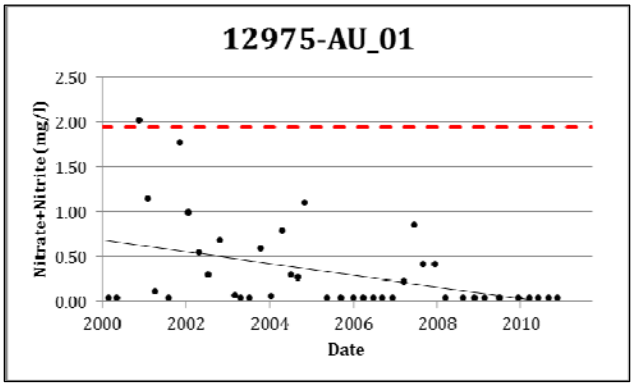
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 25 | <0.05 | 0.26 | 0.05 | 19 | 0 |
| AU-02 | | NC | 18 | <0.05 | 0.15 | 0.05 | 16 | 0 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 20 | <3 | 122 | 5.2 | 10 | 5 |
| AU-02 | | **CS** | **16** | **3.02** | **66.5** | **12.75** | **0** | **6** |




The highest values occurred in 2009 when no flow was recorded, indicating the water quality samples were likely taken from pools.

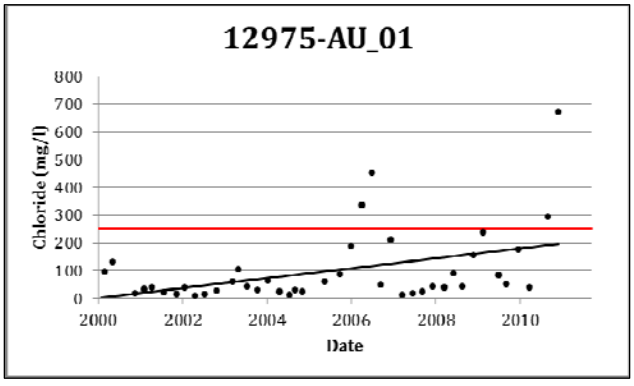
| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | NC | 24 | <0.04 | 1.1 | 0.04 | 15 | 0 |
| AU-02 | | NC | 19 | <0.04 | 0.46 | 0.04 | 14 | 0 |




Statistical analysis indicates that there is a decreasing trend in nitrate values in AU_02 with a **t-stat of -3.01** and a **p-value of 0.00.** This may be attributed to lack of runoff due to lack of rain.

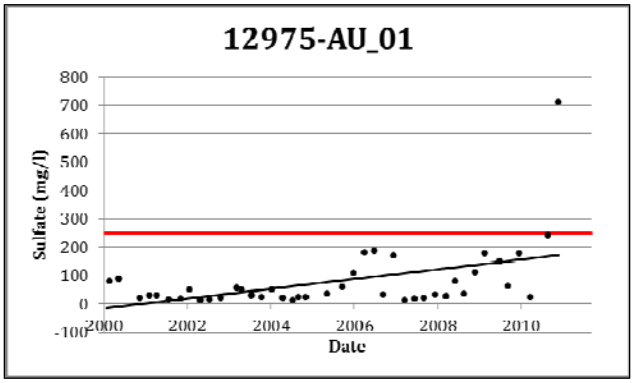
| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 24 | <0.05 | 0.28 | 0.11 | 6 | 0 |
| AU-02 | | NC | 14 | <0.06 | 0.49 | 0.07 | 7 | 0 |

| Chloride | Status | # samples | Min | Max | Average | >200 |
|---|---|---|---|---|---|---|
| 200 mg/l | FS | 43 | 7 | 451 | 90.4 | 4 |



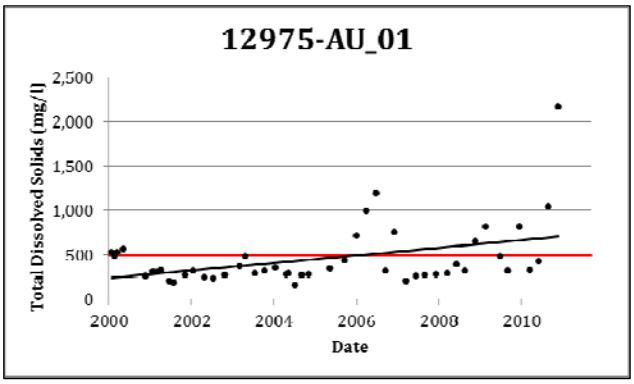

Statistical analysis indicates that there is an increasing trend in chloride values in AU_01 with a **t-stat of -2.95** and a **p-value of 0.01.** Chloride levels are inversely related to the flow, with concentrations increasing as flows decrease. The higher values tend to correlate to dry periods. The increasing trends may be due to increasing frequencies of dry periods that south Texas has been experiencing. If the droughts continue, a future impairment for this parameter is likely.

| Sulfate | Status | # samples | Min | Max | Average | >200 |
|---|---|---|---|---|---|---|
| 200 mg/l | FS | 44 | 9 | 185 | 62.1 | 0 |




Statistical analysis indicates that there is an increasing trend in sulfate values in AU_01 with a **t-stat of 3.29** and a **p-value of 0.00.** This trend is most likely related to the chloride trends. The values are approaching the criteria level.

| TDS | Status | # samples | Min | Max | Average | >900 |
|---|---|---|---|---|---|---|
| 900 mg/l | FS | 46 | 138 | 1200 | 406 | 2 |



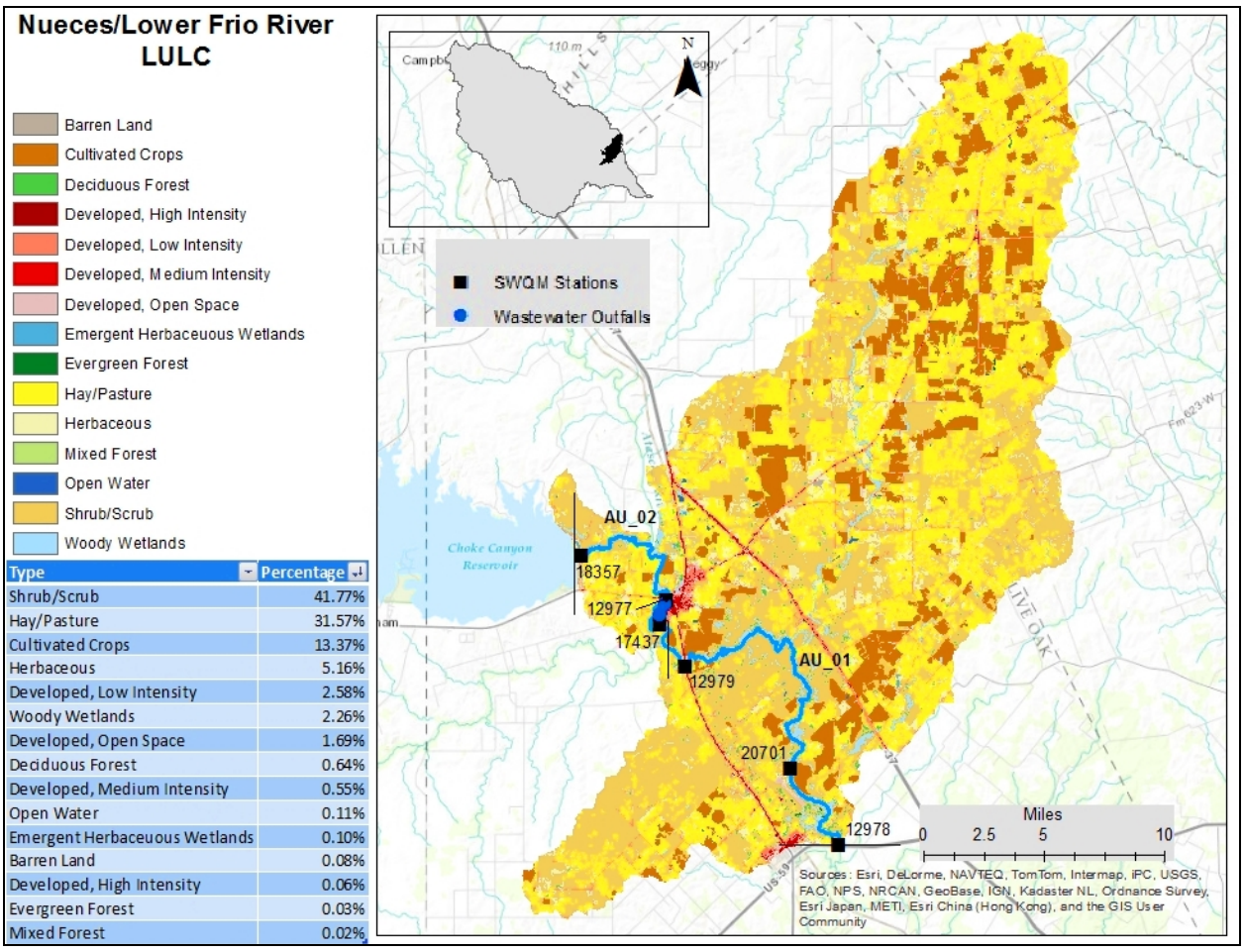

Statistical analysis indicates that there is an increasing trend in TDS values over time, in AU_01 with a **t-stat of 3.22** and a **p-value of 0.00.** This trend is also most likely related to the chloride trends. If the droughts continue, a future impairment for this parameter is likely.

### Public Water Supply Use

All 3 AUS are fully supporting for the human health criteria for public water supply use.

# NUECES RIVER / LOWER FRIO RIVER WATERSHED – SEGMENT 2106

The 27 mile segment extends from a point 100 m (110 yards) upstream of US 59 in Live Oak County to Choke Canyon Reservoir Dam in Live Oak County and is divided into two AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 41.77% |
| Hay/Pasture | 31.57% |
| Cultivated Crops | 13.37% |
| Herbaceous | 5.16% |
| Developed, Low Intensity | 2.58% |
| Woody Wetlands | 2.26% |
| Developed, Open Space | 1.69% |
| Deciduous Forest | 0.64% |
| Developed, Medium Intensity | 0.55% |
| Open Water | 0.11% |
| Emergent Herbaceuous Wetlands | 0.10% |
| Barren Land | 0.08% |
| Developed, High Intensity | 0.06% |
| Evergreen Forest | 0.03% |
| Mixed Forest | 0.02% |

| | |
|---|---|
| **Drainage area** | 204,055 acres |
| **Major Aquifers** | Carrizo, Gulf Coast |
| **Cities** | Three Rivers, Pawnee, Nell, Zunkerville, El Oso |
| **Counties** | Live Oak, Bee, Karnes |
| **EcoRegions** | Southern Post Oak Savanna, Texas-Tamaulipan Thornscrub |
| **Climate Annual Average** | Rain: 25" – 31"; Low: 58° F - 59° F; High: 81° F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Public Water Supply |
| **Permitted WWTFs** | WQ0001353-000 – Diamond Shamrock Refining Company: 1,500,000 gpd via unnamed ditch<br>WQ0010301-001 – City of Three Rivers: 400,000 gpd<br>WQ0010301-002 – City of Three Rivers: 400,000 gpd |

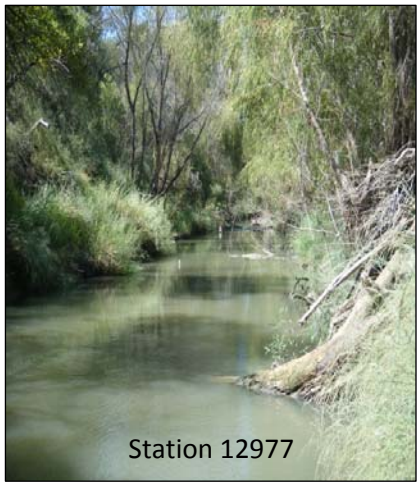
## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with the Frio River**.**
**AU_02** is the reach from the upstream end of AU_01 to the Choke Canyon Reservoir Dam.

The analysis for AU_01 is based on data from **Station 12978**, located at US 59, **Station 12979**, located at US 281 south of Three Rivers, and **Station 20701**, located at Airport Road north of George West. Trend analysis was conducted on data from Station 12979 from January 2000 through October 2011. NRA is responsible for quarterly routine monitoring at Stations 12979 and 20701. Monitoring ceased at Station 12978 in July 2009 and monitoring began at Station 20701 in November 2009.


The analysis for AU_02 is based on data from **Station 12977**, located at US 72 in Three Rivers. Trend analysis was conducted on data from January 2000 through October 2011. NRA is responsible for quarterly routine monitoring at this site.

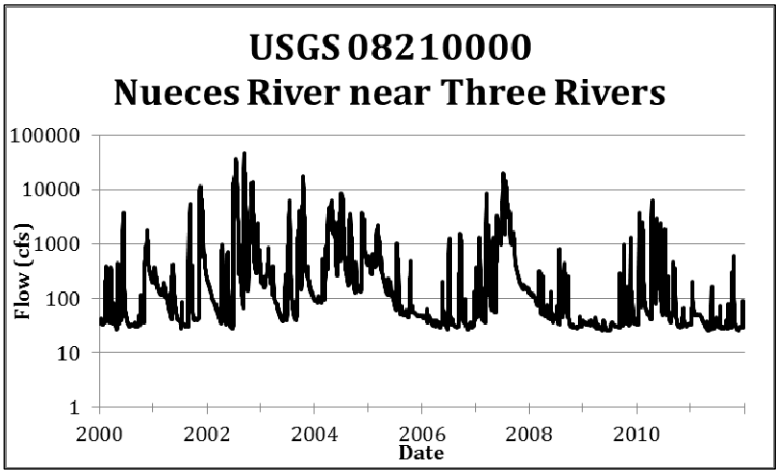
There is currently a **TDS impairment** for the entire segment. However, the proposed standards revisions as discussed below, when approved, will change the status from non-supporting to fully supporting.



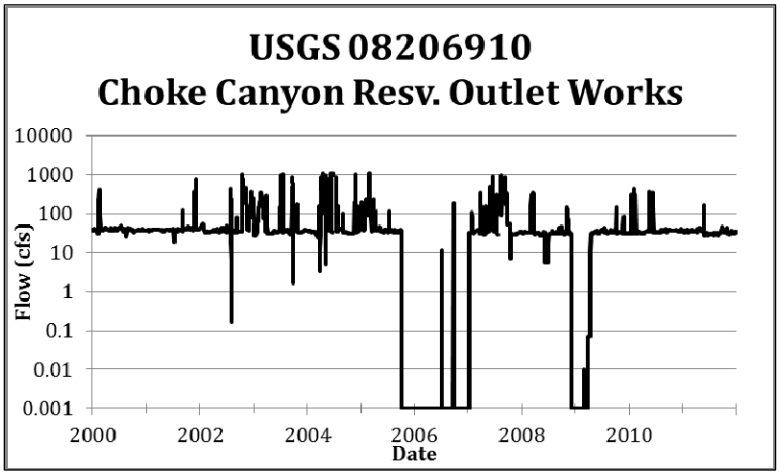

The watershed is a mixture of brush, pastures, and crop lands. Three Rivers, located just above the confluence of the Nueces and Frio Rivers, is the largest community within the watershed. This segment is the reach that connects Choke Canyon Reservoir (Segment 2116) and Lake Corpus Christi (Segment 2103).

The USGS flow gauge at the Nueces River near Three Rivers is located at the same location as Station 12979. The annual mean flows are:

2000 – 172 cfs
2001 – 452 cfs
2002 – 3,119 cfs
2003 – 728 cfs
2004 – 1,243 cfs
2005 – 264 cfs
2006 – 86.4 cfs
2007 – 1,685 cfs
2008 – 83.1 cfs
2009 – 51.7 cfs
2010 – 345 cfs
2011 – 46.0 cfs




A USGS flow gauge is located at the Choke Canyon Reservoir Outlet Works. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The zero values occur when releases from the reservoir are temporarily suspended. The annual mean flows are:




2000 – 44.3 cfs
2001 – 41.6 cfs
2002 – 74.2 cfs
2003 – 84.3 cfs
2004 – 108 cfs,
2005 – 55.0 cfs
2006 – 1.16 cfs
2007 – 84.8 cfs
2008 – 42.1 cfs
2009 – 23.6 cfs
2010 – 39.8 cfs
2011 – 32.9 cfs

### Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 75 | 5.1 | 11.2 | 7.6 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 28 | 5.1 | 11.4 | 7.6 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

AU_01 and AU_02 are fully supporting for toxic substances in water and have no concerns for toxic substances in sediment for aquatic life use.

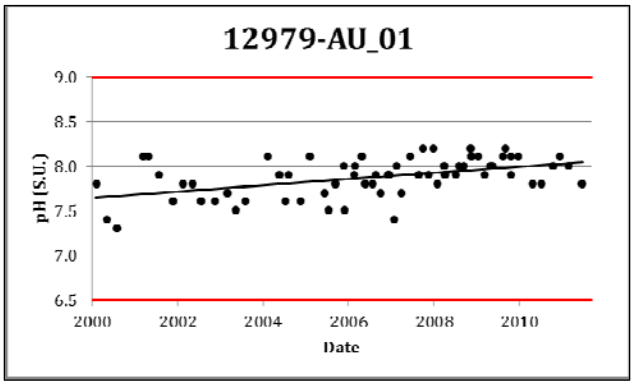
### Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | FS | 49 | <2 | 2200 | 65.85 | 1 | 3 |
| AU-02 | | FS | 28 | <2 | 2500 | 123 | 1 | 5 |

### General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 75 | 11.1 | 21.2 | 22.6 | 0 |
| AU-02 | | FS | 28 | 12.2 | 29.9 | 21.6 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 75 | 7.4 | 8.2 | 7.9 | 0 | 0 |
| AU-02 | | FS | 28 | 7.5 | 8.2 | 7.9 | 0 | 0 |




Statistical analysis indicates that there is an increasing trend in pH values in AU_01 with a **t-stat of 4.40** and a **p-value of 0.00.** This segment of the river is not as affected by the drought because water is released continually from Choke Canyon Reservoir for municipal and industrial water use and environmental requirements. However, the flows are somewhat lower during drought, but discharges remain about the same, possibly resulting in slightly higher pH values.

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 68 | <0.02 | 0.166 | 0.04 | 21 | 0 |
| AU-02 | | NC | 28 | <0.02 | 0.071 | 0.02 | 20 | 0 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 49 | <2 | 33.9 | 8.54 | 5 | 12 |
| | | NC | 28 | <2 | 21.2 | 8.9 | 1 | 7 |

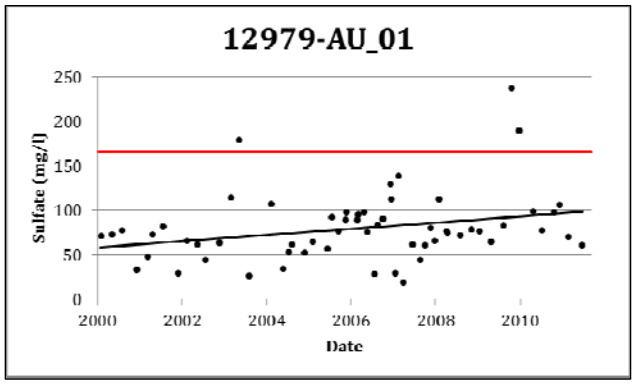
| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | NC | 68 | <0.02 | 0.79 | 0.11 | 8 | 0 |
| AU-02 | | NC | 28 | <0.02 | 0.63 | 0.08 | 6 | 0 |

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 49 | <0.04 | 0.498 | 0.131 | 4 | 0 |
| AU-02 | | NC | 28 | <0.04 | 0.413 | 0.093 | 5 | 0 |

TCEQ has submitted standards revisions for AU specific criteria for chloride, sulfate, and TDS to EPA for this segment due to its unique characteristics: AU_01 is the Nueces River and AU_02 is the Frio River. Arguments were made to split this segment into two segments, but since it is only 27 miles, the decision was made to accept different criteria for each AU. The 2012 IR assessment is based on the current criteria, but the analysis below is based on the new, yet-to-be approved criteria. Once the revision has been approved by EPA, the TDS status will change from non-supporting to fully supporting. The existing criteria for chloride, sulfate, and TDS are 250 mg/l, 250 mg/l, and 500 mg/l, respectively.

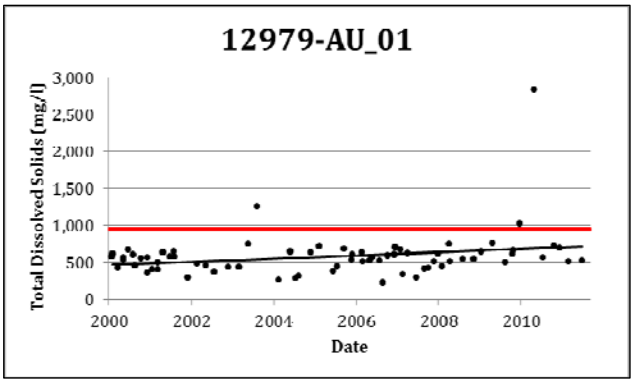
| Chloride | | Status | # samples | Min | Max | Average | >350 | >285 |
|---|---|---|---|---|---|---|---|---|
| AU_01 | 350 mg/l | FS | 68 | 32.7 | 1380 | 197 | 4 | NA |
| AU_02 | 285 mg/l | FS | 28 | 33.2 | 464 | 163 | NA | 3 |

| Sulfate | | Status | # samples | Min | Max | Average | >165 | >145 |
|---|---|---|---|---|---|---|---|---|
| AU_01 | 165 mg/l | FS | 68 | 18.8 | 237 | 86.4 | 4 | NA |
| AU_02 | 145 mg/l | FS | 28 | 29.7 | 388 | 120 | NA | 7 |




Statistical analysis indicates that there is an increasing trend in sulfate in AU_01 with a **t-stat of 2.20** and a **p-value of 0.03.** Although not as strong of a correlation between droughts and the sulfate concentrations, the higher values tend to correlate to dry periods, and the increasing trends may be due to increasing frequencies of dry periods. The actual values are generally below the criteria level and no apparent concern in the near future.

| TDS | | Status | # samples | Min | Max | Average | >950 | >735 |
|---|---|---|---|---|---|---|---|---|
| AU_01 | 950 mg/l | FS | 69 | 222 | 2830 | 654 | 6 | NA |
| AU_02 | 735 mg/l | FS | 28 | 288 | 1210 | 646 | NA | |




Statistical analysis indicates that there is an increasing trend in TDS values in AU_01 with a **t-stat of 2.06** and a **p-value of 0.04.** This trend is most likely related to the sulfate trend. The actual values are generally below the criteria level and no apparent concern in the near future.

### Fish Consumption Use

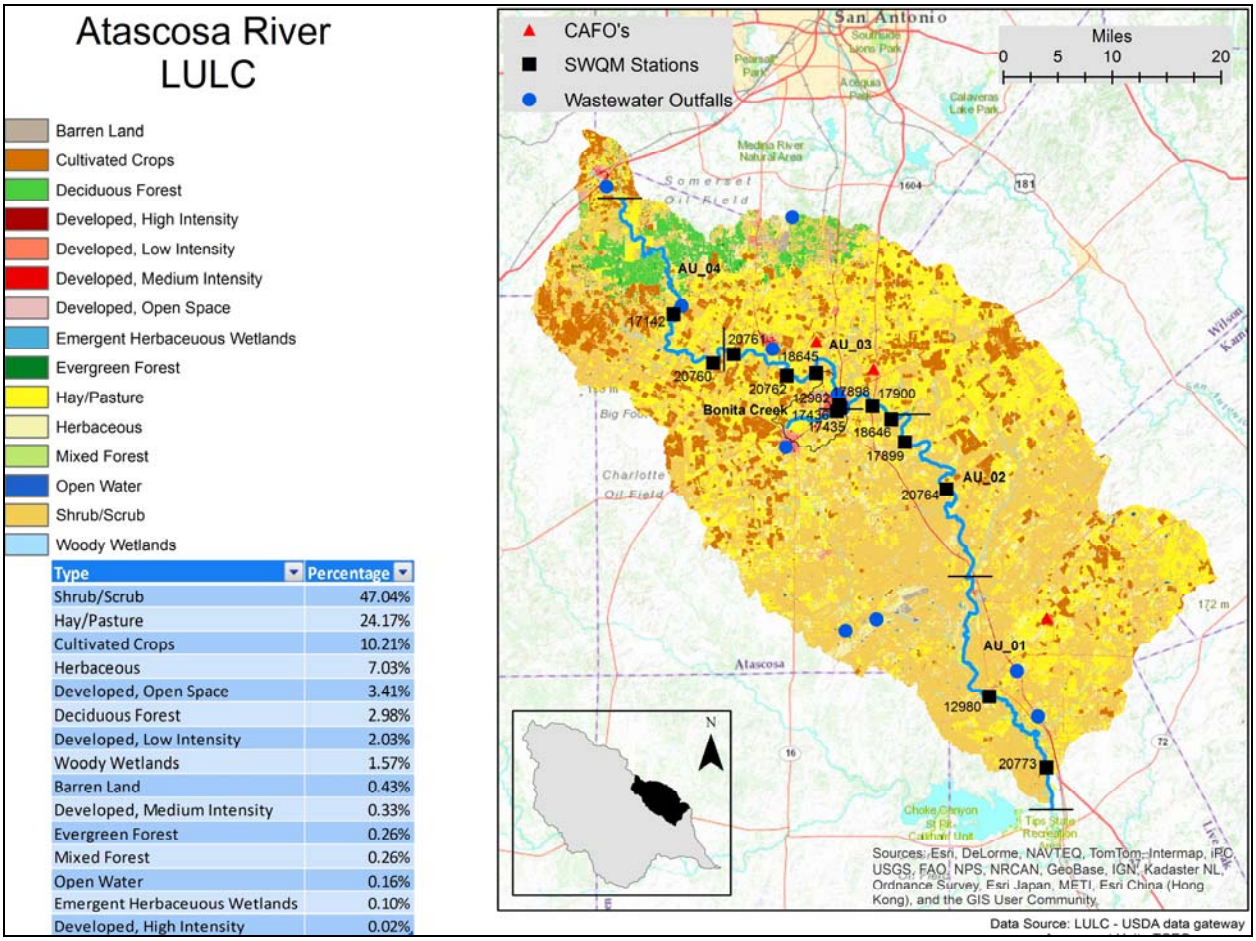
AU_01 and AU_02 are fully supporting and/or have no concerns for bioaccumulation of toxics in water for fish consumption.

### Public Water Supply Use

AU_01 and AU_02 are fully supporting and/or have no concerns for surface water human health criteria for public water supply.

# ATASCOSA RIVER WATERSHED – SEGMENT 2107

The 103 mile segment extends from the confluence with the Frio River in Live Oak County to the confluence of the West Prong Atascosa River in Atascosa County and is divided into four AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 47.04% |
| Hay/Pasture | 24.17% |
| Cultivated Crops | 10.21% |
| Herbaceous | 7.03% |
| Developed, Open Space | 3.41% |
| Deciduous Forest | 2.98% |
| Developed, Low Intensity | 2.03% |
| Woody Wetlands | 1.57% |
| Barren Land | 0.43% |
| Developed, Medium Intensity | 0.33% |
| Evergreen Forest | 0.26% |
| Mixed Forest | 0.26% |
| Open Water | 0.16% |
| Emergent Herbaceuous Wetlands | 0.10% |
| Developed, High Intensity | 0.02% |

| | |
|---|---|
| **Drainage area** | 886,750 acres |
| **Major Aquifers** | Carrizo, Edwards |
| **Minor Aquifers** | Queen City, Sparta, Yegua Jackson |
| **Cities** | Sunniland, Whitsett, Esseville, Campbellton, Poteet, Jourdanton, Pleasanton, Coughran, Lemin, Rossville, Christine, Benton, Lytle, Natalia, Kyote, Peggy, McCoy, Fashing |
| **Counties** | Atascosa, Bexar, Frio, Karnes, Live Oak, McMullen, Medina, Wilson |
| **EcoRegions** | Northern Blackland Prairie, Northern Nueces Alluvial Plains, Southern Post Oak Savanna, Texas-Tamaulipan Thornscrub |
| **Climate Annual Averages** | Rain: 27" – 31"; Low: 56° F - 59° F ; High: 81° F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Public Water Supply |

| | |
|---|---|
| **Permitted WWTFs** | WQ0002043-000 – San Miguel Electric Cooperative: 62,000 gpd (nine outfalls) via evaporation (one outfall in San Miguel Creek Segment 2108)<br>WQ0002601-000 - San Miguel Electric Cooperative: coal pile runoff and storm water<br>WQ0010096-001 – City of Lytle: 450,000 gpd via West Prong Atascosa River<br>WQ0010418-001 – City of Jourdanton: 980,000 gpd via Metate Creek<br>WQ0010598-001 – City of Pleasanton: 1,420,000 gpd<br>WQ0013630-001 – City of Poteet: 640,000 gpd via Rutledge Hollow<br>WQ0014265-001 – Benton City WSC: 15,000 gpd via unnamed tributary<br>WQ0014767-001 – TxDOT (Northbound rest stop): 10,000 gpd via unnamed tributary<br>WQ0014768-001 – TxDOT (Southbound rest stop): 10,000 gpd via Salt Branch Creek |

### Special Studies

The Atascosa River watershed is the subject of the RUAA and ALUAA described in the Nueces Basin write-up on Page 26.

### Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Borrego Creek**.** **AU_02** is the reach from the upstream end of AU_01 to the confluence with Galvan Creek. **AU_03** is the reach from the upstream end of AU_02 to the confluence with Palo Alto Creek. **AU_04** is the reach from the upstream end of AU_03 to the upper end of the segment.

The analysis for AU_01 is based on data from **Station 12980**, located at FM 99. Trend analysis was conducted on data from April 2000 through September 2011.


Station 12980

The analysis for AU_02 is based on combined data from **Station 17900**, located at IH 37, **Station 20764**, located at FM 541, **Station 18646**, located at Coughran Rd., and **Station 17899**, located near Leal Rd. and the MoPac railroad. The data from these stations were collected during the TMDL. There are large gaps in the data and therefore insufficient data for trend analysis. There is no routine monitoring in this AU.

The analysis for AU_03 is based on data from **Station 12982**, located at US 281 in Pleasanton. Trend analysis was conducted on data from February 2000 through March 2011.

There is insufficient data in AU_04 for analysis.

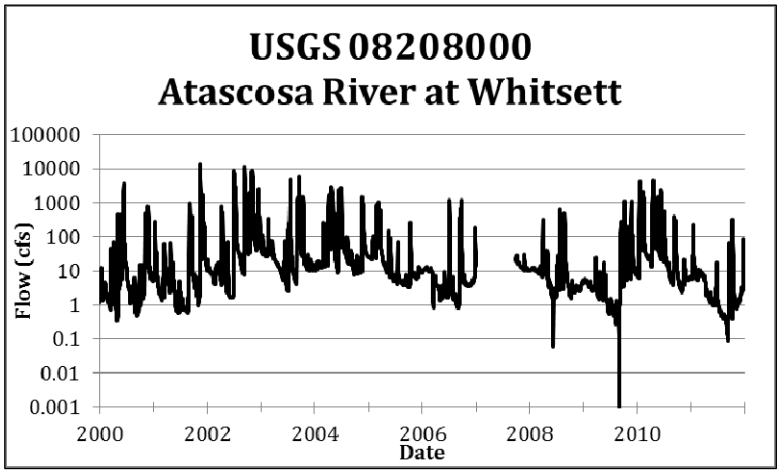
There is a **low DO screening level concern,** a **low DO minimum grab sample impairment**, and a **24-Hr DO average impairment** for AU_02. There is also a **low DO screening level concern** for AU_03. There is a **bacteria impairment** for AU_01 and AU_02 and a **chlorophyll-*a* concern** for AU_01 and AU_03. There is a **habitat concern** and **macrobenthic** and **fish communities impairments** for AU_02 and AU_03.

The watershed is comprised primarily of brush and pasture lands in the southern half; a mixture of brush, pastures, croplands, and forests in the northern half. There are many small cities and towns throughout the watershed, with Pleasanton and Jourdanton being the largest.

The USGS flow gauge at the Atascosa River at Whitsett is located at the same location as Station 12980. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

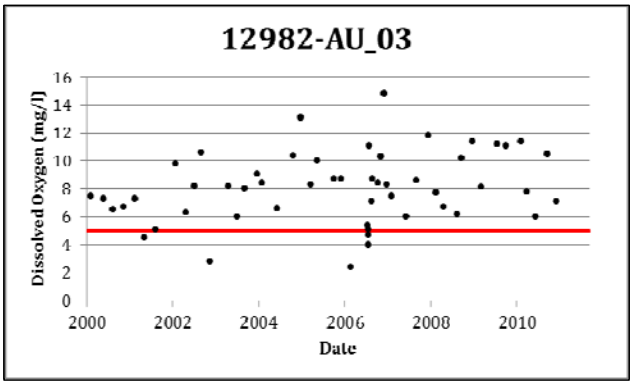
2000 – 49.7 cfs
2001 – 93.3 cfs
2002 – 438 cfs
2003 – 124 cfs
2004 – 180 cfs
2005 – 40.3 cfs
2006 – 25.0 cfs
2007 – 14.1 cfs
2008 – 83.1 cfs
2009 – 16.0 cfs
2010 – 20.3 cfs
2011 – 7.5 cfs

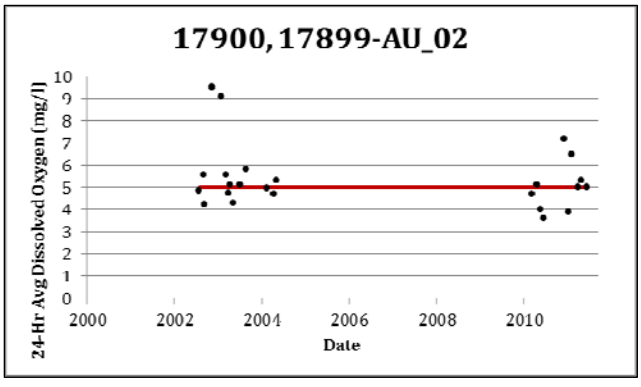
The USGS flow gauge at the Atascosa River near McCoy, located at the same location as Station 20764, has been discontinued.




**Aquatic Life Use Assessment**

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 48 | 3.1 | 11.0 | 6.7 | 0 | 6 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 7 | 2.0 | 7.1 | 5.9 | 1 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 3.0 | 7.3 | 6.3 | NA | 1 |
| AU-02 | Minimum 3.0 mg/l | **NS** | **20** | **1.6** | **8.7** | **4.8** | **5** | **11** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | **24** | 3.0 | 9.0 | 4.6 | 0 | NA |
| | 24-Hr Average 5.0 mg/l | **NS** | | **3.6** | **9.5** | **5.0** | **NA** | **10** |
| AU-03 | Minimum 3.0 mg/l | FS | **36** | **2.4** | **14.8** | **8.4** | **1** | **3** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 10 | 2.8 | 8.1 | 5.4 | 1 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 4.5 | 8.7 | 6.6 | NA | 1 |



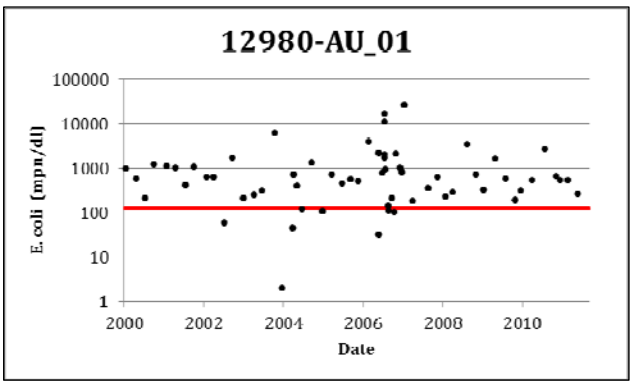



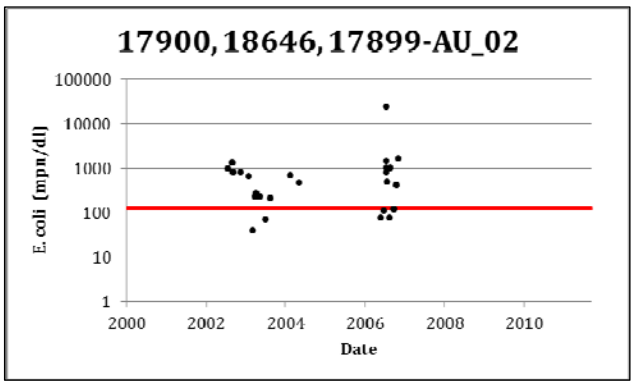

The ALUAA report, discussed on Page 26 concluded that the data collected "confirm occasional departures from DO criteria and minor impairment to aquatic life but the remarkable stability of fish and invertebrate populations in the stream, in spite of highly variable flow conditions, demonstrates that the

biotic community is well adapted to the variability." However, these studies also resulted in a **habitat concern** and **macrobenthic and fish communities impairments** in AU_02 and AU_03.

### Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | **NS** | **43** | **<2** | **26,000** | **529** | **1** | **25** |
| AU-02 | | **NS** | **14** | **14** | **24,000** | **547** | **0** | **10** |
| AU-03 | | FS | 34 | <1 | 13,000 | 90.5 | 1 | 8 |



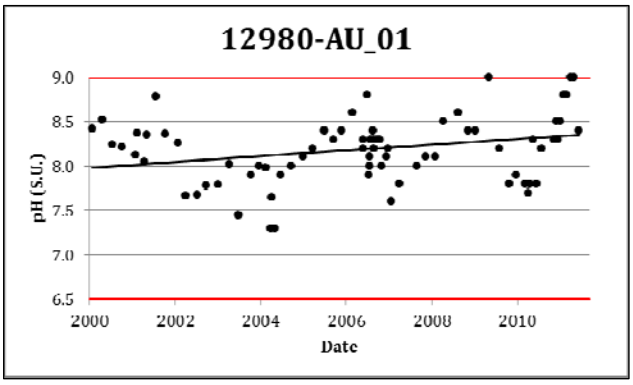



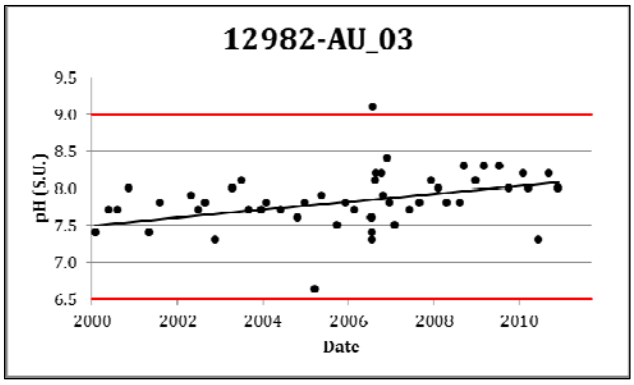

The current bacteria levels are most likely a combination of contributions from WTTF discharges, failing OSSFs, and wildlife. The stakeholders want to see the river reclassified as secondary contact recreation, which would raise the criteria to a geomean of 630 cfu. If and when this happens, every AU should become fully supporting.

### General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 48 | 11.6 | 30.9 | 22.4 | 0 |
| AU-02 | | FS | 20 | 13.0 | 27.6 | 23.3 | 0 |
| AU-03 | | FS | 36 | 9.7 | 33.7 | 23.0 | 1 |

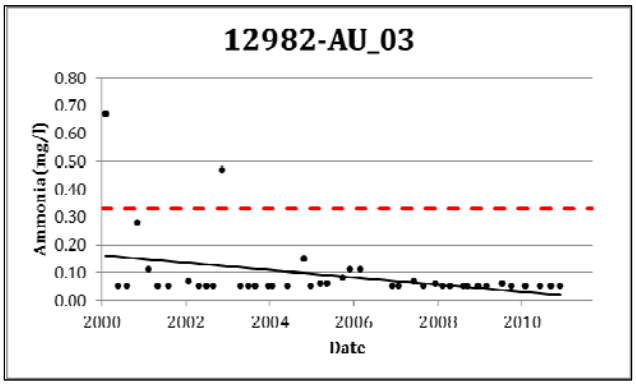
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 48 | 7.3 | 9.0 | 8.1 | 0 | 0 |
| AU-02 | | FS | 20 | 7.3 | 8.1 | 7.8 | 0 | 0 |
| AU-03 | | FS | 36 | 6.6 | 9.1 | 7.8 | 0 | 1 |



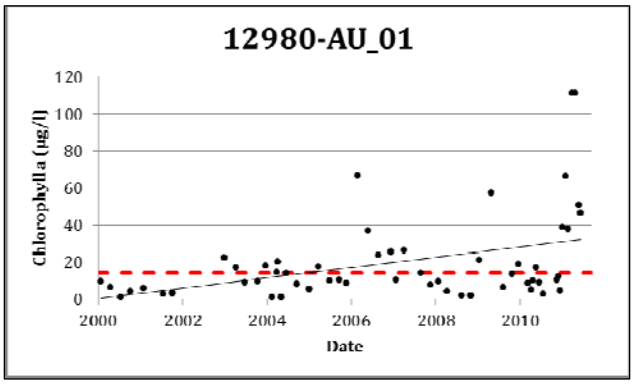

Statistical analysis indicates that there is an increasing trend in pH values in AU_01 with a **t-stat of 2.54** and a **p-value of 0.01** and in AU_03 with a **t-stat of 2.81** and a **p-value of 0.01.** In AU_01, there is an apparent correlation to drought and higher pH values. The increasing levels may be association with WWTF discharges combined with the drought. The lack of WWTFs in AU_02 may be why it is not also showing any trends.

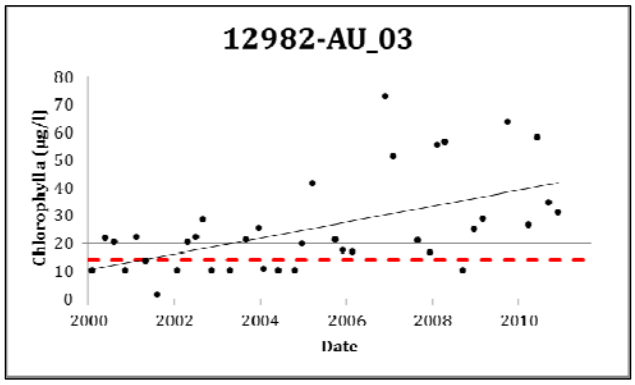
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 35 | <0.02 | 0.12 | 0.032 | 15 | 0 |
| AU-02 | | NC | 7 | <0.03 | 0.208 | 0.03 | 5 | 0 |
| AU-03 | | NC | 25 | <0.05 | 0.15 | 0.05 | 15 | 0 |




Statistical analysis indicates that there is a decreasing trend in ammonia values in AU_03 with a **t-stat of -2.46** and a **p-value of 0.02.** This trend is a result of some very high values early in the dataset. Since 2007, all values have been non-detects or very low.

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | **CS** | **35** | **<2** | **66.9** | **10.3** | **4** | **13** |
| AU-02 | | NC | 7 | <1 | 11.5 | 1 | 4 | 0 |
| AU-03 | | **CS** | **21** | **<10** | **72.9** | **25.1** | **3** | **17** |



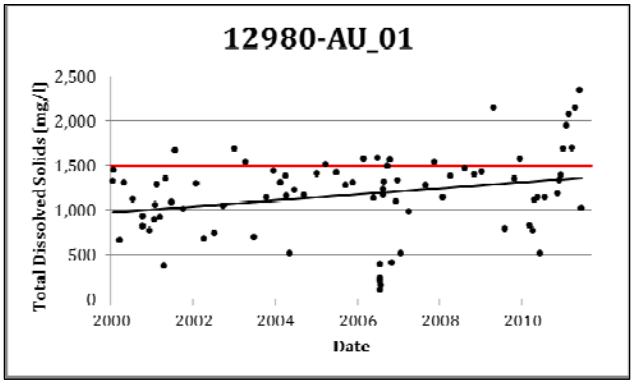

Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values in AU_01 with a **t-stat of 3.27** and a **p-value of 0.0** and in AU_03 with a **t-stat of 3.93** and a **p-value of 0.0.** The higher values tend to correlate to dry periods. The increasing trends may be due to increasing frequencies of dry periods that south Texas has been experiencing.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | NC | 35 | <0.02 | 1.078 | 0.107 | 9 | 0 |
| AU-02 | | NC | 7 | <0.05 | 5.77 | 0.257 | 2 | 2 |
| AU-03 | | NC | 25 | <0.04 | 0.65 | 0.04 | 16 | 0 |

| Chloride | Status | # samples | Min | Max | Average | >600 |
|---|---|---|---|---|---|---|
| 600 mg/l | FS | 64 | 35 | 480 | 244 | 0 |

| Sulfate | Status | # samples | Min | Max | Average | >500 |
|---|---|---|---|---|---|---|
| 500 mg/l | FS | 65 | 45 | 500 | 257 | 0 |

| TDS | Status | # samples | Min | Max | Average | >1,500 |
|---|---|---|---|---|---|---|
| 1,500 mg/l | FS | 103 | 100 | 2150 | 982 | 11 |



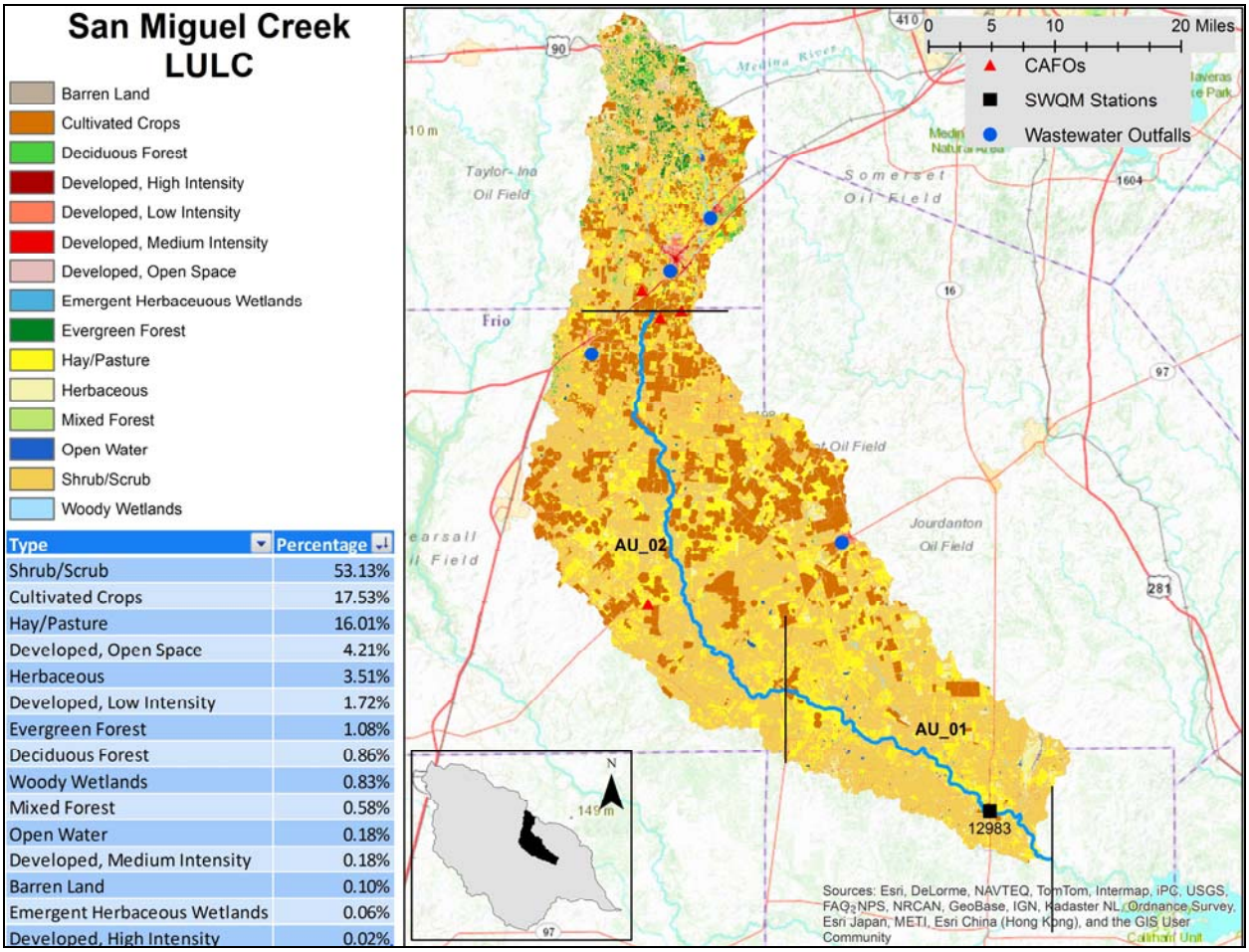

Statistical analysis indicates that there is an increasing trend in TDS values in AU_01 with a **t-stat of 2.48** and a **p-value of 0.02.** The highest values tend to correlate to dry periods, and the increasing trends may be due to increasing frequencies of dry periods. If the droughts continue, a future impairment for this parameter is possible.

### Public Water Supply Use

All AUs are fully supporting for surface water human health criteria for public water supply.

## SAN MIGUEL CREEK WATERSHED – SEGMENT 2108

The 66 mile segment extends from Choke Canyon Reservoir in McMullen County to the confluence of Perez Creek and Chacon Creek in Frio County and is divided into two AUs.

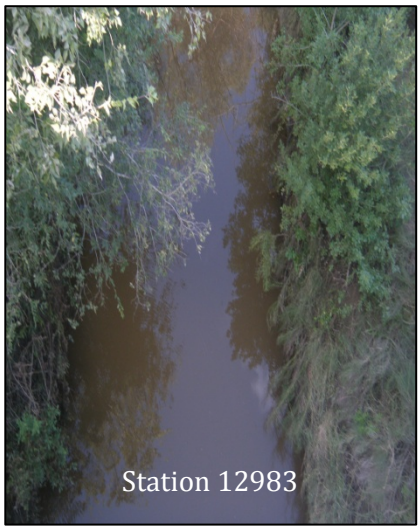



| Type | Percentage |
|---|---|
| Shrub/Scrub | 53.13% |
| Cultivated Crops | 17.53% |
| Hay/Pasture | 16.01% |
| Developed, Open Space | 4.21% |
| Herbaceous | 3.51% |
| Developed, Low Intensity | 1.72% |
| Evergreen Forest | 1.08% |
| Deciduous Forest | 0.86% |
| Woody Wetlands | 0.83% |
| Mixed Forest | 0.58% |
| Open Water | 0.18% |
| Developed, Medium Intensity | 0.18% |
| Barren Land | 0.10% |
| Emergent Herbaceous Wetlands | 0.06% |
| Developed, High Intensity | 0.02% |

| | |
|---|---|
| **Drainage area** | 535,610 acres |
| **Major Aquifers** | Carrizo, Edwards |
| **Minor Aquifers** | Queen City, Sparta, Yegua Jackson |
| **Cities** | Hindes, Goldfinch, Schattel, Bigfoot, Devine, Natalia, Pearson, Castroville |
| **Counties** | Frio, Atascosa, McMullen, Medina |
| **EcoRegions** | Northern Nueces Alluvial Plains, Texas-Tamaulipan Thornscrub |
| **Climate Annual Averages** | Rain: 25” – 29”; Low: 55° F - 58° F; High: 80° F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Public Water |
| **Permitted WWTFs** | WQ0002043-000 – San Miguel Electric Cooperative: 62,000 gpd (nine outfalls) via evaporation (eight outfalls in Atascosa River Segment 2107)<br>WQ0010142-001 – City of Charlotte: 220,000 gpd via Lagunillas Creek<br>WQ0010160-001 – City of Devine: 650,000 gpd via San Francisco Perez Creek<br>WQ0011806-001 – City of Natalia: 190,000 gpd via Chacon Creek<br>WQ0014239-001 – Moore WSC: 65,000 gpd via Black Creek |

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Live Oak Creek**.** **AU_02** is the reach from upstream end of AU_01 to the upstream end of the segment.




The analysis for AU_01 is based on data from **Station 12983**, located at SH 16. Trend analysis was conducted on data from January 2000 through December 2011. NRA is responsible for quarterly monitoring at this site.

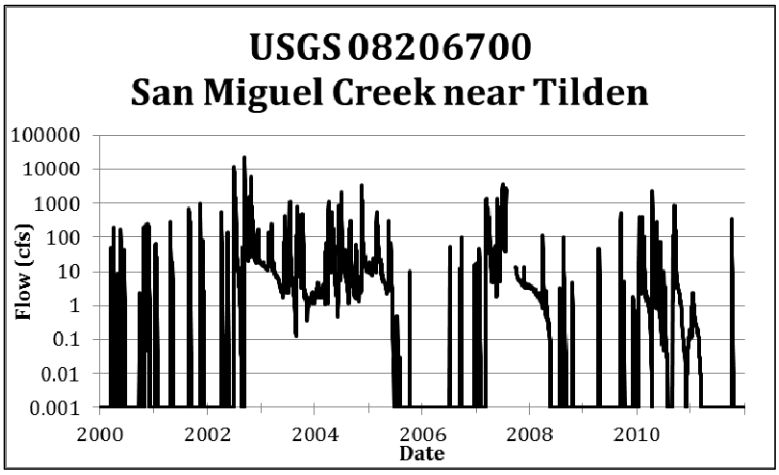
There are no monitoring sites in AU_02.

There is a **bacteria impairment** for AU_01.

The watershed is a mixture of brush, pastures, and croplands, with some forests in the most northern areas. There are a number of small cities and towns location throughout the watershed.

The USGS flow gauge at San Miguel Creek near Tilden is located at the same location as Station 12983. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 9.2 cfs
2001 – 14.0 cfs
2002 – 337 cfs
2003 – 30.9 cfs
2004 – 82.1 cfs
2005 – 14.2 cfs
2006 – 0.6 cfs
2007 – 162 cfs
2008 – 1.8 cfs
2009 – 3.6 cfs
2010 – 28.0 cfs
2011 – 1.6 cfs

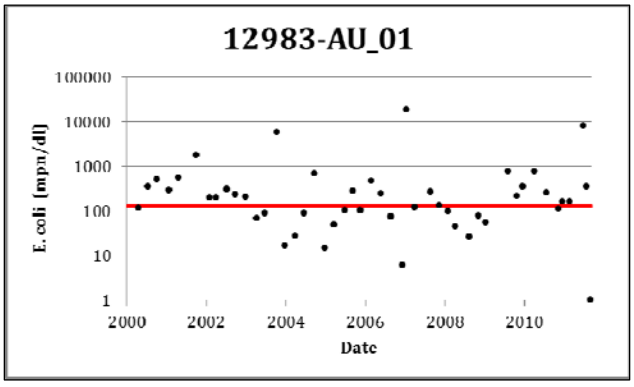



### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 14 | 3.1 | 9.7 | 6.1 | 0 | 2 |
| Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use

| *E. coli* | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|
| Geomean 126 cfu/100 ml | **NS** | **27** | **6** | **18,000** | **131** | **0** | **5** |




TSSWCB may fund an RUAA for San Miguel Creek beginning in FY 2014 to address the *E. coli* impairment the source of which may be a combination of WWTF discharges, failing OSSFs, and wildlife.

## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 27 | 9.9 | 28.8 | 19.5 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 27 | 7.2 | 8.0 | 7.7 | 0 | 0 |

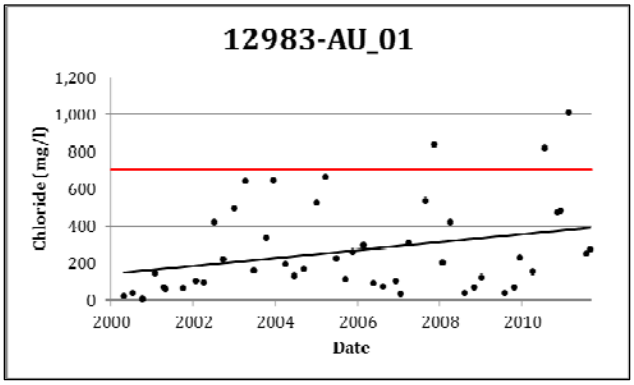
| Ammonia | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|
| 0.33 mg/l | NC | 27 | <0.02 | 0.105 | 0.021 | 13 | 0 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|
| 14.1 µg/l | NC | 27 | <2 | 42.3 | 5.0 | 10 | 6 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|
| 1.95 mg/l | NC | 27 | <0.01 | 0.918 | 0.01 | 15 | 0 |

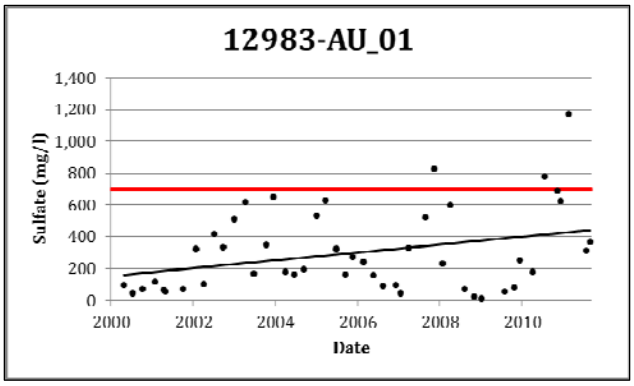
| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|
| 0.69 mg/l | NC | 27 | <0.04 | 8.02 | 0.145 | 4 | 3 |

| Chloride | Status | # samples | Min | Max | Average | >700 |
|---|---|---|---|---|---|---|
| 700 mg/l | FS | 27 | 32 | 834 | 271.56 | 2 |




Statistical analysis indicates that there is an increasing trend in chloride values in AU_01 with a **t-stat of 2.12** and a **p-value of 0.04.** The highest values tend to correlate to dry periods, and the increasing trends may be due to increasing frequencies of dry periods. If the droughts continue, a future impairment for this parameter is possible.

| Sulfate | Status | # samples | Min | Max | Average | >700 |
|---|---|---|---|---|---|---|
| 700 mg/l | FS | 27 | 12.9 | 824 | 283.59 | 2 |




Statistical analysis indicates that there is an increasing trend in sulfate values in AU_01 with a **t-stat of -2.32** and a **p-value of 0.02.** This trend is most likely related to the chloride trend. If the droughts continue, a future impairment for this parameter is possible.

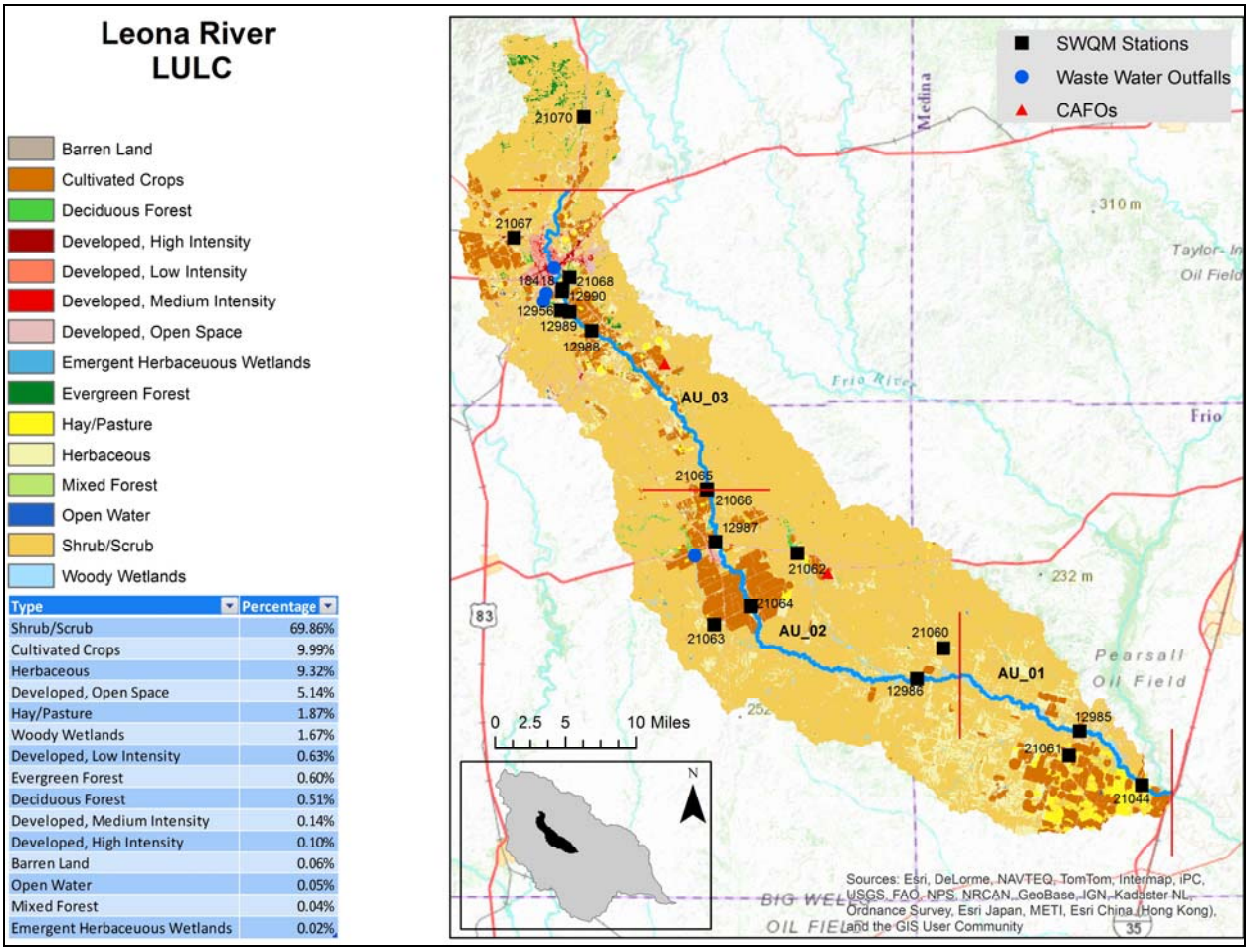
| TDS | Status | # samples | Min | Max | Average | >2,000 |
|---|---|---|---|---|---|---|
| 2,000 mg/l | FS | 27 | 240 | 2820 | 1120.04 | 5 |

## Public Water Supply Use

Both AUs are fully supporting for surface water human health criteria for public water supply.

# LEONA RIVER WATERSHED – SEGMENT 2109

The 65 mile segment extends from the confluence with the Frio River in Frio County to US 83 in Uvalde County as is divided into three AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 69.86% |
| Cultivated Crops | 9.99% |
| Herbaceous | 9.32% |
| Developed, Open Space | 5.14% |
| Hay/Pasture | 1.87% |
| Woody Wetlands | 1.67% |
| Developed, Low Intensity | 0.63% |
| Evergreen Forest | 0.60% |
| Deciduous Forest | 0.51% |
| Developed, Medium Intensity | 0.14% |
| Developed, High Intensity | 0.10% |
| Barren Land | 0.06% |
| Open Water | 0.05% |
| Mixed Forest | 0.04% |
| Emergent Herbaceuous Wetlands | 0.02% |

| | |
|---|---|
| **Drainage area** | 429,555 acres |
| **Major Aquifers** | Carrizo, Edwards |
| **Cities** | Batesville, Uvalde, Uvalde Estates |
| **Counties** | Frio, Zavala, Uvalde |
| **EcoRegions** | Balcones Canyonlands, Northern Nueces Alluvial Plains, Texas-Tamaulipan Thornscrub |
| **Climate Annual Averages** | Rain: 23" – 29"; Low: 54° F - 58° F; High: 80°F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Public Water Supply Use |
| **Permitted WWTFs** | WQ0002752-000 – TAFMI, Inc., Agrilink Foods: 250,000,000 gallons per year via irrigation<br>WQ0010306-001 – City of Uvalde: 970,000 gpd<br>WQ0014394-001 – Batesville WSC: 184,000 gpd via Gallina Slough |

## Special Studies

An RUAA was conducted on the Leona River as described in the Nueces River Basin write-up on Page 27.

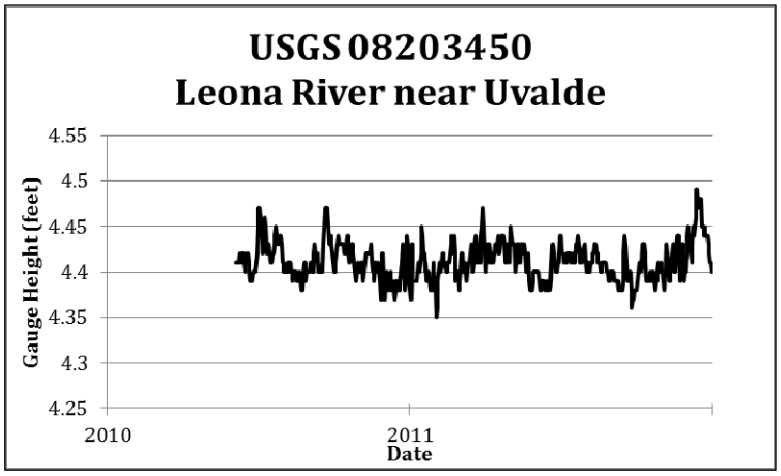
## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Yoledigo Creek**.** **AU_02** is the reach from the upstream end of AU_01 to the confluence of Camp Lake Slough. **AU_03** is the reach from the upstream end of AU_02 to the upper end of the segment.

The analysis for AU_01 is based on data from **Station 12985**, located at FM 1571 southwest of Pearsall. Trend analysis was conducted on data from February 2000 through October 2011. TCEQ is responsible for quarterly routine monitoring at this site.

The analysis for AU_02 is based on data from **Station 12987**, located at US 57 near Batesville. Trend analysis was conducted on data from February 2001 through October 2011. TCEQ is responsible for quarterly routine monitoring at this site.

The analysis for AU_03 is based on combined data from **Station 12989**, located upstream of Hoags Dam and **Station 18418**, located upstream of FM 140. There is some data in 2001 at Station 12989, then a gap until 2005. Data collection at Station 18418 began in 2004. Therefore, there is insufficient data for trend analysis. NRA is responsible for quarterly routine monitoring at this site.


There is a **bacteria impairment** and a **nitrate concern** for the entire segment.

The watershed is primarily brush. However, there are pockets of croplands around the cities in and towards the downstream end.

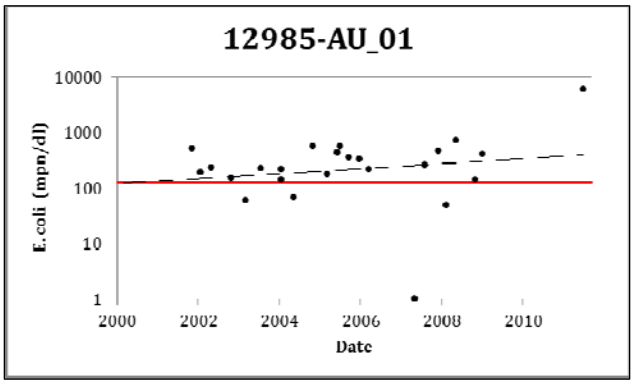
The USGS flow gauge at the Leona River near Uvalde is located a little downstream as Station 12989. The only current data available is gauge height beginning in June 2010.

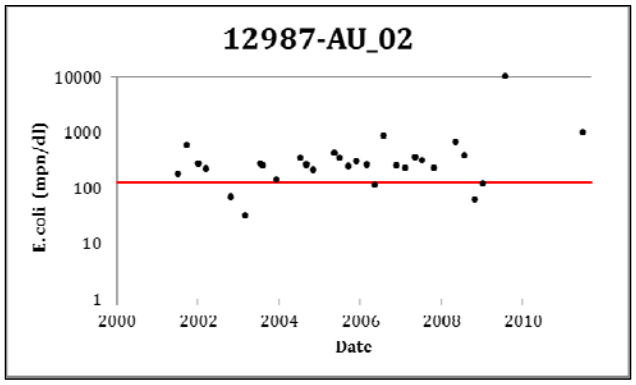
**Aquatic Life Use Assessment**

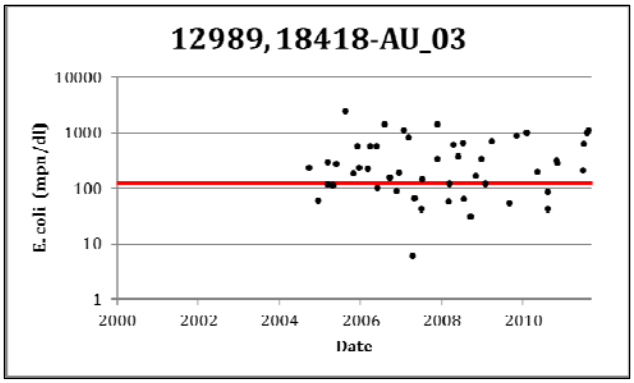
| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 18 | 5.7 | 11.5 | 8.4 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 21 | 3.0 | 12.1 | 8.1 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-03 | Minimum 3.0 mg/l | FS | **47** | **3.4** | **11.7** | **6.4** | **0** | **9** |
| | Screening Level 5.0 mg/l | **NS** | | | | | | |

## Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | NS | 17 | <1 | 730 | 184.99 | 1 | 6 |
| AU-02 | | NS | 21 | 63 | 10,000 | 309.14 | 0 | 4 |
| AU-03 | | NS | 43 | 6 | 2,400 | 206.24 | 0 | 13 |




In addition to all AUs being impaired, statistical analysis indicates that there is an increasing trend in *E. coli* values in AU_01 with a **t-stat of 2.76** and a **p-value of 0.01.** The current bacteria levels are most likely a combination of contributions from WTTF discharges, failing OSSFs, and wildlife.

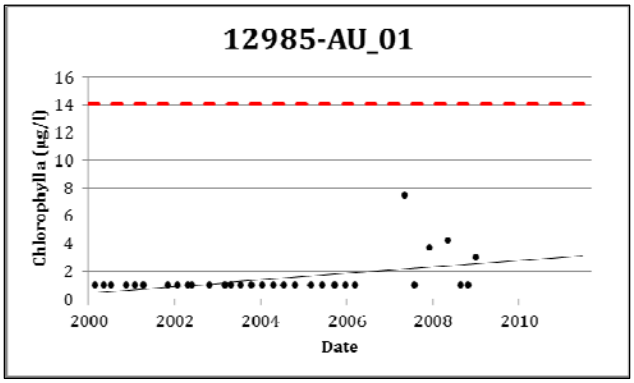
## General Use

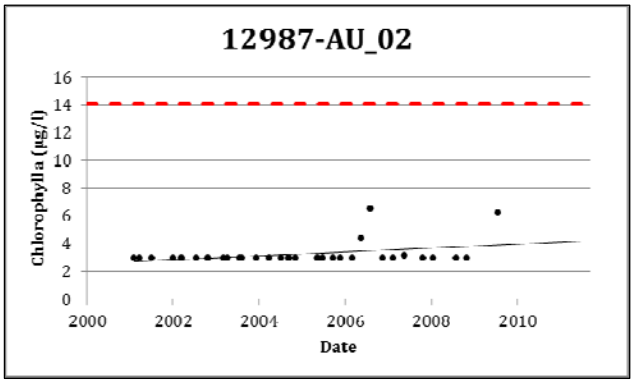
| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 17 | 10.3 | 27.5 | 21.3 | 0 |
| AU-02 | | FS | 22 | 7.4 | 28.5 | 22.1 | 0 |
| AU-03 | | FS | 47 | 12.2 | 28.1 | 22.8 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 17 | 6.5 | 8.2 | 8.0 | 0 | 0 |
| AU-02 | | FS | 21 | 7.8 | 8.2 | 8.0 | 0 | 0 |
| AU-03 | | FS | 47 | 6.3 | 8.2 | 7.3 | 1 | 0 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 16 | <0.05 | <0.05 | 0.05 | 16 | 0 |
| AU-02 | | NC | 23 | <0.05 | 0.19 | 0.05 | 21 | 0 |
| AU-03 | | NC | 42 | <0.02 | 0.11 | 0.02 | 32 | 0 |

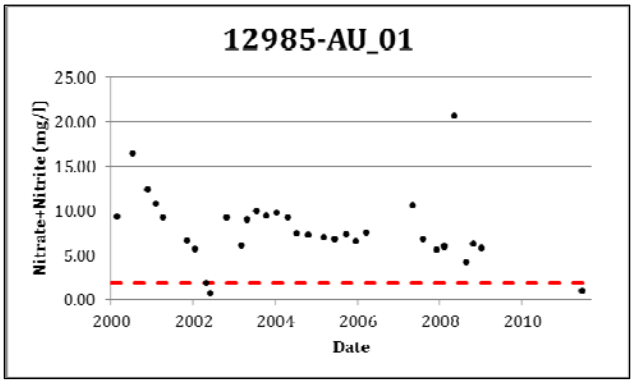
| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 16 | <3 | 7.47 | 3.0 | 12 | 0 |
| AU-02 | | NC | 20 | <3 | 6.54 | 3.0 | 16 | 0 |
| AU-03 | | NC | 41 | <2 | 56.8 | 2 | 29 | 3 |

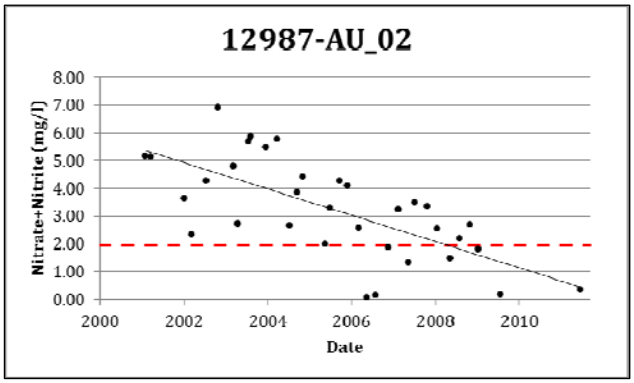


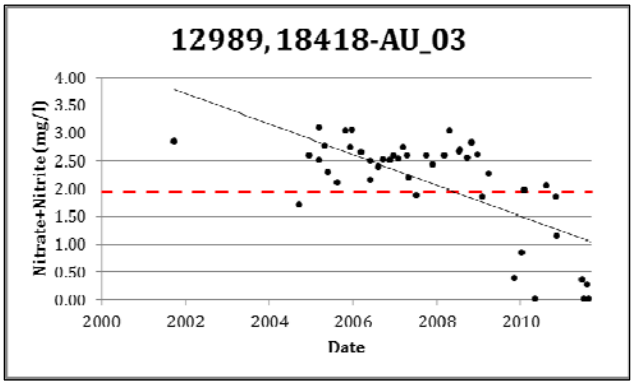




Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values over time in AU_01 with a **t-stat of 2.80** and a **p-value of 0.01** and in AU_02 with a **t-stat of 2.12** and a **p-value of 0.04.** The sudden increase in values in 2006 coincides with a change in method used for analysis. This newer method provides for more reliable results at lower concentrations. The non-detects for the trend analysis were converted from <10 µg/l to<1 µg/l (AU_01) <3 µg/l (AU_02) for consistency. Therefore, a real trend may not even exist.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | **CS** | **17** | **4.14** | **20.7** | **6.92** | **0** | **17** |
| AU-02 | | **CS** | **23** | **0.07** | **5.78** | **2.66** | **0** | **16** |
| AU-03 | | **CS** | **38** | **<0.02** | **3.1** | **2.53** | **1** | **32** |

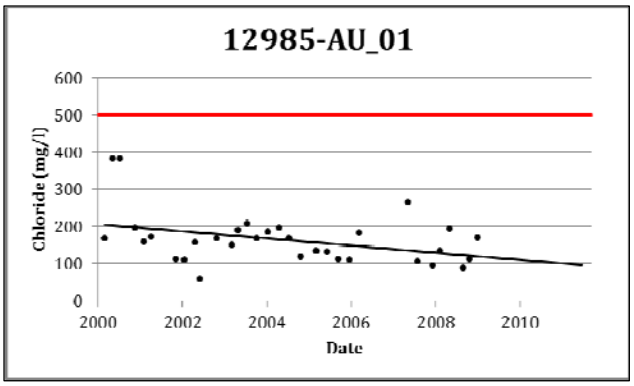


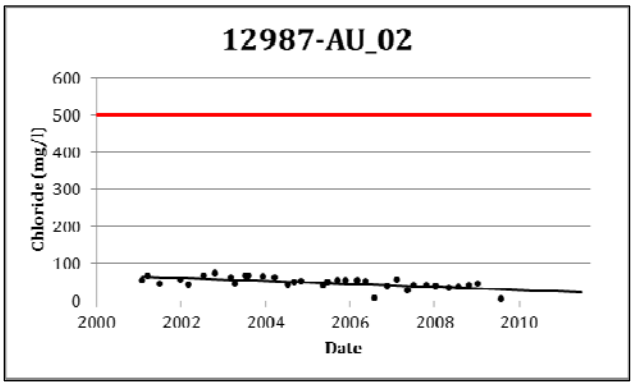




In addition to being a concern in all AUs in this segment, statistical analysis indicates that there is a decreasing trend in nitrate values in AU_02 with a **t-stat of -5.33** and a **p-value of 0.00** and values in AU_03 with a **t-stat of -6.31** and a **p-value of 0.00.** The decreasing values in the upper two AUs could possibly be associated with changes in wastewater treatment and/or agricultural practices.

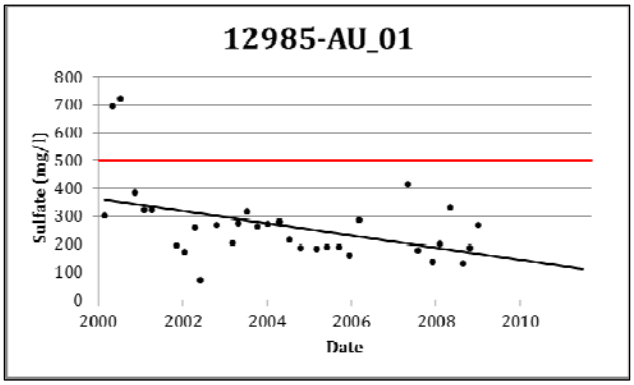
| Chloride | Status | # samples | Min | Max | Average | >650 |
|---|---|---|---|---|---|---|
| 500 mg/l | FS | 82 | 5 | 775 | 69.4 | 1 |



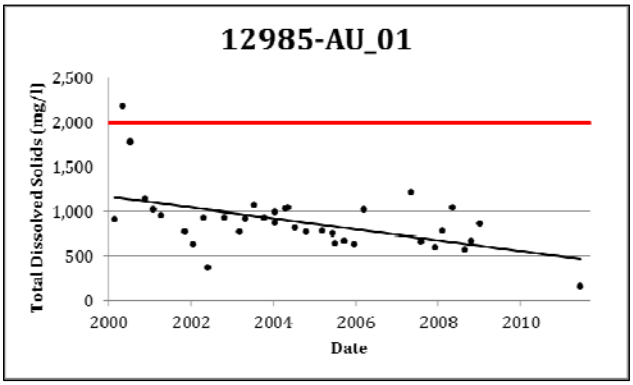

Statistical analysis indicates that there is a decreasing trend in chloride values in AU_01 with a **t-stat of -2.22** and a **p-value of 0.03** and in AU_02 with a **t-stat of -4.61** and a **p-value of 0.00.** The decreasing values could possibly be associated with changes in wastewater treatment practices.

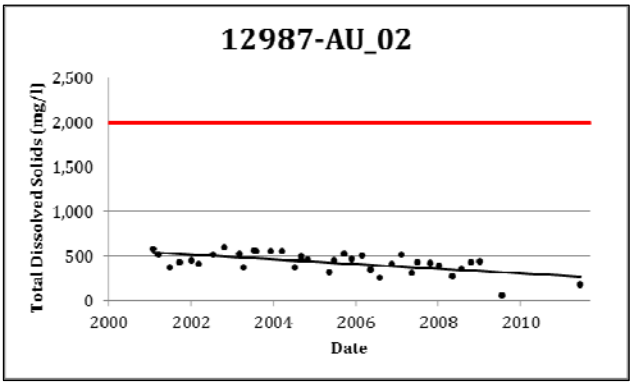
| Sulfate | Status | # samples | Min | Max | Average | >500 |
|---|---|---|---|---|---|---|
| 500 mg/l | FS | 82 | 5 | 3,150 | 121.7 | 2 |




Statistical analysis indicates that there is a decreasing trend in sulfate values in AU_01 with a **t-stat of -2.68** and a **p-value of 0.01.** The decreasing values could possibly be associated with changes in wastewater treatment practices.

| TDS | Status | # samples | Min | Max | Average | >2,000 |
|---|---|---|---|---|---|---|
| 2,000 mg/l | FS | 91 | 60.4 | 1,210 | 471.5 | 0 |



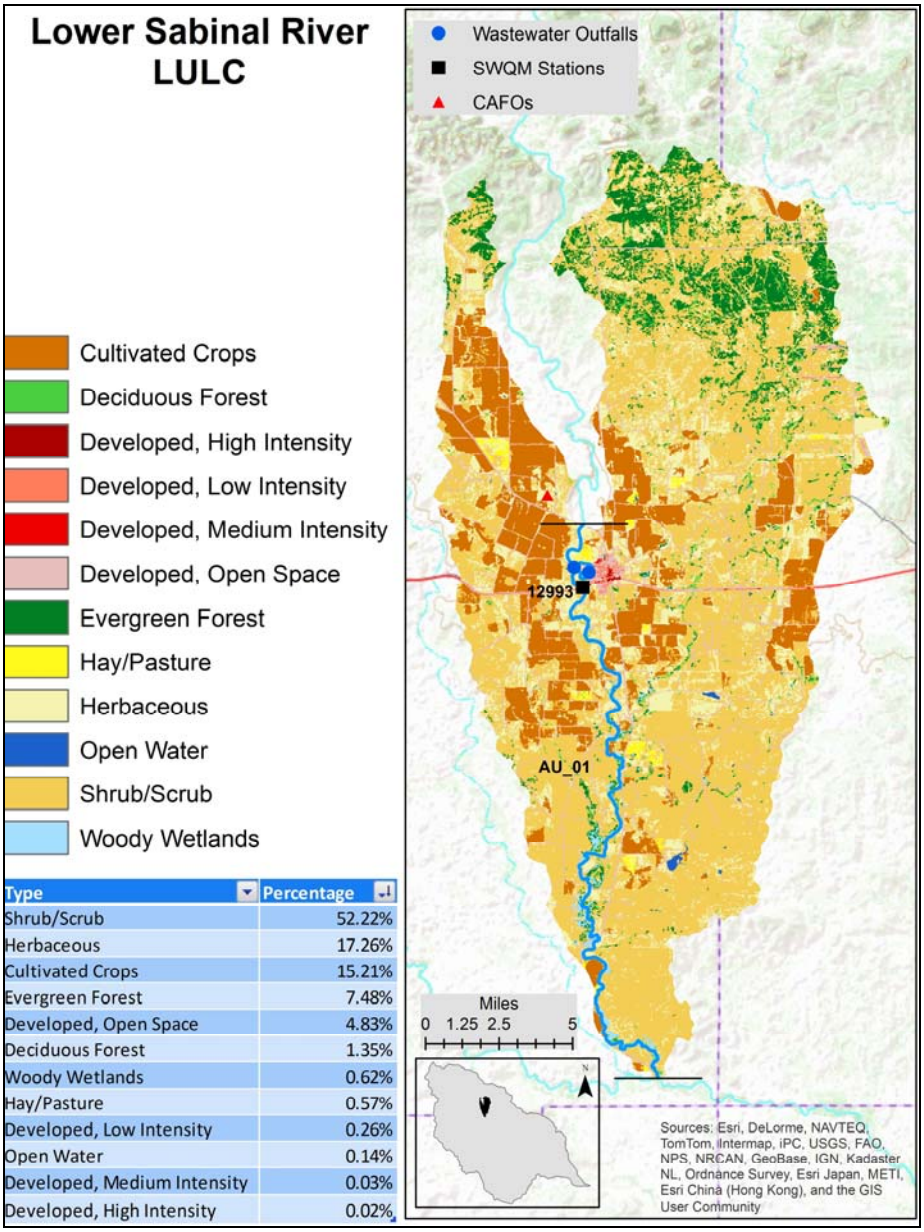

Statistical analysis indicates that there is a decreasing trend in TDS values in AU_01 with a **t-stat of -3.48** and a **p-value of 0.00** and in AU_02 with a **t-stat of -4.43** and a **p-value of 0.00.** The decreasing values could possibly be associated with changes in wastewater treatment practices.

### Fish Consumption Use
There are no concerns for bioaccumulation of toxins in fish tissue for this segment.

### Public Water Supply Use
All AUs are fully supporting for surface water human health criteria for public water supply.

## LOWER SABINAL RIVER WATERSHED – SEGMENT 2110

The 27 mile segment extends from the confluence of the Frio River in Uvalde County to a point 100 m upstream of SH 127 in Bandera and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 52.22% |
| Herbaceous | 17.26% |
| Cultivated Crops | 15.21% |
| Evergreen Forest | 7.48% |
| Developed, Open Space | 4.83% |
| Deciduous Forest | 1.35% |
| Woody Wetlands | 0.62% |
| Hay/Pasture | 0.57% |
| Developed, Low Intensity | 0.26% |
| Open Water | 0.14% |
| Developed, Medium Intensity | 0.03% |
| Developed, High Intensity | 0.02% |

| | |
|---|---|
| **Drainage area** | 136,678 acres |
| **Major Aquifers** | Edwards |
| **Cities** | Sabinal |
| **Counties** | Uvalde, Medina |
| **EcoRegions** | Northern Nueces Alluvial Plains |
| **Climate Annual Averages** | Rain: 25” – 27”; Low: 55° F - 57° F; High: 81° F - 82° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Public Water Supply |
| **Permitted WWTFs** | WQ0014342-001 – City of Sabinal: 142,000 gpd via unnamed tributary<br>WQ0014689-001 – City of Sabinal: 340,000 gpd |

## Special Studies

A TMDL was conducted on the Lower Sabinal River as described in the Nueces River Basin write-up on Page 27.

## Water Quality Analysis

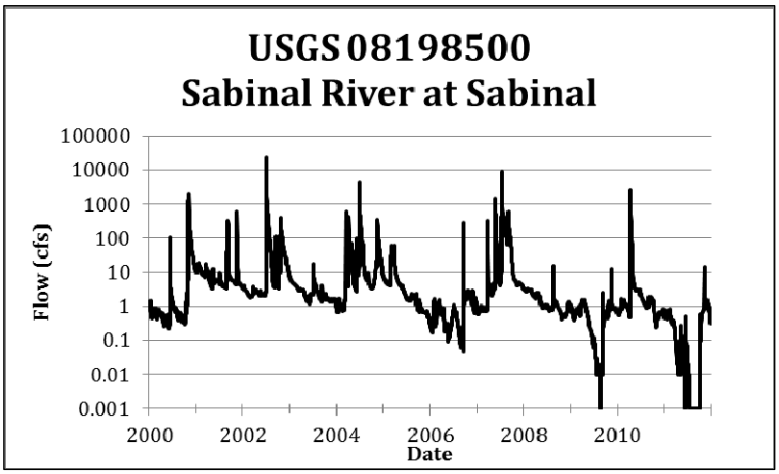
The analysis for this segment is based on data from **Station 12993**, located at US 90 west of Sabinal. Trend analysis was conducted on data from February 2000 through October 2011. TCEQ is responsible for quarterly routine monitoring at this site.

There is a **nitrate impairment** for the segment.

The watershed is predominately brush lands, with croplands adjacent to the river in the upper reaches. Sabinal is the only city within the watershed, situated at the upper end of the segment. Forests exist in the most north portion of the watershed.

The USGS flow gauge at Sabinal River at Sabinal is located at the same location as Station 12993. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 28.7 cfs
2001 – 12.7 cfs
2002 – 215 cfs
2003 – 2.7 cfs
2004 – 61.4 cfs
2005 – 5.8 cfs
2006 – 2.0 cfs
2007 – 81.6 cfs
2008 – 1.5 cfs
2009 – 0.6 cfs
2010 – 14.0 cfs
2011 – 0.4 cfs

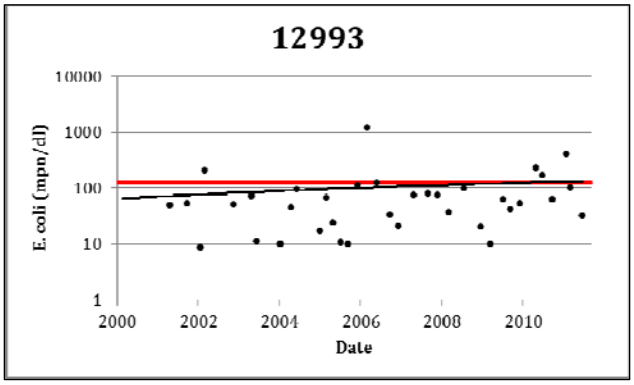



### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 27 | 5.2 | 13.2 | 7.3 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use

| *E. coli* | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|
| Geomean 126 cfu/100 ml | FS | 25 | 10 | 1,200 | 49.33 | 1 | 1 |




Statistical analysis indicates that there is an increasing trend in *E. coli* values with a **t-stat of 2.60** and a **p-value of 0.01.** A new WWTF was built to address a nitrate impairment (see nitrate discussion below). The old plant is sitting idle and may be contributing to the loading during runoff events. With minimal populations above this site or in the Upper Sabinal River, wildlife would be another possible source of bacteria.

### General Use

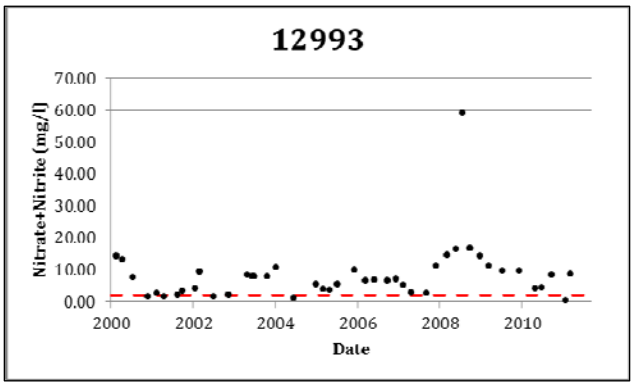
| Water Temperature | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|
| 32.2 °C | FS | 28 | 12.3 | 27.8 | 21.5 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 28 | 6.2 | 8 | 7.5 | 1 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|
| 0.33 mg/l | NC | 27 | <0.05 | 0.09 | 0.05 | 24 | 0 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|
| 14.1 µg/l | NC | 26 | <3 | 23 | 3 | 21 | 1 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|
| 1.95 mg/l | **NS** | **25** | **1.13** | **59.2** | **6.48** | **0** | **24** |



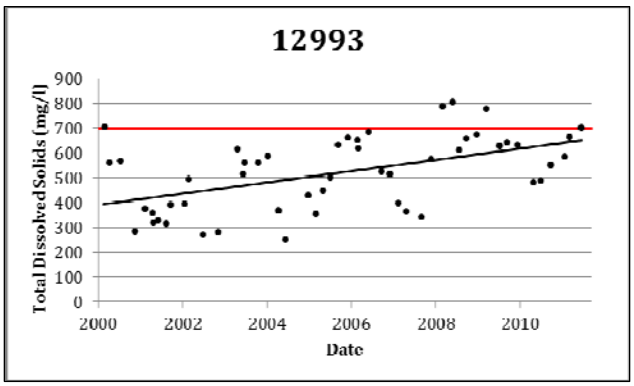

The new Sabinal WWTF, discussed on Page 27, came online July 27, 2011. Nitrate samples will continue to be taken and it is expected that the values will begin to decrease.

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|
| 0.69 mg/l | NC | 25 | <0.05 | <0.05 | 0.05 | 25 | 0 |

| Chloride | Status | # samples | Min | Max | Average | >200 |
|---|---|---|---|---|---|---|
| 200 mg/l | FS | 27 | 14 | 154 | 94.8 | 0 |

| Sulfate | Status | # samples | Min | Max | Average | >100 |
|---|---|---|---|---|---|---|
| 100 mg/l | FS | 28 | 21 | 66 | 47.8 | 0 |

| TDS | Status | # samples | Min | Max | Average | >700 |
|---|---|---|---|---|---|---|
| 700 mg/l | FS | 29 | 252 | 804 | 554.0 | 3 |



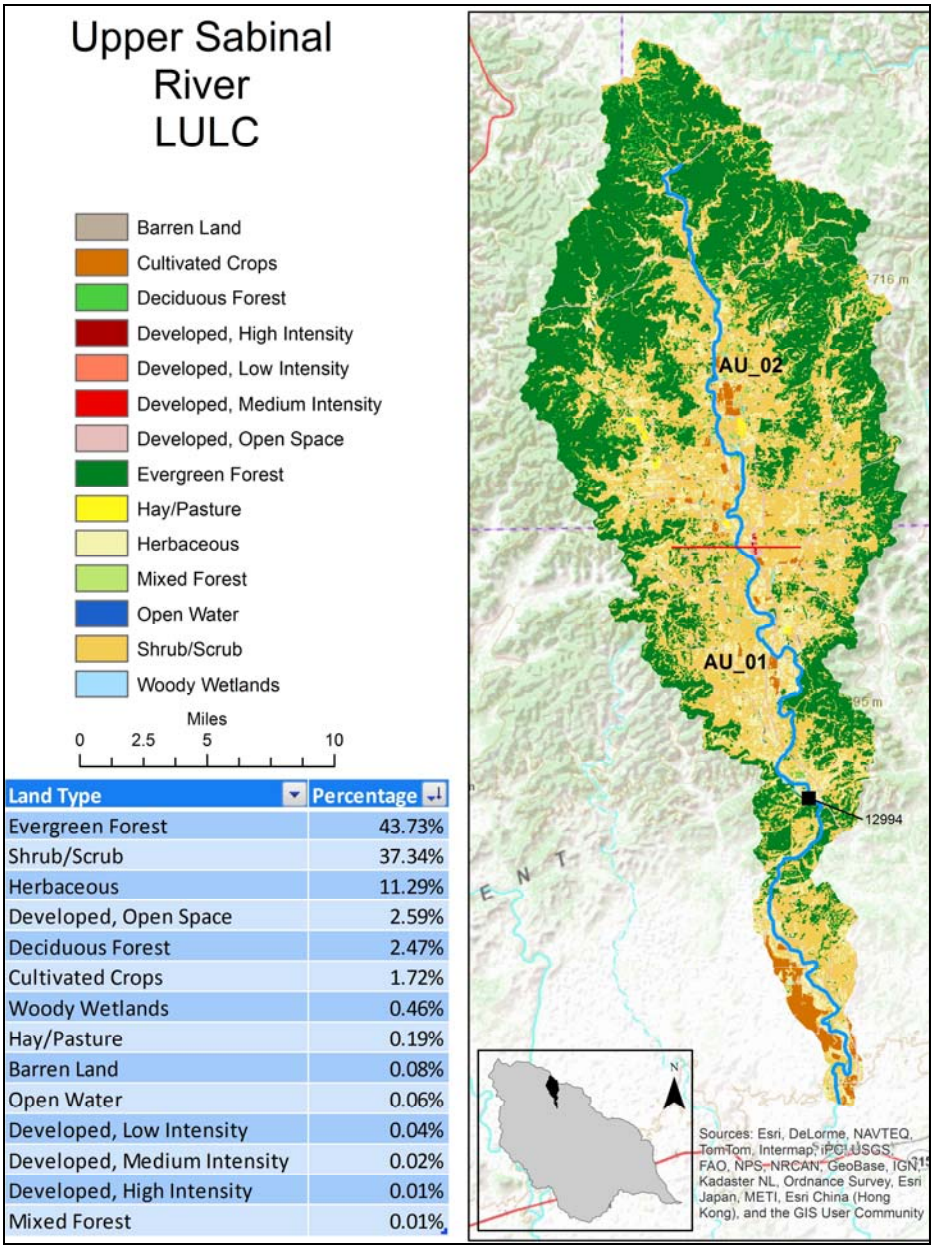

Statistical analysis indicates that there is an increasing trend in TDS values with a **t-stat of 3.51** and a **p-value of 0.00.** The increasing trend may be due to increasing frequencies of dry periods that Texas has been experiencing.

## Public Water Supply Use

The segment is fully supporting for surface water human health criteria for public water supply.

## UPPER SABINAL RIVER WATERSHED – SEGMENT 2111

The 48 mile segment extends from a point 100m (110 yards) upstream of SH 127 in Uvalde County to the most upstream crossing of FM 187 in Bandera and is divided into two AUs.




| Land Type | Percentage |
|---|---|
| Evergreen Forest | 43.73% |
| Shrub/Scrub | 37.34% |
| Herbaceous | 11.29% |
| Developed, Open Space | 2.59% |
| Deciduous Forest | 2.47% |
| Cultivated Crops | 1.72% |
| Woody Wetlands | 0.46% |
| Hay/Pasture | 0.19% |
| Barren Land | 0.08% |
| Open Water | 0.06% |
| Developed, Low Intensity | 0.04% |
| Developed, Medium Intensity | 0.02% |
| Developed, High Intensity | 0.01% |
| Mixed Forest | 0.01% |

| | |
|---|---|
| **Drainage area** | 149,444 acres |
| **Major Aquifers** | Edwards, Trinity |
| **Cities** | Utopia, Vanderpool |
| **Counties** | Bandera, Real, Uvalde |
| **EcoRegions** | Balcones Canyonlands, Northern Nueces Alluvial Plains |
| **Climate Annual Average** | Rain: 27" – 35"; Low: 51° F - 56° F; High: 77° F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Public Water Supply |
| **Permitted WWTFs** | WQ0011951-001 – Lost Maples State Park: 8,000 gpd via irrigation |

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with the West Sabinal River. **AU_02** is the reach from the upstream end of AU_01 to the upstream end of segment.

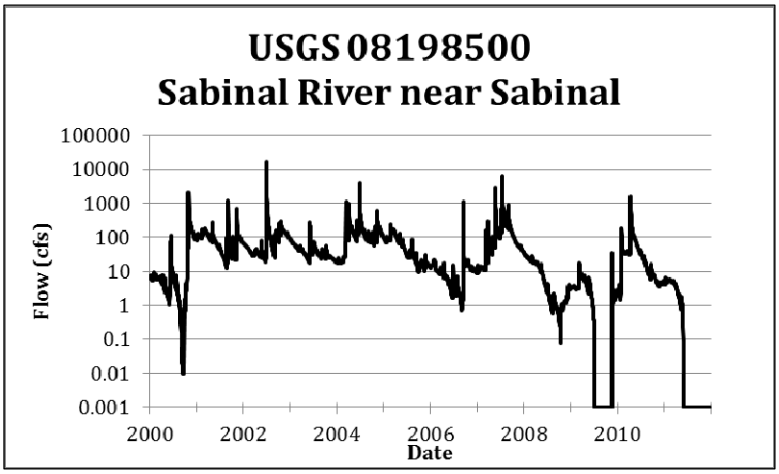
The analysis for AU_01 is based on data from **Station 12994**, located 12.5 miles north of Sabinal and 2.3 miles downstream from the mouth of Onion Creek. Trend analysis was conducted on data from February 2000 through July 2011. TCEQ is responsible for quarterly routine monitoring at this site.

There are no monitoring stations on AU_02.

This segment is located in one of the more pristine and natural areas of the basin. All water quality standards are being met. This is most likely due to it being a headwater stream, and therefore no influences from upstream, having only a couple of small population centers, and no direct WWTF discharges.

The USGS flow gauge at Sabinal River near Sabinal is located at the same location as Station 12994. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 54.8 cfs
2001 – 82.8 cfs
2002 – 203 cfs
2003 – 40.4 cfs
2004 – 139 cfs
2005 – 55.9 cfs
2006 – 12.9 cfs
2007 – 148 cfs
2008 – 9.3 cfs
2009 – 2.5 cfs
2010 – 40.7 cfs
2011 – 1.5 cfs




### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 25 | 5.5 | 12.3 | 8.6 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use Assessment

| *E. coli* | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|
| Geomean 126 cfu/100 ml | FS | 23 | 2 | 430 | 35.03 | 0 | 1 |

### General Use Assessment

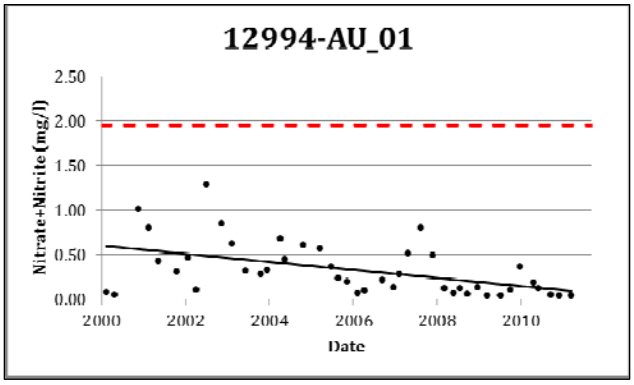
| Water Temperature | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|
| 32.2 °C | FS | 25 | 9.2 | 29.4 | 22.1 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 24 | 7.4 | 8.3 | 7.8 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|
| 0.33 mg/l | NC | 27 | <0.01 | <0.01 | 0.01 | 27 | 0 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|
| 14.1 µg/l | NC | 25 | <1 | 4.3 | 1 | 24 | 0 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|
| 1.95 mg/l | NC | 27 | <0.04 | 0.8 | 0.2 | 2 | 0 |

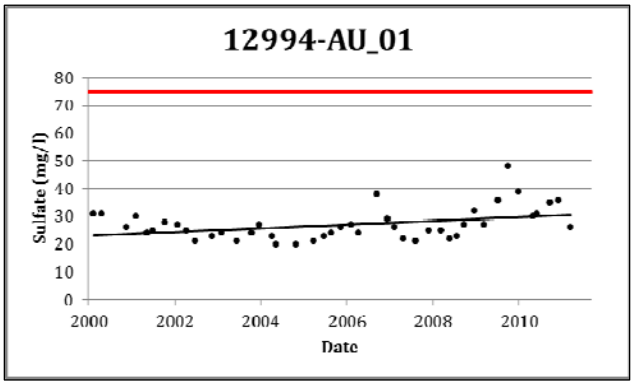



Statistical analysis indicates that there is a decreasing trend in nitrate values in AU_01 with a **t-stat of -3.69** and a **p-value of 0.00.** This may be attributed to lack of runoff due to lack of rain.

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|
| 0.69 mg/l | NC | 26 | <0.01 | <0.01 | 0.01 | 26 | 0 |

| Chloride | Status | # samples | Min | Max | Average | >50 |
|---|---|---|---|---|---|---|
| 50 mg/l | FS | 27 | 8 | 91 | 14.7 | 1 |

| Sulfate | Status | # samples | Min | Max | Average | >75 |
|---|---|---|---|---|---|---|
| 75 mg/l | FS | 27 | 20 | 48 | 27.26 | |




Statistical analysis indicates that there is an increasing trend in sulfate values in AU_01 with a **t-stat of 2.65** and a **p-value of 0.01.** The increasing trend may be due to increasing frequencies of dry periods that Texas has been experiencing. However, the actual values are generally well below the criteria level and no apparent concern in the near future.

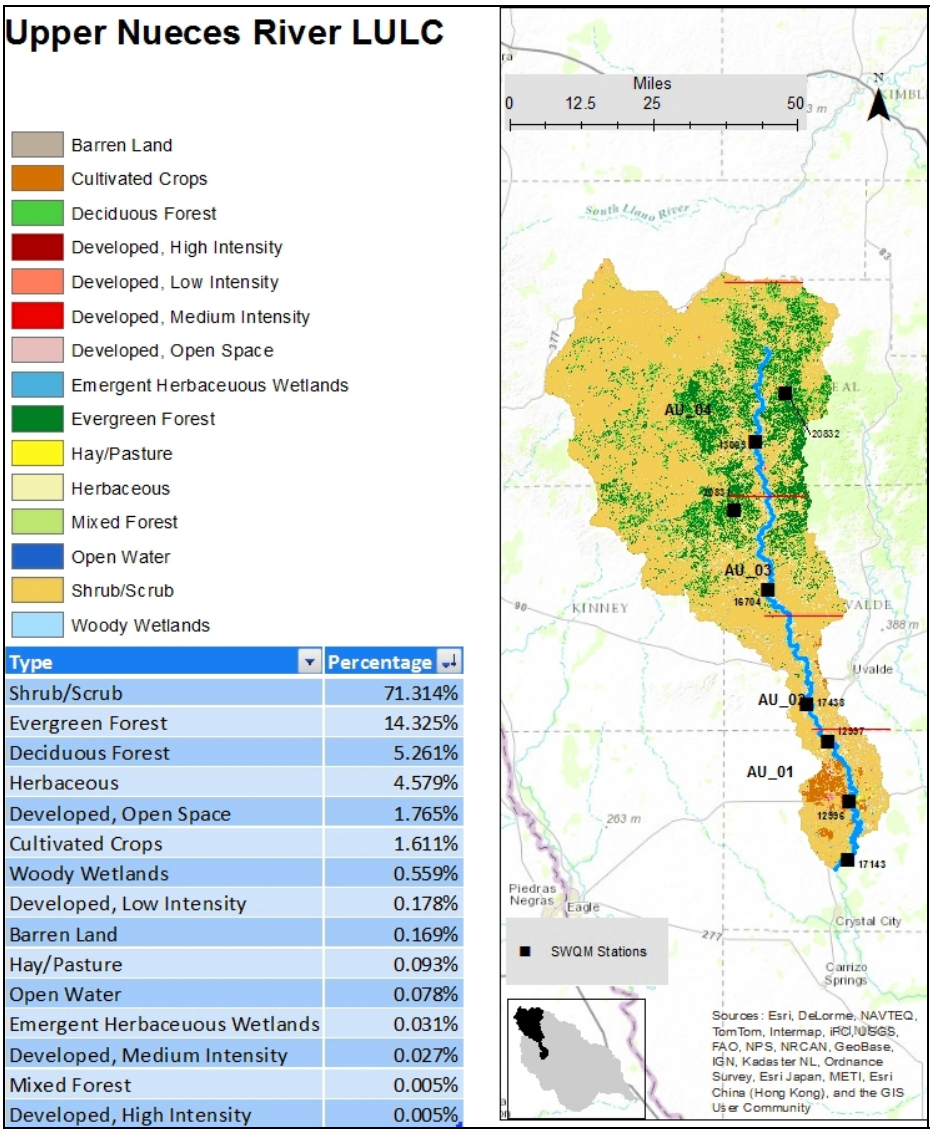
| TDS | Status | # samples | Min | Max | Average | >500 |
|---|---|---|---|---|---|---|
| 500 mg/l | FS | 27 | 236 | 320 | 279.7 | 0 |

### Public Water Supply Use

The segment is fully supporting for surface water human health criteria for public water supply.

## UPPER NUECES RIVER WATERSHED – SEGMENT 2112

The 123 mile segment extends from a point 100m (110 yards) upstream of FM 1025 in Zavala County to the confluence of the East Prong Nueces River and Hackberry Creek in Edwards County and is divided into four AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 71.314% |
| Evergreen Forest | 14.325% |
| Deciduous Forest | 5.261% |
| Herbaceous | 4.579% |
| Developed, Open Space | 1.765% |
| Cultivated Crops | 1.611% |
| Woody Wetlands | 0.559% |
| Developed, Low Intensity | 0.178% |
| Barren Land | 0.169% |
| Hay/Pasture | 0.093% |
| Open Water | 0.078% |
| Emergent Herbaceuous Wetlands | 0.031% |
| Developed, Medium Intensity | 0.027% |
| Mixed Forest | 0.005% |
| Developed, High Intensity | 0.005% |

| | |
|---|---|
| **Drainage area** | 1,336,006 acres |
| **Major Aquifers** | Carrizo, Edwards, Edwards-Trinity |
| **Cities** | La Pryor, Smyth Crossing, Montell, Camp Wood, Barksdale, Vance |
| **Counties** | Real, Edwards, Uvalde, Zavala |
| **EcoRegions** | Balcones Canyonlands, Edwards Plateau Woodland, Northern Nueces Alluvial Plains, Texas-Tamaulipan Thornscrub |
| **Climate Annual Averages** | Rain: 21" – 33"; Low: 51° F - 58° F; High: 77° F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Public Water Supply |
| **Permitted WWTFs** | WQ0012334-001 – City of Camp Wood: 101,000 gpd via irrigation<br>WQ0014367-002 – Zavala County WCID: 330,000 gpd via irrigation |

### Special Studies

The Upper Nueces River is a subject of the Pull.Kill.Plant initiative for Arrundo removal as described in the Nueces River Basin write-up on Page 28.

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Sand Ridge Creek. **AU_02** is the reach from the upstream end of AU_01 to the confluence with an unnamed tributary just downstream of US Highway 90. **AU_03** is the reach from the upstream end of AU_02 to the confluence with Miller Creek. **AU_04** is the reach from the upstream end of AU_03 to the upper end of the segment.

The analysis for AU_01 is based on data from **Station 17143**, located at Lake Averhoff upstream of the TPWD boat ramp. Trend analysis was conducted on data from October 2000 through November 2011. TCEQ is responsible for quarterly monitoring at this site.


There are no current monitoring stations on AU_02.

The analysis for AU_03 is based on data from **Station 16704**, located upstream of SH 55 south of Laguna. Trend analysis was conducted on data from February 2000 through August 2011. TCEQ is responsible for quarterly monitoring at this site.

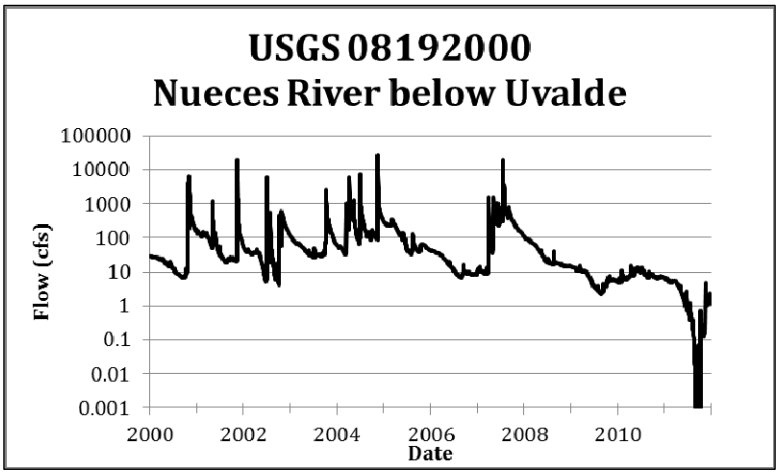
The analysis for AU_04 is based on data from **Station 13005**, at SH 55 south Barksdale. Trend analysis was conducted on data from October 2001 through November 2011. NRA is responsible for quarterly monitoring at this site.

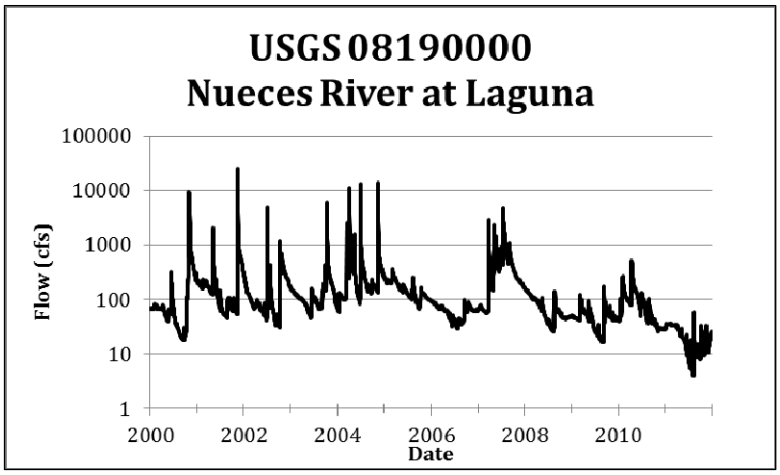
All water quality standards are met, which is most likely due to it being a headwater stream, and therefore no influences from upstream, having only a couple of small population centers, and no direct WWTF discharges.

The watershed is a mixture of brush and croplands with forests in the northern end.

The USGS flow gauge at Nueces River below Uvalde is located near the upper end of AU_02. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

| | |
|---|---|
| 2000 – 124 cfs | 2006 – 18.2 cfs |
| 2001 – 200 cfs | 2007 – 357 cfs |
| 2002 – 110 cfs | 2008 – 7.0 cfs |
| 2003 – 93.9 cfs | 2009 – 7.9 cfs |
| 2004 – 409 cfs | 2010 – 2.9 cfs |
| 2005 – 120 cfs | 2011 – 1.5 cfs |




The USGS flow gauge at Nueces River near Laguna is located just upstream of Station 16704. The annual mean flows are:

| | |
|---|---|
| 2000 – 124 cfs | 2006 – 18.2 cfs |
| 2001 – 200 cfs | 2007 – 357 cfs |
| 2002 – 110 cfs | 2008 – 37.2 cfs |
| 2003 – 93.9 cfs | 2009 – 7.0 cfs |
| 2004 – 409 cfs | 2010 – 7.9 cfs |
| 2005 – 120 cfs | 2011 – 2.3 cfs |

**Aquatic Life Use Assessment**

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 26 | 4.9 | 12.2 | 7.95 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-03 | Minimum 3.0 mg/l | FS | 29 | 7.0 | 11.4 | 9.1 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-04 | Minimum 3.0 mg/l | FS | 29 | 6.6 | 11.0 | 8.5 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

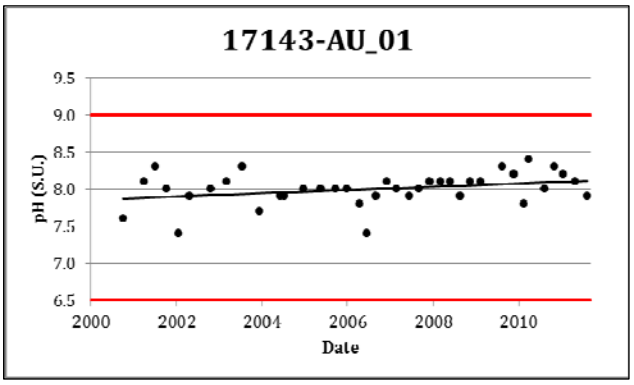
**Recreation Use**

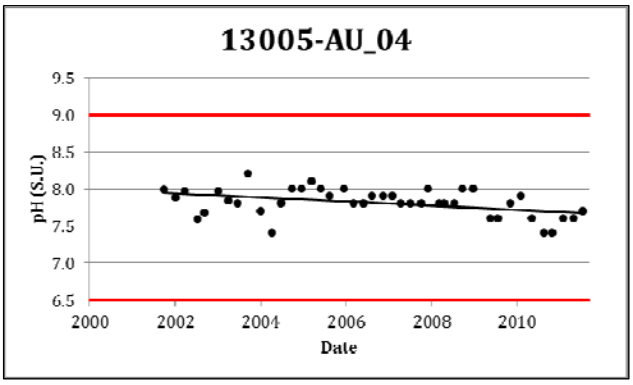
| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | FS | 25 | 1 | 66 | 8.45 | 3 | 0 |
| AU-03 | | FS | 27 | <1 | 2,419 | 8.50 | 3 | 1 |
| AU-04 | | FS | 29 | 2 | 61 | 10.96 | 0 | 0 |

**General Use**

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 26 | 12.9 | 31.9 | 21.6 | 0 |
| AU-03 | | FS | 29 | 13.8 | 33.5 | 23.2 | 1 |
| AU-04 | | FS | 29 | 13.8 | 27.4 | 22.1 | 0 |

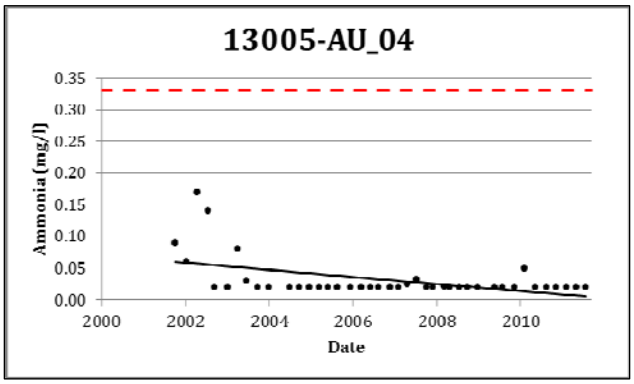
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 25 | 7.4 | 8.4 | 8.0 | 0 | 0 |
| AU-03 | | FS | 28 | 6.4 | 8.7 | 8.0 | 1 | 0 |
| AU-04 | | FS | 29 | 7.4 | 8.1 | 7.8 | 0 | 0 |




Statistical analysis indicates that there is an increasing trend in pH values in AU_01 with a **t-stat of 2.10** and a **p-value of 0.04** and a decreasing in AU_04 with a **t-stat of -2.79** and a **p-value of 0.01.** The sampling site for AU-01 is at the very end of the segment and the site for AU_04 is about 100 miles upstream. So the different trend directions is not unusual, but the cause of the trends is unknown. In either case, all values are well within the pH range and not a concern.

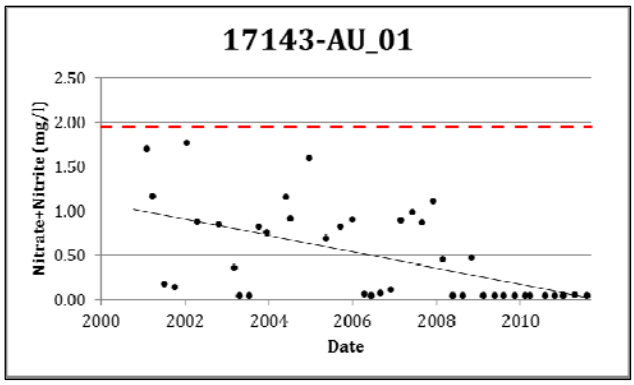
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 25 | <0.05 | 0.06 | 0.05 | 23 | 0 |
| AU-03 | | NC | 28 | <0.05 | 0.06 | 0.05 | 27 | 0 |
| AU-04 | | NC | 28 | <0.02 | 0.05 | 0.02 | 23 | 0 |

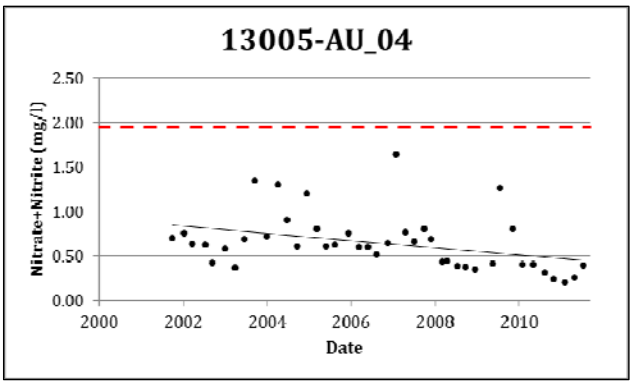



Statistical analysis indicates that there is a decreasing trend in ammonia concentrations in AU_04 with a **t-stat of -3.48** and a **p-value of 0.00.** This trend is a result of some relatively high values early in the dataset. Since 2004, all values have been non-detects or very low.

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 23 | <3 | 11.2 | 3.56 | 10 | 0 |
| AU-03 | | NC | 36 | <3 | <3 | 3 | 26 | 0 |
| AU-04 | | NC | 28 | <2 | 2 | 2 | 25 | 0 |

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | NC | 26 | <0.04 | 1.59 | 0.275 | 9 | 0 |
| AU-03 | | NC | 25 | 0.26 | 2.61 | 0.7 | 0 | 1 |
| AU-04 | | NC | 29 | 0.307 | 1.64 | 0.61 | 0 | 0 |

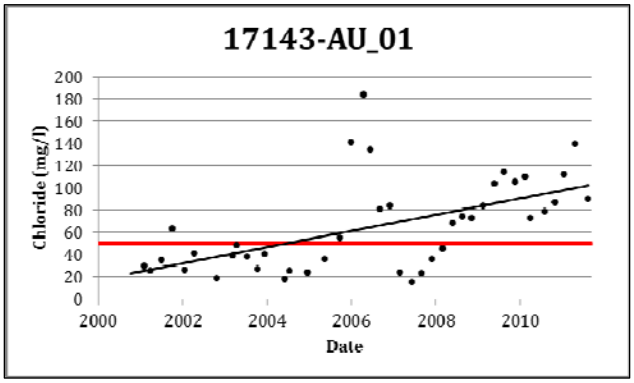



Statistical analysis indicates that there is a decreasing trend in nitrate values in AU_01 with a **t-stat of -4.21** and a **p-value of 0.00** and in AU_04 with a **t-stat of -2.52** and a **p-value of 0.02.** This may be attributed to lack of runoff due to lack of rain.

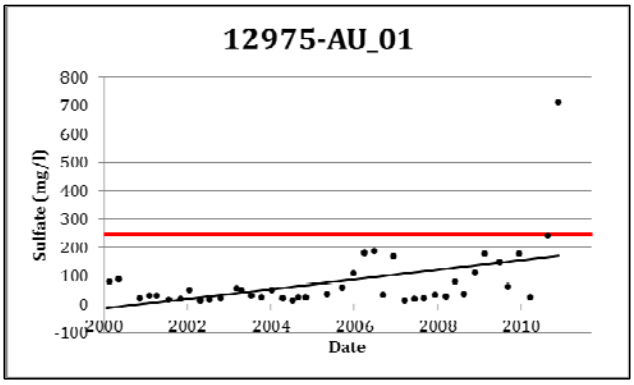
| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 25 | <0.05 | <0.05 | 0.05 | 25 | 0 |
| AU-03 | | NC | 27 | <0.02 | <0.02 | 0.02 | 27 | 0 |
| AU-04 | | NC | 29 | <0.002 | 0.012 | 0.002 | 26 | 0 |

| Chloride | Status | # samples | Min | Max | Average | >50 |
|---|---|---|---|---|---|---|
| 50 mg/l | FS | 83 | 7.8 | 263 | 32.9 | 17 |



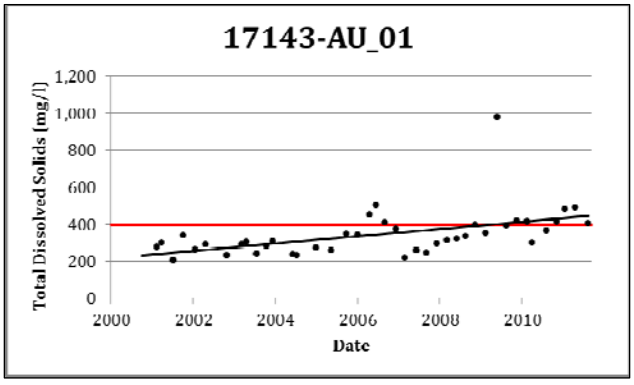

Statistical analysis indicates that there is an increasing trend in chloride values in AU_01 with a **t-stat of 4.29** and a **p-value of 0.00.** Chloride levels are inversely related to the flow, with concentrations increasing as flows decrease. The higher values tend to correlate to dry periods. The increasing trends may be due to increasing frequencies of dry periods that south Texas has been experiencing. If the droughts continue, a future impairment for this parameter is likely.

| Sulfate | Status | # samples | Min | Max | Average | >50 |
|---|---|---|---|---|---|---|
| 50 mg/l | FS | 83 | 6.9 | 197 | 21.9 | 8 |




Statistical analysis indicates that there is an increasing trend in sulfate values in AU_01 with a **t-stat of 3.71** and a **p-value of 0.00.** This trend is most likely related to the same factors associated with the chloride trend. If the droughts continue, a future impairment for this parameter is possible.

| TDS | Status | # samples | Min | Max | Average | >400 |
|---|---|---|---|---|---|---|
| 400 mg/l | FS | 86 | 173 | 980 | 264.5 | 6 |



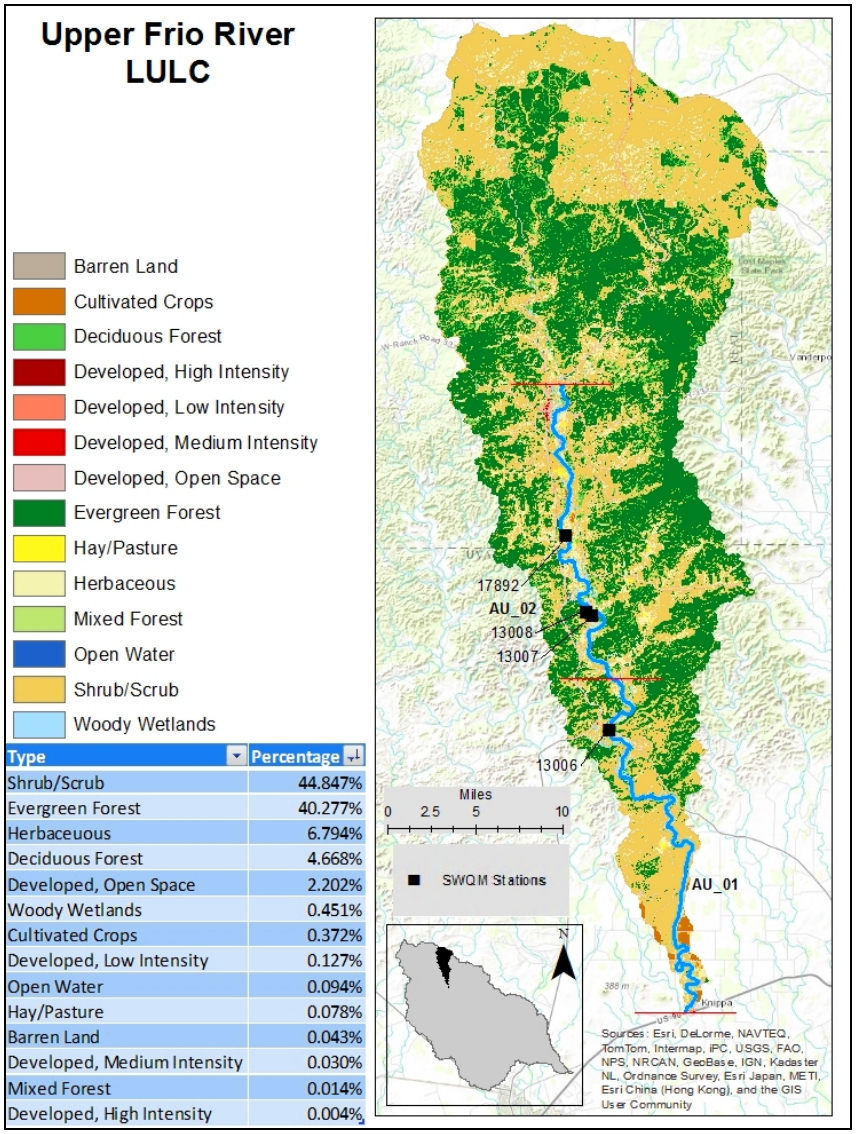

Statistical analysis indicates that there is an increasing trend in TDS values in AU_01 with a **t-stat of 3.46** and a **p-value of 0.00.** This trend is most likely related to the chloride trends. If the droughts continue, a future impairment for this parameter is possible.

### Public Water Supply Use

All AUs are fully supporting for surface water human health criteria for public water supply.

# UPPER FRIO RIVER WATERSHED – SEGMENT 2113

The 47 mile segment extends from a point 100m (110 yards) upstream of FM 90 in Uvalde County to the confluence of the West Frio River and the East Frio River in Real County and is divided into two AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 44.847% |
| Evergreen Forest | 40.277% |
| Herbaceuous | 6.794% |
| Deciduous Forest | 4.668% |
| Developed, Open Space | 2.202% |
| Woody Wetlands | 0.451% |
| Cultivated Crops | 0.372% |
| Developed, Low Intensity | 0.127% |
| Open Water | 0.094% |
| Hay/Pasture | 0.078% |
| Barren Land | 0.043% |
| Developed, Medium Intensity | 0.030% |
| Mixed Forest | 0.014% |
| Developed, High Intensity | 0.004% |

| | |
|---|---|
| **Drainage area** | 280,596 acres |
| **Major Aquifers** | Edwards, Edwards-Trinity |
| **Cities** | Leakey, Rio Frio, Concan, Knippa, Silver Mine Pass |
| **Counties** | Uvalde, Real, Bandera |
| **EcoRegions** | Balcones Canyonlands, Edwards Plateau Woodland, Northern Nueces Alluvial Plains |
| **Climate Annual Averages** | Rain: 27” – 33”; Low: 50° F - 55° F; High: 76° F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Public Water Supply |
| **Permitted WWTFs** | WQ0011683-001 – Alto Frio Baptist Encampment: 20,000 gpd via irrigation<br>WQ0011962-001 – Garner State Park: 60,000 gpd via irrigation<br>WQ0015083-001 – NRA: 359,500 gpd via irrigation (pending) |

## Special Studies

The Upper Frio River is a subject of the Pull.Kill.Plant initiative for Arundo removal as described in the Nueces River Basin write-up on Page 28.

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Bear Creek. **AU_02** is the reach from the upstream end of AU_01 to the upper end of the segment.

The analysis for AU_01 is based on data from **Station 13006**, located at SH 127 east of Concan. Trend analysis was conducted on data from January 2000 through October 2011. TCEQ is responsible for quarterly routine monitoring at this site.

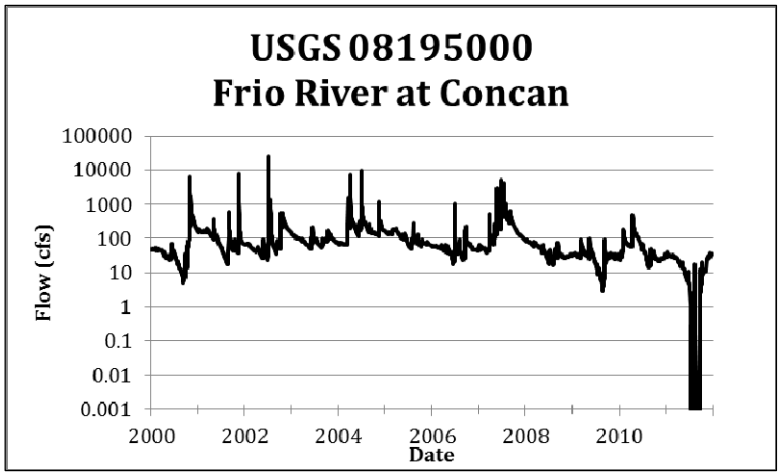
The analysis for AU_02 is based on data from **Station 13007**, located at Magers Crossing. Trend analysis was not conducted due to a data gap from August 2004 to November 2009. TCEQ is responsible for quarterly routine monitoring at this site.

All water quality standards are being met, which is most likely due to it being a headwater stream, and therefore no influences from upstream, having only a couple of small population centers, and no direct WWTF discharges. However, an ALUAA resulted in **habitat concerns** for both AUs, a **fish communities concern** for AU_02, and **macrobenthic** and **fish communities impairments** for AU_01.

The watershed is a mixture of brush and forest. This segment of the river is very popular recreational location for tubing. People come from all over the state to float the Frio.

The USGS flow gauge at Frio River at Concan is located at the same location as Station 13006. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

| | |
|---|---|
| 2000 – 122 cfs | 2006 – 52.2 cfs |
| 2001 – 137 cfs | 2007 – 279 cfs |
| 2002 – 261 cfs | 2008 – 44.7 cfs |
| 2003 – 87.9 cfs | 2009 – 28.9 cfs |
| 2004 – 264 cfs | 2010 – 60.2 cfs |
| 2005 – 104 cfs | 2011 – 16.3 cfs |




## Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <4 | <6 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 4.0 mg/l | FS | 37 | 6.3 | 13.3 | 8.8 | 0 | 0 |
| | Screening Level 6.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 4.0 mg/l | FS | 11 | 7.2 | 11.3 | 8.7 | 0 | 0 |
| | Screening Level 6.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 4.0 mg/l | NC | 4 | 5.9 | 7.2 | 6.6 | 0 | NA |
| | 24-Hr Average 6.0 mg/l | NC | | 6.3 | 7.8 | 7.4 | NA | 0 |

AU_02 is fully supporting / has no concerns for toxic substances in sediment for aquatic life use. There habitat concerns for both AUs and a fish communities concern for AU_02. There are macrobenthic and fish communities impairments for AU_01.

## Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean | FS | 29 | <1 | 2,419 | 9.52 | 4 | 1 |
| AU-02 | 126 cfu/100 ml | FS | 9 | 6 | 60 | 17.26 | 0 | 0 |

## General Use

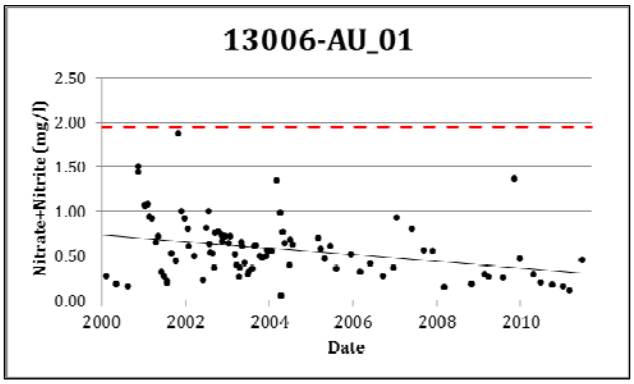
| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 38 | 11.5 | 29.7 | 23.3 | 0 |
| AU-02 | | FS | 11 | 12.0 | 29.1 | 21.6 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 37 | 5.7 | 8.3 | 7.9 | 1 | 0 |
| AU-02 | | FS | 11 | 7.9 | 8.4 | 8.1 | 0 | 0 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 38 | <0.03 | 0.08 | 0.03 | 37 | 0 |
| AU-02 | | NC | 11 | <0.03 | 0.1 | 0.03 | 8 | 0 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 31 | <1 | <1 | 1 | 31 | 0 |
| AU-02 | | NC | 11 | <1 | <1 | 1 | 11 | 0 |

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | NC | 36 | 0.05 | 1.36 | 0.5 | 0 | 0 |
| AU-02 | | NC | 11 | <0.05 | 1.31 | 0.49 | 1 | 0 |

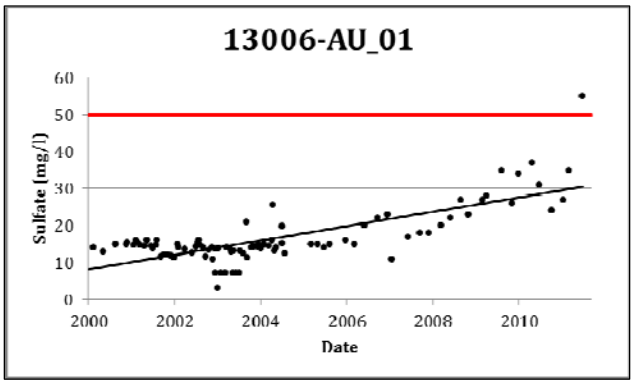



Statistical analysis indicates that there is a decreasing trend in nitrate values in AU_01 with a **t-stat of -3.21** and a **p-value of 0.00.** This may be attributed to lack of runoff due to lack of rain.

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 38 | <0.004 | 0.006 | 0.004 | 35 | 0 |
| AU-02 | | NC | 10 | <0.01 | <0.01 | 0.01 | 10 | 0 |

| Chloride | Status | # samples | Min | Max | Average | >50 |
|---|---|---|---|---|---|---|
| 50 mg/l | FS | 46 | 7 | 24 | 11.98 | 0 |

| Sulfate | Status | # samples | Min | Max | Average | >50 |
|---|---|---|---|---|---|---|
| 50 mg/l | FS | 48 | 11 | 37 | 19.0 | 0 |




Statistical analysis indicates that there is an increasing trend in nitrate values in AU_01 with a **t-stat of 10.99** and a **p-value of 0.00.** The increasing trends may be due to increasing frequencies of dry periods that south Texas has been experiencing. The values are generally below the criteria, so an impairment is not likely in the near future.

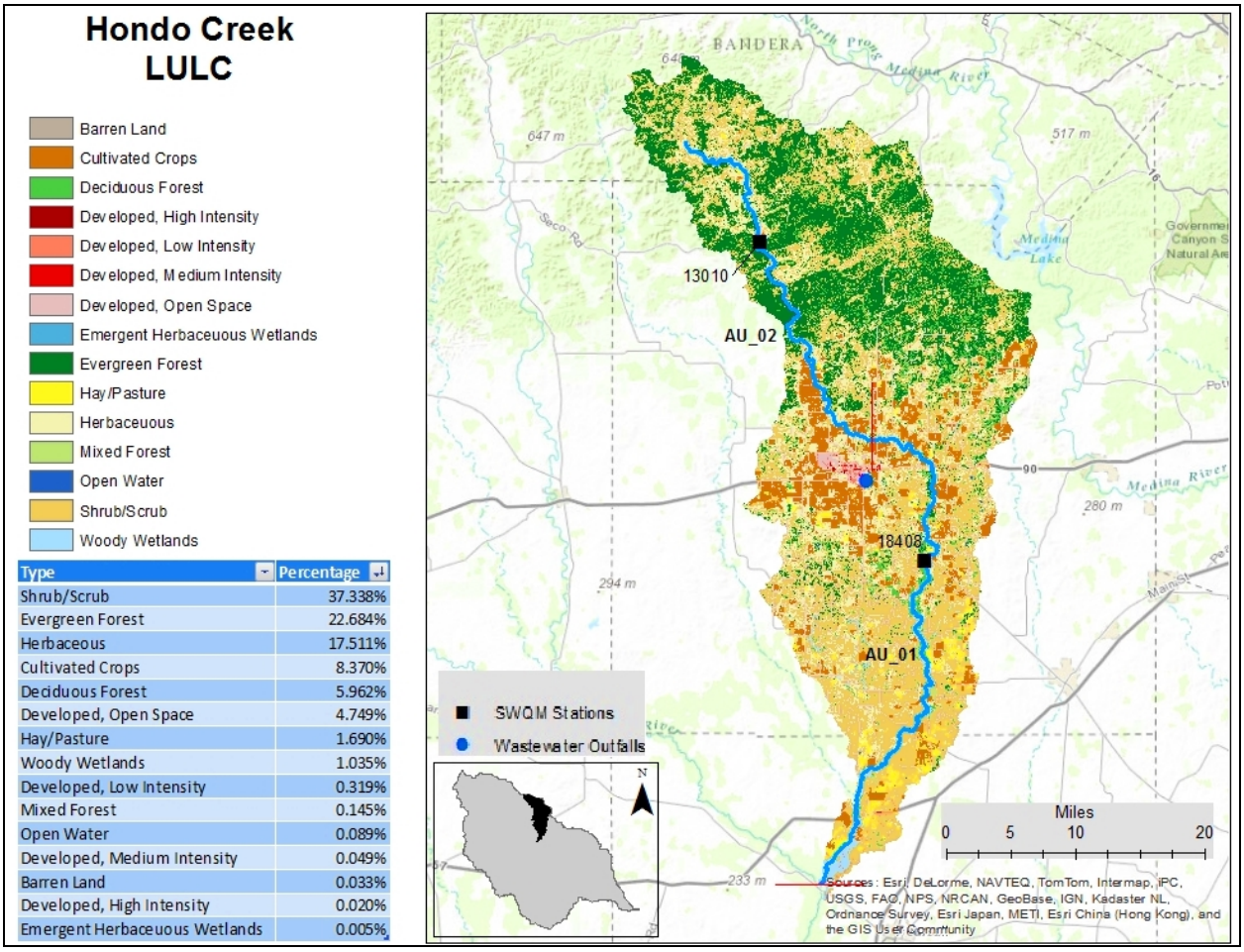
| TDS | Status | # samples | Min | Max | Average | >400 |
|---|---|---|---|---|---|---|
| 400 mg/l | FS | 86 | 173 | 980 | 264 | 6 |

### Public Water Supply Use

Both AUs are fully supporting for surface water human health criteria for public water supply.

# HONDO CREEK WATERSHED – SEGMENT 2114

The 78 mile segment extends from the confluence with the Frio River in Frio County to FM 470 in Bandera County and is divided into two AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 37.338% |
| Evergreen Forest | 22.684% |
| Herbaceous | 17.511% |
| Cultivated Crops | 8.370% |
| Deciduous Forest | 5.962% |
| Developed, Open Space | 4.749% |
| Hay/Pasture | 1.690% |
| Woody Wetlands | 1.035% |
| Developed, Low Intensity | 0.319% |
| Mixed Forest | 0.145% |
| Open Water | 0.089% |
| Developed, Medium Intensity | 0.049% |
| Barren Land | 0.033% |
| Developed, High Intensity | 0.020% |
| Emergent Herbaceuous Wetlands | 0.005% |

| | |
|---|---|
| **Drainage area** | 435,985 acres |
| **Major Aquifers** | Carrizo, Edwards, Trinity |
| **Minor Aquifers** | Queen City |
| **Cities** | Biry, Hondo, Tarpley |
| **Counties** | Bandera, Frio, Medina |
| **EcoRegions** | Balcones Canyonlands, Northern Nueces Alluvial Plains |
| **Climate Annual Averages** | Rain: 25" – 35"; Low: 51° F - 58° F; 76° F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Public Water Supply |
| **Permitted WWTFs** | WQ0001645-000 – Hondo Vitreous China Plant: 30,000 gpd via evaporation<br>WQ0010189-001 – City of Hondo: 1,800,000 gpd via Elm Slough |

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence an unnamed tributary just upstream of FM 2676. **AU_02** is the reach from the upstream end of AU_01 to the upper end of the segment.

The analysis for AU_01 is based on data from **Station 18408**, located immediately downstream of SH 173 southeast of Hondo. Data collection began in December 2004, so there is insufficient data for trend analysis. TCEQ is responsible for quarterly routine monitoring at this site.

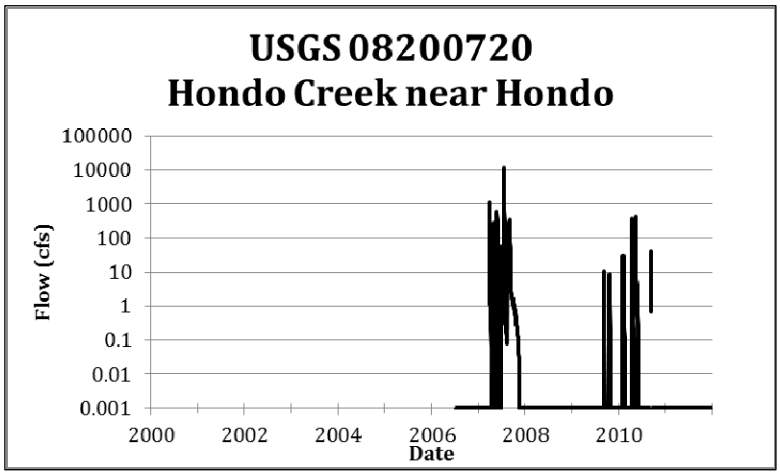
The analysis for AU_02 is based on data from **Station 13010**, located downstream of RR 462 near Tarpley. Trend analysis was conducted on data from January 2000 through March 2011. TCEQ is responsible for quarterly routine monitoring at this site.

There is a **nitrate concern** for AU_01 and a **chloride impairment** for the entire segment.

The southern portion of the watershed is predominately brush, while the northern portion is mostly forest. Croplands are more numerous around Hondo near the middle of the watershed.

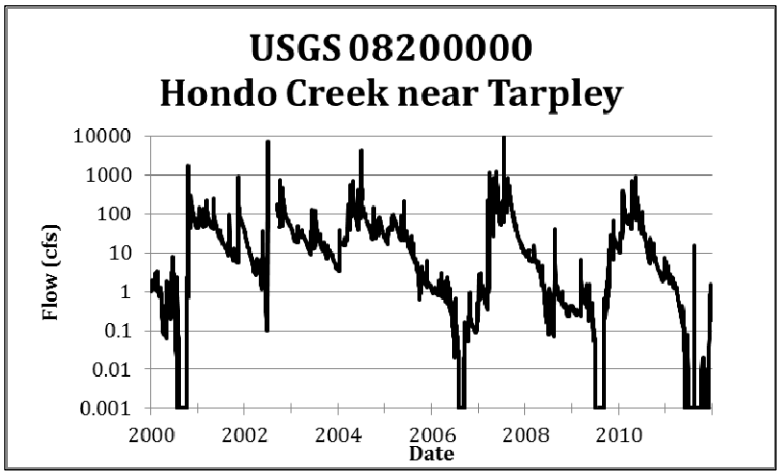
The USGS flow gauge at Hondo Creek near Hondo is located on SH 173 north of Hondo. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2006 – 0 cfs
2007 – 58.9 cfs
2008 – 0 cfs
2009 – 0.1 cfs
2010 – 4.6 cfs
2011 – 0 cfs




The USGS flow gauge at Hondo Creek near Tarpley is located at the same location as Station 13010. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 23.1 cfs
2001 – 45.7 cfs
2002 – 80.5 cfs
2003 – 19.2 cfs
2004 – 86.5 cfs
2005 – 21.9 cfs
2006 – 0.5 cfs
2007 – 151 cfs
2008 – 2.4 cfs
2009 – 3.4 cfs
2010 – 62.3 cfs
2011 – 0.6 cfs




**Aquatic Life Use Assessment**

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 24 | 6.1 | 13.9 | 9.4 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 23 | 6.5 | 13.0 | 9.3 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

**Recreation Use**

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean | FS | 23 | <1 | 101.4 | 19.0 | 4 | 0 |
| AU-02 | 126 cfu/100 ml | FS | 22 | <1 | 2,140 | 25.5 | 2 | 3 |

## General Use

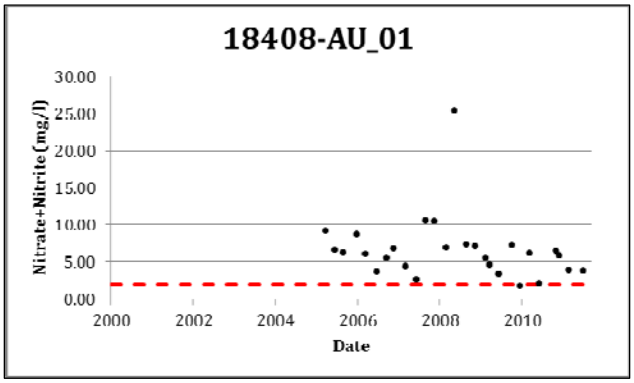
| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 24 | 10.6 | 33.2 | 24.9 | 2 |
| AU-02 | | FS | 23 | 7.1 | 29.6 | 21.2 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 24 | 5.9 | 8.3 | 7.9 | 1 | 0 |
| AU-02 | | FS | 23 | 6.9 | 8.5 | 8.0 | 0 | 0 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 23 | <0.05 | 0.06 | 0.05 | 21 | 0 |
| AU-02 | | NC | 25 | <0.02 | 0.56 | 0.02 | 24 | 1 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 21 | <3 | 31.6 | 3 | 11 | 2 |
| AU-02 | | NC | 24 | <3 | 4.82 | 3 | 22 | 0 |

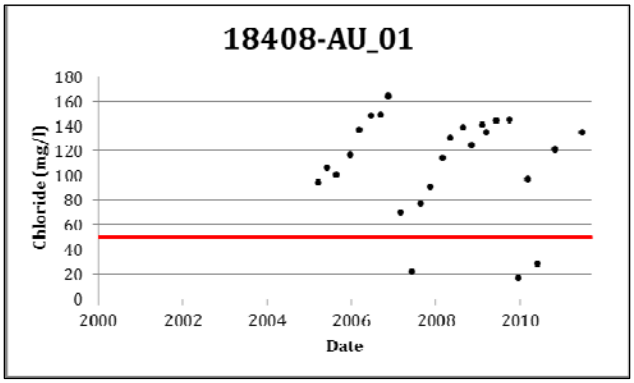
| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | **CS** | **23** | **1.7** | **25.4** | **6.24** | **0** | **22** |
| AU-02 | | NC | 24 | <0.04 | 3.87 | 0.2 | 2 | 1 |

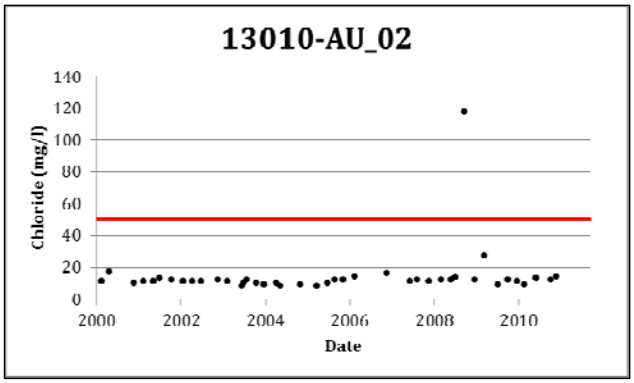



The elevated values may be related to WWTF discharge and/or agricultural runoff.

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 23 | <0.05 | 0.06 | 0.05 | 22 | 0 |
| AU-02 | | NC | 24 | <0.02 | 3.46 | 0.02 | 22 | 1 |

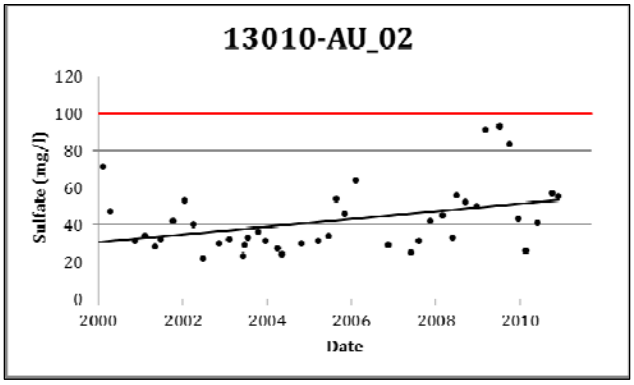
| Chloride | Status | # samples | Min | Max | Average | >50 |
|---|---|---|---|---|---|---|
| 50 mg/l | **NS** | **47** | **8** | **164** | **61.27** | **21** |



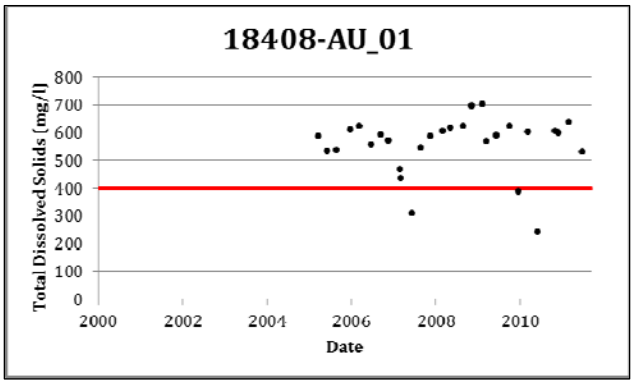

Although chloride is assessed for the entire segment, it is obvious from these graphs that the impairment is in the lower AU and may be related to WWTF discharges.

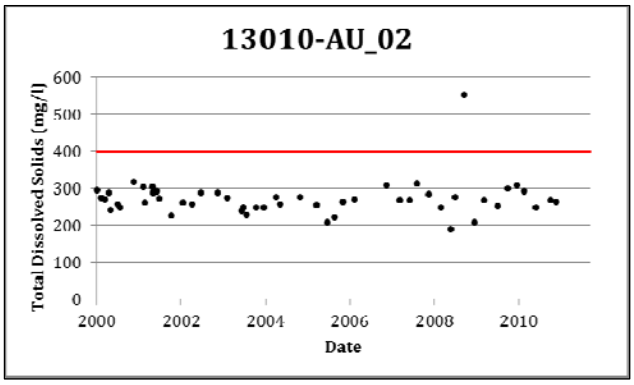
| Sulfate | Status | # samples | Min | Max | Average | >100 |
|---|---|---|---|---|---|---|
| 100 mg/l | FS | 47 | 24 | 120 | 66.2 | 7 |




Statistical analysis indicates that there is an increasing trend in sulfate values in AU_02 with a **t-stat of 2.61** and a **p-value of 0.01.** The increasing trends may be due to increasing frequencies of dry periods that south Texas has been experiencing. The values are generally below the criteria, so an impairment is not likely in the near future.

| TDS | Status | # samples | Min | Max | Average | >400 |
|---|---|---|---|---|---|---|
| 400 mg/l | FS | 49 | 189 | 702 | 409 | 22 |



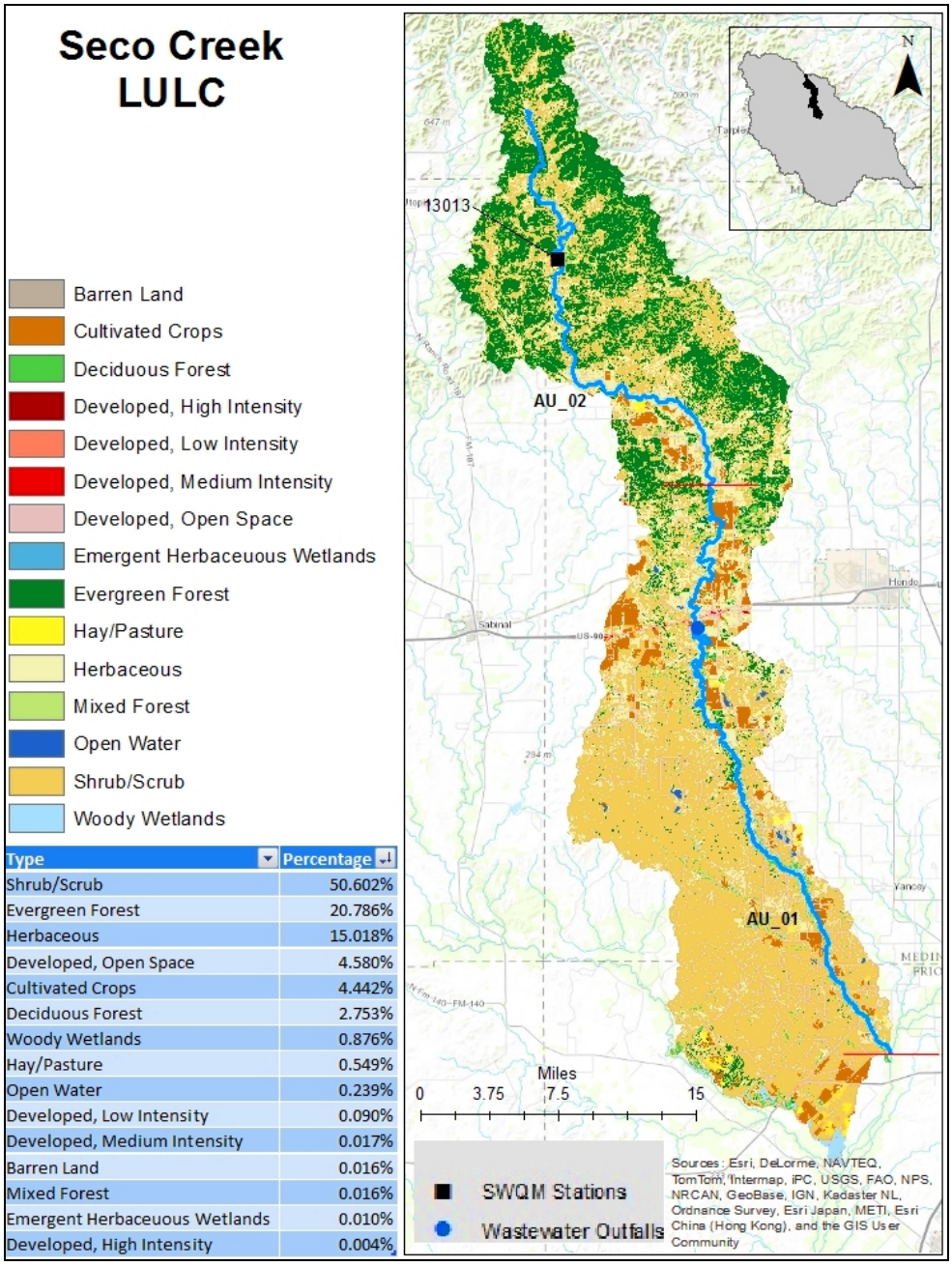

Although TDS is assessed for the entire segment, it is obvious from these graphs that the impairment is in the lower AU and may be related to WWTF discharge.

### Public Water Supply Use

Both AUs are fully supporting for surface water human health criteria for public water supply.

# SECO CREEK WATERSHED – SEGMENT 2115

The 70 mile segment extends from the confluence with Hondo Creek in Frio County to the confluence of West Seco Creek in Bandera County and is divided into two AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 50.602% |
| Evergreen Forest | 20.786% |
| Herbaceous | 15.018% |
| Developed, Open Space | 4.580% |
| Cultivated Crops | 4.442% |
| Deciduous Forest | 2.753% |
| Woody Wetlands | 0.876% |
| Hay/Pasture | 0.549% |
| Open Water | 0.239% |
| Developed, Low Intensity | 0.090% |
| Developed, Medium Intensity | 0.017% |
| Barren Land | 0.016% |
| Mixed Forest | 0.016% |
| Emergent Herbaceuous Wetlands | 0.010% |
| Developed, High Intensity | 0.004% |

| | |
|---|---|
| **Drainage area** | 266,833 acres |
| **Aquifers** | Edwards, Trinity |
| **Cities** | Yancey, D'Hanis |
| **Counties** | Medina, Uvalde, Frio, Bandera |
| **EcoRegions** | Balcones Canyonlands, Northern Nueces Alluvial Plains |
| **Climate Annual Averages** | Rain: 27" – 35"; Low: 51° F - 57° F; High: 77° F - 82° F |
| **Water Body Uses** | General, Public Water Supply, Recreation, Aquatic Life |
| **Permitted WWTFs** | WQ0011144-001 – Medina County WCID 002: 80,000 gpd |

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence an unnamed tributary just upstream of FM 2676. **AU_02** is the reach from the upstream end of AU_01 to the upper end of the segment.

There are no monitoring sites in AU_01.

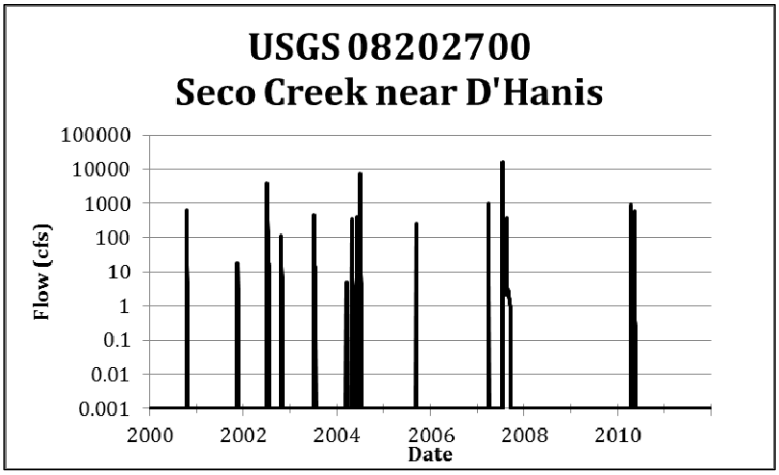
The analysis for AU_02 is based on data from **Station 13013**, located CR 111 near Utopia. Trend analysis was conducted on data from February 2000 through September 2010. TCEQ is responsible for quarterly routine monitoring at this site.

All water quality standards are met, which is most likely due to it being a headwater stream, and therefore no influences from upstream, having only a couple of small population centers, and only one WWTF discharge.

The southern portion of the watershed is predominately brush, while the northern portion is mostly forest. There are just a few small communities located within the watershed.

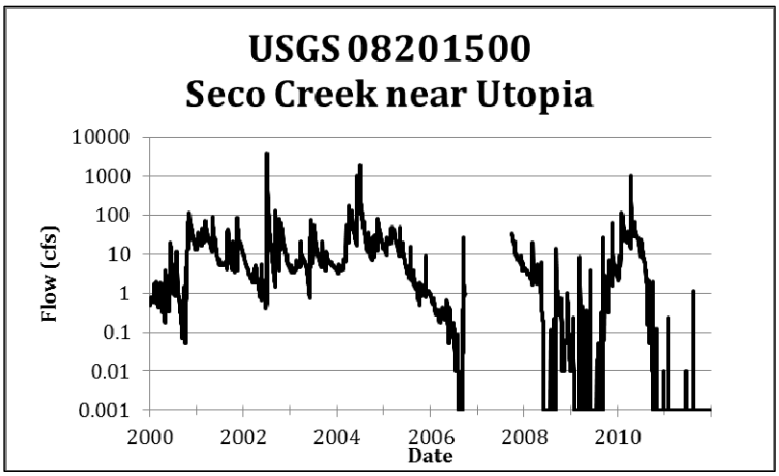
The USGS flow gauge at Seco near D'Hanis is located on Rowe Ranch north of US 90. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 2.4 cfs
2001 – 0.1 cfs
2002 – 42.1 cfs
2003 – 1.4 cfs
2004 – 23.9 cfs
2005 – 0.8 cfs
2006 – 0 cfs
2007 – 49.1 cfs
2008 – 0 cfs
2009 – 0 cfs
2010 – 5.3 cfs
2011 – 0 cfs




The USGS flow gauge at Seco near Utopia is located on Miller Ranch at the same location as Station 13013. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

2000 – 7.3 cfs
2001 – 15.9 cfs
2002 – 36.9 cfs
2003 – 7.6 cfs
2004 – 45.0 cfs
2005 – 10.0 cfs
2006 – 0.4 cfs
2007 – 10.5 cfs
2008 – 1.3 cfs
2009 – 1.3 cfs
2010 – 19.7 cfs
2011 – 0.005 cfs




## Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | Minimum 3.0 mg/l | FS | 16 | 6.0 | 12.9 | 9.1 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

**Recreation Use**

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | Geomean 126 cfu/100 ml | FS | 16 | <1 | >2,420 | 6.3 | 4 | 1 |

**General Use**

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-02 | 32.2 °C | FS | 16 | 8.4 | 31.9 | 23.6 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | 6.5 – 9.0 su | FS | 16 | 5.9 | 8.7 | 8.0 | 1 | 0 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | 0.33 mg/l | NC | 17 | <0.05 | <0.05 | 0.05 | 17 | 0 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | 14.1 µg/l | NC | 17 | <3 | <3 | 3 | 17 | 0 |

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | 1.95 mg/l | NC | 16 | <0.04 | 0.59 | 0.285 | 2 | 0 |

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | 0.69 mg/l | NC | 17 | <0.02 | <0.02 | 0.02 | 17 | 0 |

| Chloride | Status | # samples | Min | Max | Average | >50 |
|---|---|---|---|---|---|---|
| 50 mg/l | FS | 17 | 10 | 16 | 11.6 | 0 |

| Sulfate | Status | # samples | Min | Max | Average | >70 |
|---|---|---|---|---|---|---|
| 70 mg/l | FS | 17 | 24 | 61 | 40 | 0 |

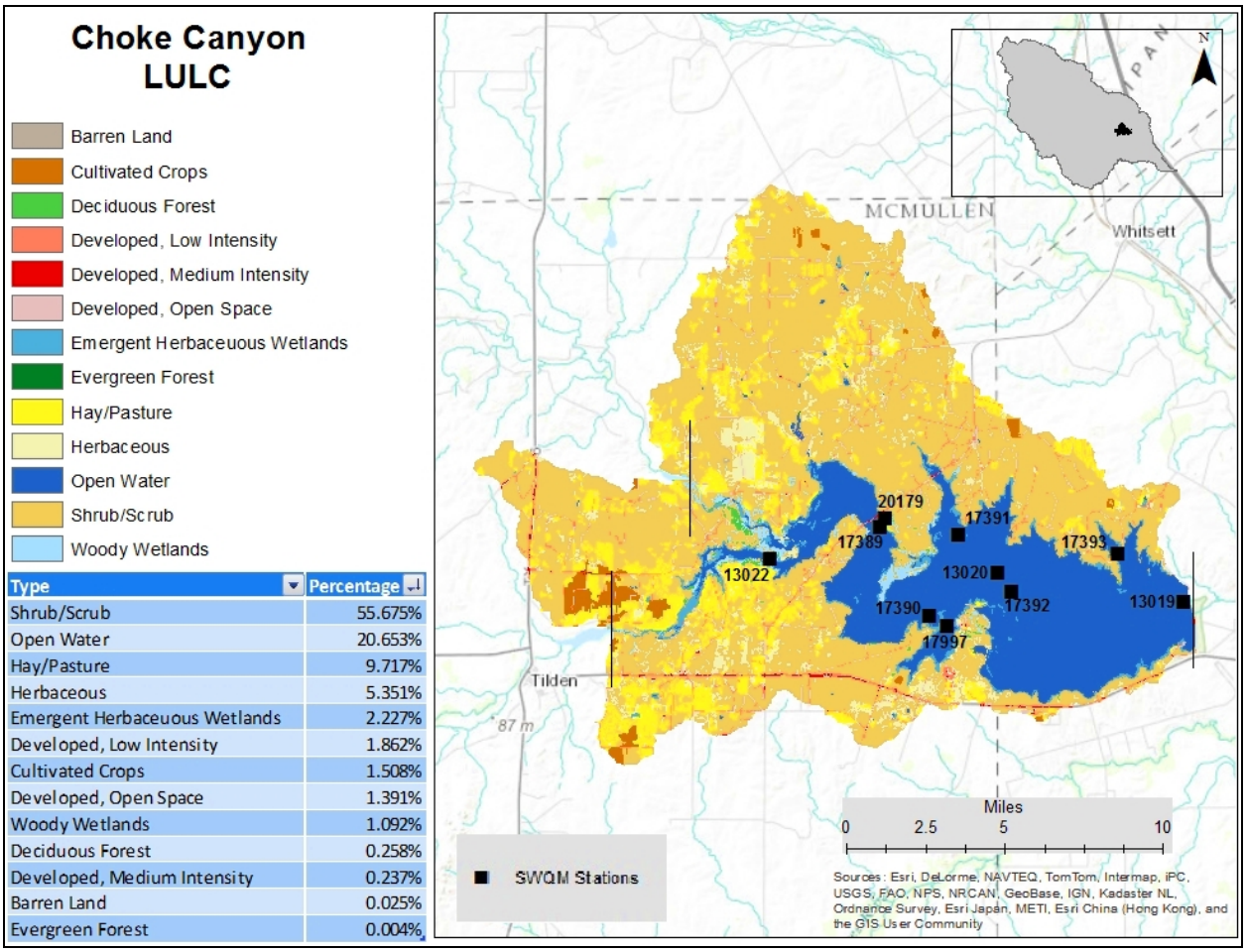
| TDS | Status | # samples | Min | Max | Average | >400 |
|---|---|---|---|---|---|---|
| 400 mg/l | FS | 16 | 194 | 296 | 257 | 0 |

**Public Water Supply Use**

Both AUs are fully supporting for surface water human health criteria for public water supply.

# CHOKE CANYON RESERVOIR WATERSHED – SEGMENT 2116

Choke Canyon Reservoir is formed by Choke Canyon Dam in Live Oak County and impounds the Frio River. It is defined by the 220.5' above MSL elevation with a surface area of 25,670 acres. The lake covers portions of Live Oak and McMullen Counties. The segment extends upstream to a point 100 m (110 yards) upstream of the confluence of Mustang Branch on San Miguel Creek in McMullen County and 4.2 km (2.6 miles) downstream of SH 16 on the Frio Arm in McMullen County. It is divided into seven AUs.

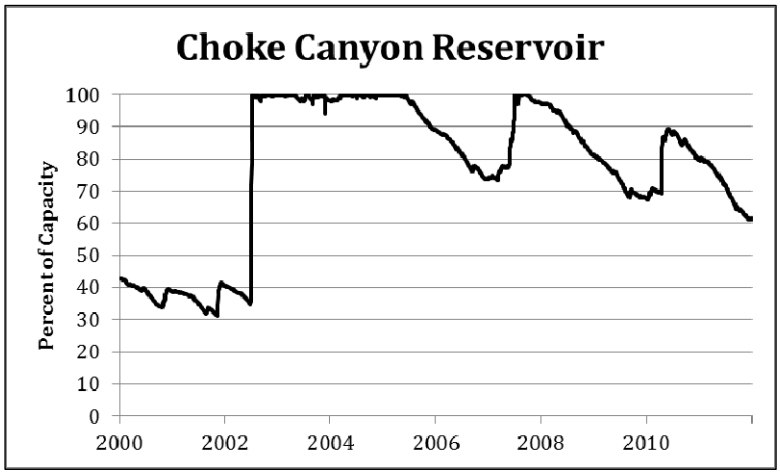



| Type | Percentage |
|---|---|
| Shrub/Scrub | 55.675% |
| Open Water | 20.653% |
| Hay/Pasture | 9.717% |
| Herbaceous | 5.351% |
| Emergent Herbaceuous Wetlands | 2.227% |
| Developed, Low Intensity | 1.862% |
| Cultivated Crops | 1.508% |
| Developed, Open Space | 1.391% |
| Woody Wetlands | 1.092% |
| Deciduous Forest | 0.258% |
| Developed, Medium Intensity | 0.237% |
| Barren Land | 0.025% |
| Evergreen Forest | 0.004% |

| | |
|---|---|
| **Drainage area** | 111,304 acres |
| **Major Aquifers** | Carrizo |
| **Minor Aquifers** | Yegua Jackson |
| **Cities** | None |
| **Counties** | McMullen, Live Oak, Atascosa |
| **EcoRegions** | Southern Post Oak Savanna, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 23" – 27"; Low: 58° F - 59° F; High: 82° F – 83° F |
| **Water Body Uses** | Aquatic Life, General, Fish Consumption, Public Water Supply, Recreation |
| **Permitted WWTFs** | WQ0013100-001 – TPWD – Choke Canyon State Park, Calliham Unit: 13,000 gpd via evaporation<br>WQ0013461-001 – US DOJ – Federal Corrections Institution at Three Rivers: 300,000 gpd via irrigation plus effluent line to the Nueces River Segment 2104 |

## Water Quality Analysis

**AU_01** is the 5120 acres near the dam. **AU_02** is the small arm of the lake near the dam and Willow Hollow Tank. **AU_03** is the 5120 acres in the middle of the lake. **AU_04** is the large north arm near mid- lake and Jacob Oil Field. **AU_05** is the southern arm near mid- lake and Recreation Road 7 west of Calliham. **AU_06** is the western end of the lake up to the RR 99 bridge. **AU_07** is the remainder of the lake from the RR 99 bridge to the upper end of the segment.




The analysis for AU_01 is based on data from **Station 13019**, located 422 meters south and 129 meters east of the spillway channel near the dam. Trend analysis was conducted on data from February 2000 through June 2010. USGS conducts monitoring at this site.

The analysis for AU_02 is based on data from **Station 17393**, located mid-arm of the northeast arm west of the intersection of US 281 and IH 37. Trend analysis was conducted on data from May 2000 through June 2010. USGS conducts monitoring at this site.

The analysis for AU_03 is based on data from **Station 13020**, located mid-lake 15 meters east of the Live Oak / McMullen county line near old Hwy 99. Trend analysis was conducted on data from October 2000 through September 2011. NRA is responsible for quarterly routine monitoring at this site.


Station 13020

The analysis for AU_04 is based on data from **Station 17391**, located southwest of SR Road 8 termination at the mouth of Opossum Creek arm. Trend analysis was conducted on data from May 2000 through June 2010. USGS conducts monitoring at this site.

The analysis for AU_05 is based on the combined data from **Station 17390** (2000 – 2001), located west of Choke Canyon State Park and north of the SH 72 crossing in the Salt Creek arm, and . **Station 17997** (2002 – 2010), located northeast of the end of McMullen CR 303. Trend analysis was conducted on data from February 2000 through June 2010. USGS conducts monitoring at this site.


Station 17389

The analysis for AU_06 is based on data from **Station 17389**, located southeast of the southernmost FM 99 bridge. Trend analysis was conducted on data from February 2000 through September 2011. NRA took over routine quarterly monitoring from USGS beginning in 2004.

There are no routine monitoring sites in AU_07. However, data from **Station 13022**, located at the county upstream of the Frio River confluence upstream of FM 99, were used to assess the public water supply use.

There is a **chlorophyll-*a* concern** in AU_06.

The watershed around the reservoir is predominately brush, with some cropland on the western end. When the Bureau of Reclamation constructed the reservoir, the government imposed a no-build buffer around it. Therefore, there are no cities and no private land ownership immediately adjacent to the reservoir.

### Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 20 | 6.8 | 12.2 | 8.0 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 19 | 7.0 | 12.1 | 8.9 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-03 | Minimum 3.0 mg/l | FS | 28 | 6.6 | 11.2 | 7.7 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-04 | Minimum 3.0 mg/l | FS | 20 | 6.7 | 12.5 | 12.5 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-05 | Minimum 3.0 mg/l | FS | 20 | 4.3 | 11.1 | 8.3 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-06 | Minimum 3.0 mg/l | FS | 31 | 4.9 | 12.9 | 8.3 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 14 | 0.6 | 9.2 | 6.4 | 1 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 2.0 | 10.9 | 8.0 | NA | 1 |

AU_01, AU_03, and AU_06 are fully supporting / have no concerns for toxic substances in water for aquatic life use. AU_03 and AU_06 have no concerns for toxic substances in sediment.

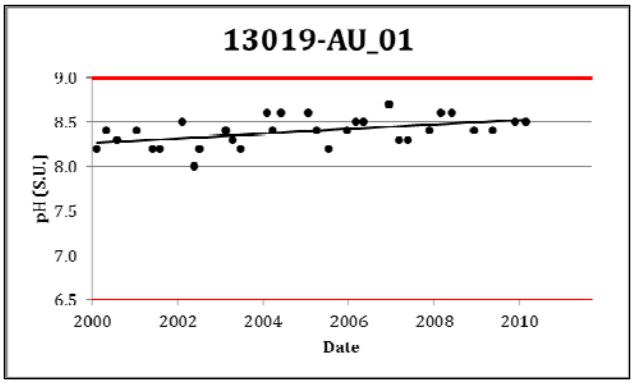
### Recreation Use

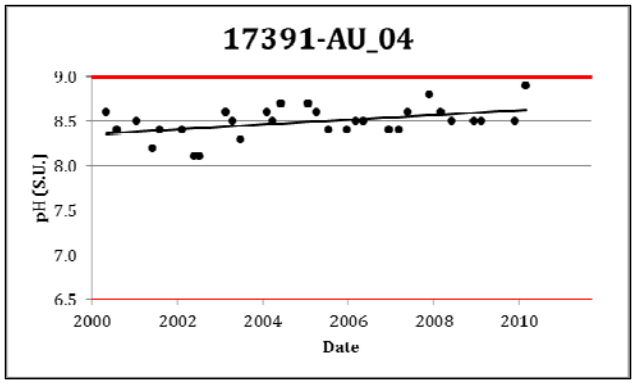
| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-03 | Geomean 126 cfu/100 ml | FS | 28 | <1 | 4 | 1.177 | 20 | 0 |
| AU-06 | | FS | 28 | <1 | 80 | 2.186 | 10 | 0 |

### General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 20 | 13.0 | 29.6 | 25.0 | 0 |
| AU-02 | | FS | 19 | 12.8 | 30.9 | 27.0 | 0 |
| AU-03 | | FS | 28 | 11.4 | 32.3 | 23.2 | 1 |
| AU-04 | | FS | 20 | 13.6 | 31.1 | 27.1 | 0 |
| AU-05 | | FS | 20 | 13.3 | 30.4 | 26.4 | 0 |
| AU-06 | | FS | 31 | 12.4 | 32.6 | 23.2 | 1 |

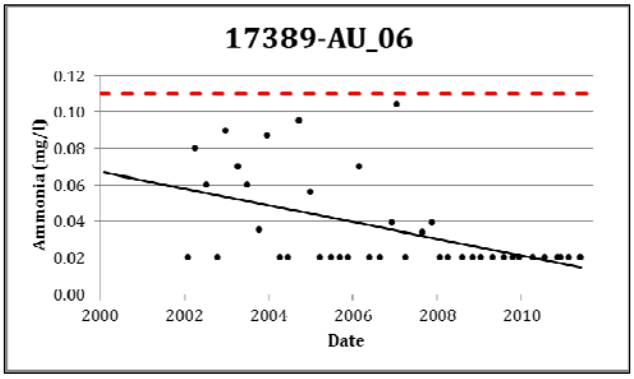
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 19 | 8.2 | 8.7 | 8.5 | 0 | 0 |
| AU-02 | | FS | 19 | 7.8 | 8.9 | 8.5 | 0 | 0 |
| AU-03 | | FS | 28 | 8.0 | 8.8 | 8.4 | 0 | 0 |
| AU-04 | | FS | 19 | 8.4 | 8.9 | 8.5 | 0 | 0 |
| AU-05 | | FS | 19 | 8.1 | 8.8 | 8.5 | 0 | 0 |
| AU-06 | | FS | 31 | 7.7 | 8.8 | 8.4 | 0 | 0 |



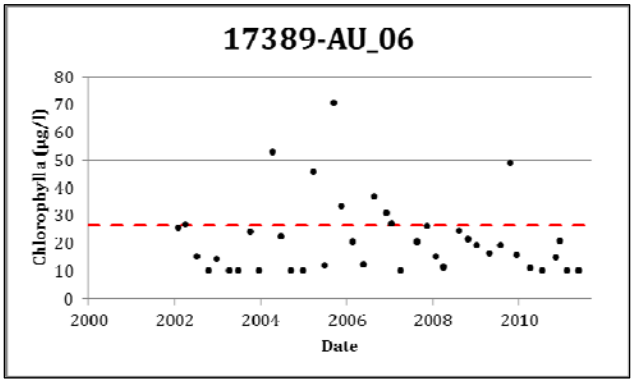

Statistical analysis indicates that there is an increasing trend in pH values in AU_01 with a **t-stat of 2.88** and a **p-value of 0.01** and in AU_04 with a **t-stat of 2.63** and a **p-value of 0.01.** The values are all within the accepted pH range. There is no obvious correlation between the lake levels and pH values and no obvious explanation for the trends.

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.11 |
|---|---|---|---|---|---|---|---|---|
| AU-03 | 0.11 mg/l | NC | 28 | <0.02 | 0.052 | 0.02 | 23 | 0 |
| AU-06 | | NC | 28 | <0.02 | 0.104 | 0.02 | 20 | 0 |



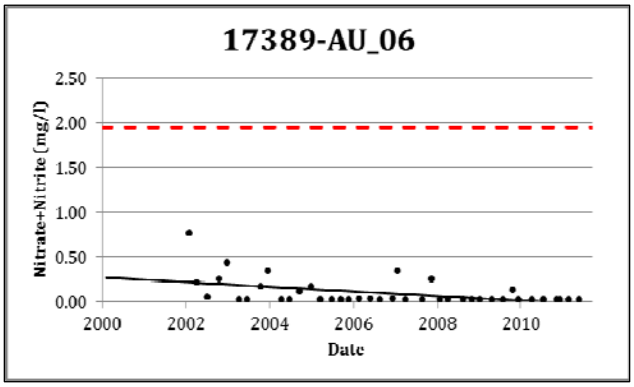

Statistical analysis indicates that there is a decreasing trend in ammonia values in AU_06 with a **t-stat of -3.58** and a **p-value of 0.00.** There is no obvious correlation between the lake levels and ammonia values and no obvious explanation for the trend.

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >26.7 |
|---|---|---|---|---|---|---|---|---|
| AU-03 | 26.7 µg/l | NC | 28 | 6.4 | 22.8 | 14.3 | 0 | 0 |
| AU-06 | | **CS** | **28** | **4.87** | **70.7** | **19.95** | **0** | **8** |




AU_06 contains a lot of vegetation (see picture on Page 97). The higher values seem to correlate to high lake levels and may be related to the vegetation.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >0.37 |
|---|---|---|---|---|---|---|---|---|
| AU-03 | 0.37 mg/l | NC | 28 | <0.02 | 0.014 | 0.02 | 20 | 0 |
| AU-06 | | NC | 28 | <0.02 | 0.34 | 0.02 | 19 | 0 |



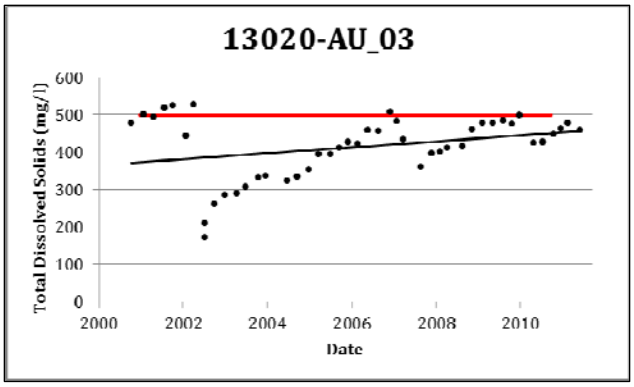

Statistical analysis indicates that there is a decreasing trend in nitrate values in AU_06 with a **t-stat of -3.33** and a **p-value of 0.00.** There is no obvious correlation between the lake levels and nitrate values and no obvious explanation for the trend. All the values are well below the screening level, and only a few that are above the LOQ since 2005.

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.2 |
|---|---|---|---|---|---|---|---|---|
| AU-03 | 0.2 mg/l | NC | 28 | <0.04 | 0.141 | 0.06 | 19 | 0 |
| AU-06 | | NC | 28 | <0.04 | 0.209 | 0.069 | 11 | 1 |

| Chloride | Status | # samples | Min | Max | Average | >250 |
|---|---|---|---|---|---|---|
| 250 mg/l | FS | 70 | 17.8 | 141 | 92.74 | 0 |

| Sulfate | Status | # samples | Min | Max | Average | >250 |
|---|---|---|---|---|---|---|
| 250 mg/l | FS | 70 | 13.8 | 135 | 69.91 | 0 |

| TDS | Status | # samples | Min | Max | Average | >500 |
|---|---|---|---|---|---|---|
| 500 mg/l | FS | 114 | 300 | 556 | 432 | 18 |




Most of the TDS exceedances were in AU_02, AU_04, and AU_05.

Statistical analysis indicates that there is an increasing trend in TDS values in AU_03 with a **t-stat of 3.32** and a **p-value of 0.00.** The TDS values are generally inversely related to the lake levels. If the drought continues and the lake remains low, a future impairment is possible.

### Fish Consumption Use

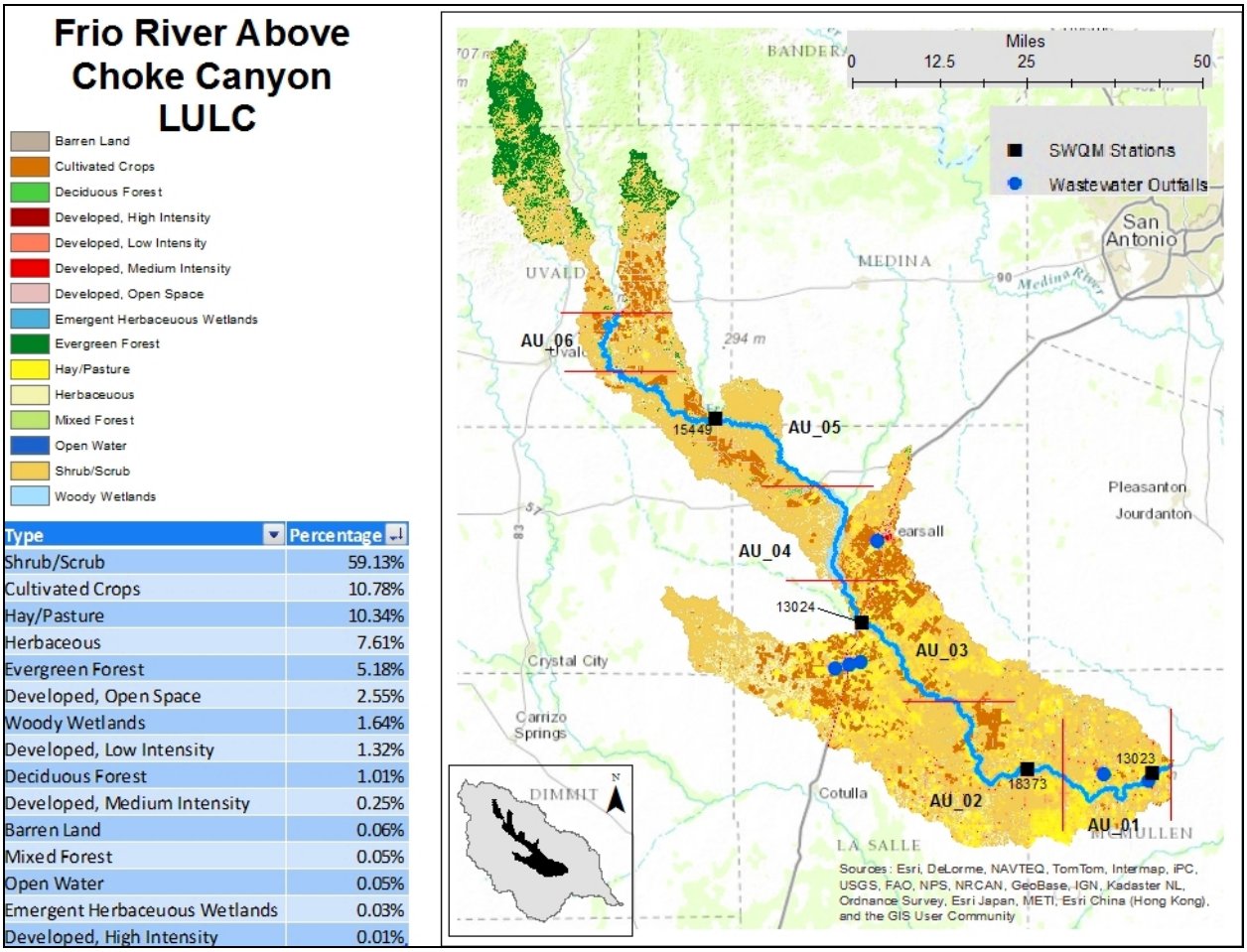
The entire reservoir is fully supporting for bioaccumulation of toxics in water for fish consumption use.

### Public Water Supply Use

The entire reservoir is fully supporting for human health criteria for public water supply use.

# FRIO RIVER ABOVE CHOKE CANYON RESERVOIR WATERSHED – SEGMENT 2117

The 158 mile segment extends from a point 4.2 km (2.5 miles) downstream of SH 16 in McMullen County to a point 100 m (110 yards) upstream of US 90 in Uvalde County and is divided into six AUs.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 59.13% |
| Cultivated Crops | 10.78% |
| Hay/Pasture | 10.34% |
| Herbaceous | 7.61% |
| Evergreen Forest | 5.18% |
| Developed, Open Space | 2.55% |
| Woody Wetlands | 1.64% |
| Developed, Low Intensity | 1.32% |
| Deciduous Forest | 1.01% |
| Developed, Medium Intensity | 0.25% |
| Barren Land | 0.06% |
| Mixed Forest | 0.05% |
| Open Water | 0.05% |
| Emergent Herbaceuous Wetlands | 0.03% |
| Developed, High Intensity | 0.01% |

| | |
|---|---|
| **Drainage area** | 1,161,405 acres |
| **Major Aquifers** | Carrizo, Edwards, Edwards-Trinity |
| **Minor Aquifers** | Queen City, Sparta, Yegua Jackson |
| **Cities** | Tilden, Fowlerton, Derby, Pearsall, North Pearsall, Frio Town, Dilley, Hilltop |
| **Counties** | McMullen, LaSalle, Frio, Uvalde, Medina, Zavala |
| **EcoRegions** | Northern Nueces Alluvial Plains, Texas-Tamaulipan Thornscrub |
| **Climate Annual Averages** | Rain: 23” – 27”; Low: 55° F - 58°F; High: 81° F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Public Water Supply |

| | |
|---|---|
| **Permitted WWTFs** | WQ0004994-000 – Reagent Chemical & Research Inc.<br>WQ0010360-001 – City of Pearsall: 1,950,000 gpd via Buck Creek<br>WQ0010404-002 – City of Dilley: 300,000 gpd via Cibolo Creek<br>WQ0010404-003 – City of Dilley: 800,000 gpd<br>WQ0010404-004 – City of Dilley: 15,000 gpd (proposed)<br>WQ0010404-005 – City of Dilley: 30,000 gpd<br>WQ0011962-001 – TPWD: 60,000 gpd via irrigation<br>WQ0013543-001 – McMullen County WCID No. 1 – Tilden WWTF<br>WQ0014945-001 – McMullen County WCID No. 1 and McMullen County: 96,000 gpd via unnamed tributary<br>WQ0015016-001 – South Central Water Company: 300,000 gpd<br>WQ0015043-001 – Chesapeake Land Development Company: 24,000 gpd<br>WQ0015084-001 – La Salle Oil Field Services: 120,000 gpd via irrigation |

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Esperanza Creek. **AU_02** is the reach from the upstream end of AU_01 to the confluence with Ruiz Creek. **AU_03** is the reach from the upstream end of AU_02 to the confluence with Live Oak Creek. **AU_04** is the reach from the upstream end of AU_03 to the confluence with Elm Creek. **AU_05** is the reach from the upstream end of AU_04 to the confluence with Spring Branch. **AU_06** is the reach from the upstream end of AU_05 to the upper end of the segment.


Station 13023

The analysis for AU_01 is based on data from **Station 13023**, located at SH 16 near Tilden. Trend analysis was conducted on data from January 2000 through March 2011. NRA is responsible for routine quarterly monitoring at this site.


Station 18373

The analysis for AU_02 is based on data from **Station 18373**, located immediately upstream of SH 97 north of Fowlerton. Sampling at this site began in November 2003, therefore there is insufficient data for trend analysis. NRA is responsible for routine quarterly monitoring at this site.

The analysis for AU_03 is based on data from **Station 13024**, located at IH 37north of Dilley. Trend analysis was conducted on data from January 2000 through October 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There are no sampling sites in either AU_04 or AU_06.

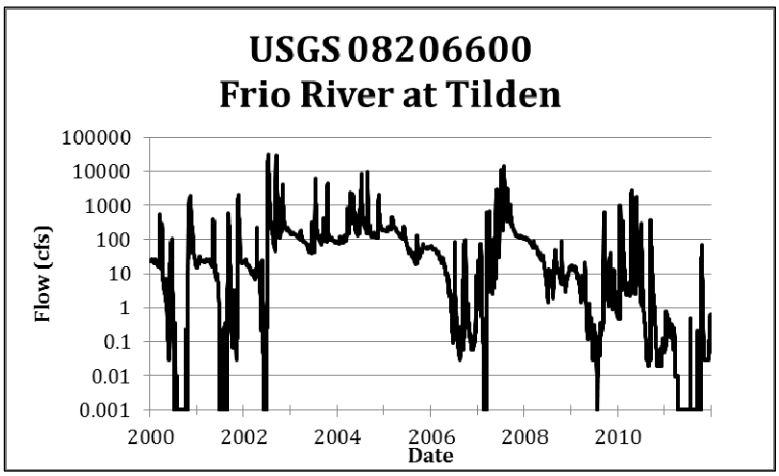
The analysis for AU_05 is based on data from **Station 15449**, located at FM 187 south of Sabinal. Trend analysis was conducted on data from December 2002 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There is a **low DO screening level concern** for AU_03. There is a **bacteria concern** for AU-01 and a **bacteria impairment** for AU_02. There is a **nitrate concern** for the entire segment.

The watershed is a mixture of brush and croplands with forests in the northern end. This segment is the longest segment in the Nueces Basin, and there are numerous small cities and towns located all along the river. It is the segment just upstream of Choke Canyon Reservoir and provides the majority of the inflow into the reservoir.

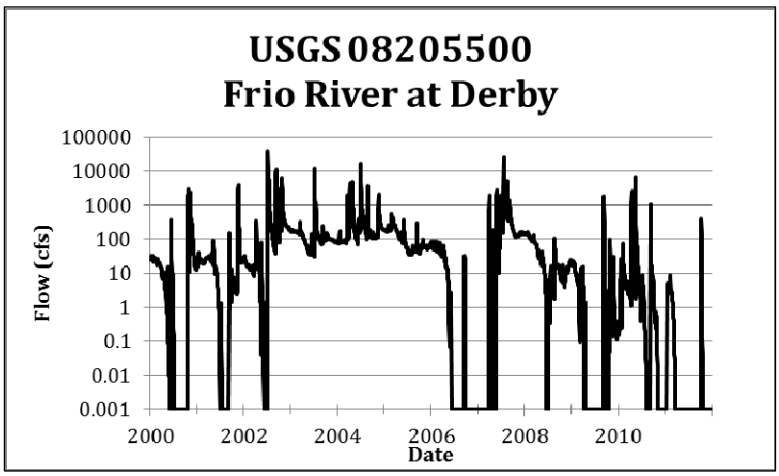
The USGS flow gauge at Frio River at Tilden is located at the same location as Station 13023. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

| | |
|---|---|
| 2000 – 66.3 cfs | 2006 – 15.1 cfs |
| 2001 – 52.0 cfs | 2007 – 617 cfs |
| 2002 – 1257 cfs | 2008 – 33.4 cfs |
| 2003 – 225 cfs | 2009 – 10.6 cfs |
| 2004 – 469 cfs | 2010 – 75.8 cfs |
| 2005 – 114 cfs | 2011 – 0.06 cfs |



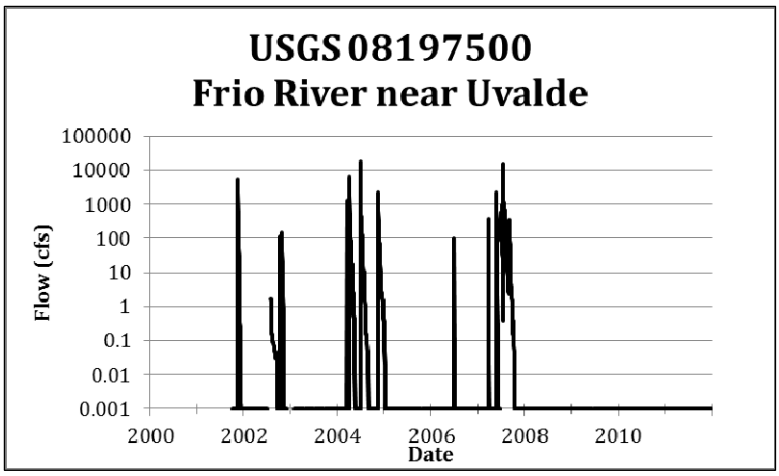

The USGS flow gauge at Frio River at Derby is located at the same location as Station 13024. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

| | |
|---|---|
| 2000 – 82.1 cfs | 2006 – 18.2 cfs |
| 2001 – 46.4 cfs | 2007 – 457 cfs |
| 2002 – 709 cfs | 2008 – 40.5 cfs |
| 2003 – 193 cfs | 2009 – 14.2 cfs |
| 2004 – 428 cfs | 2010 – 75.8 cfs |
| 2005 – 114 cfs | 2011 – 2.9 cfs |



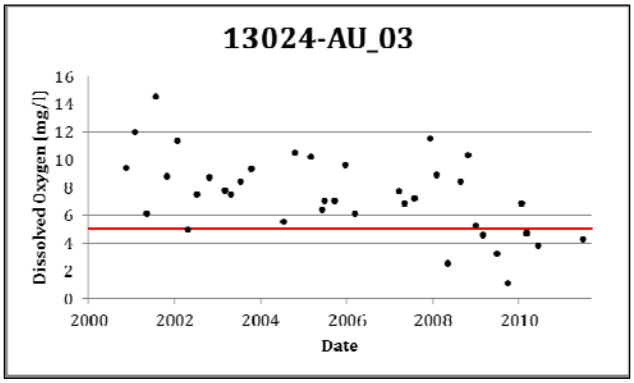

The USGS flow gauge at Frio River near Uvalde is located below the confluence of the Dry Frio River near the upper end of the segment. (Zero values were changed to 0.001 in order to plot the flows on the log scale.) The annual mean flows are:

| | |
|---|---|
| 2001 – 153 cfs | 2007 – 92.8 cfs |
| 2002 – 1.6 cfs | 2008 – 0 cfs |
| 2003 – 0 cfs | 2009 – 0 cfs |
| 2004 – 118 cfs | 2010 – 0 cfs |
| 2005 – 0.003 cfs | 2011 – 0 cfs |
| 2006 – 0.4 cfs | |



**Aquatic Life Use Assessment**

| DO | | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 51 | 1.3 | 11.0 | 6.7 | 2 | 9 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 27 | 3.4 | 10.7 | 7.2 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 10 | 4.5 | 7.7 | 6.6 | 0 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 4.7 | 7.8 | 6.6 | NA | 1 |
| AU-03 | Minimum 3.0 mg/l | FS | **23** | **1.1** | **11.5** | **6.8** | **2** | **6** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| AU-05 | Minimum 3.0 mg/l | FS | 29 | 6.3 | 13.5 | 8.5 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

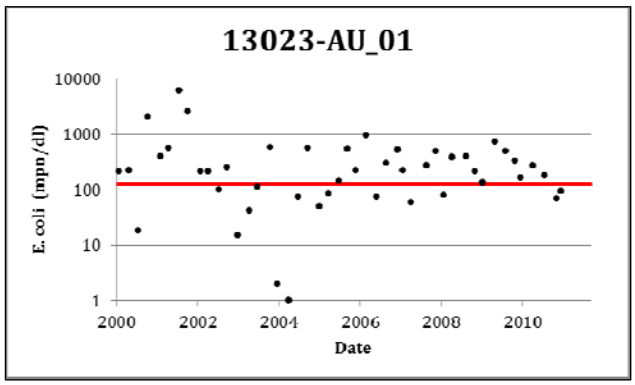


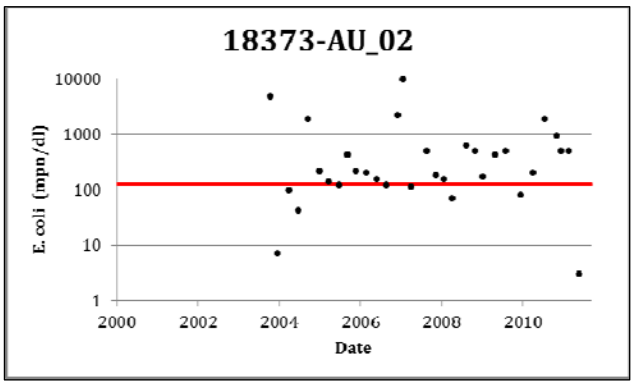

Most of the values below the screening level were measured during very low flow and possibly in pools, which would explain the low values.

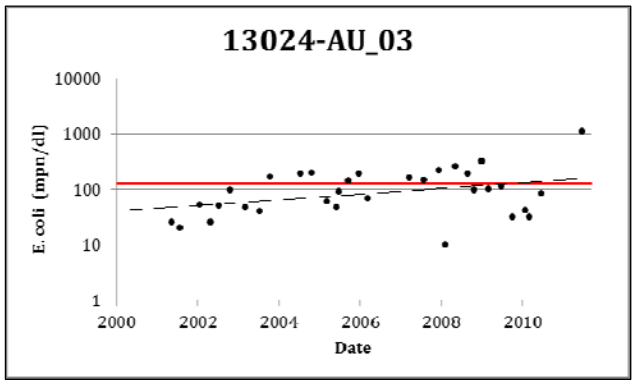
AU_01 is fully supporting for toxic substances in water for aquatic life use.

## Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | **CN** | **28** | **<1** | **940** | **156.85** | **1** | **8** |
| AU-02 | | **NS** | **27** | **7** | **9,600** | **245.63** | **0** | **10** |
| AU-03 | | FS | 22 | 10 | 320 | 97.25 | 0 | 0 |
| AU-05 | | FS | 25 | <1 | 150 | 9.52 | 3 | 0 |



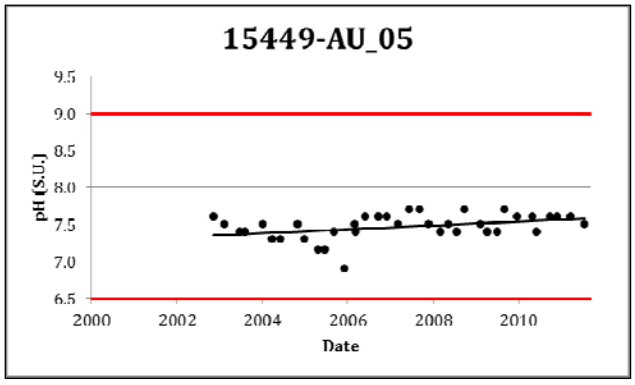




In addition to the concern in AU-01 and impairment in AU_02, statistical analysis indicates that there is an increasing trend in *E. coli* values in AU_03 with a **t-stat of 2.35** and a **p-value of 0.03.** Most of the WWTFs that discharge into this segment are below AU_03, which might explain the increased bacteria levels in the lower two AUs. The lack of rain to dilute concentrations may be why there is an increasing trend in AU_03. If the drought and trend continue, this AU may also become impaired.

## General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >32.2 |
|---|---|---|---|---|---|---|---|
| AU-01 | 32.2 °C | FS | 51 | 11.3 | 30.0 | 21.5 | 0 |
| AU-02 | | FS | 27 | 12.1 | 29.3 | 20.0 | 0 |
| AU-03 | | FS | 23 | 9.7 | 28.2 | 23.6 | 0 |
| AU-05 | | FS | 29 | 12.8 | 31.6 | 25.0 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 52 | 7.4 | 8.7 | 8.0 | 0 | 0 |
| AU-02 | | FS | 27 | 7.7 | 8.8 | 8.1 | 0 | 0 |
| AU-03 | | FS | 23 | 6.1 | 9.1 | 7.7 | 1 | 0 |
| AU-05 | | FS | 29 | 6.9 | 7.7 | 7.5 | 0 | 0 |

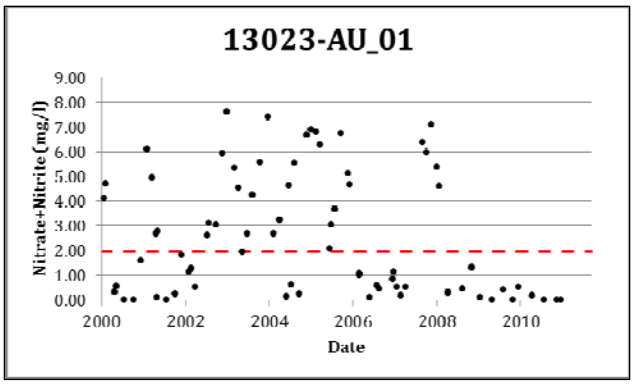


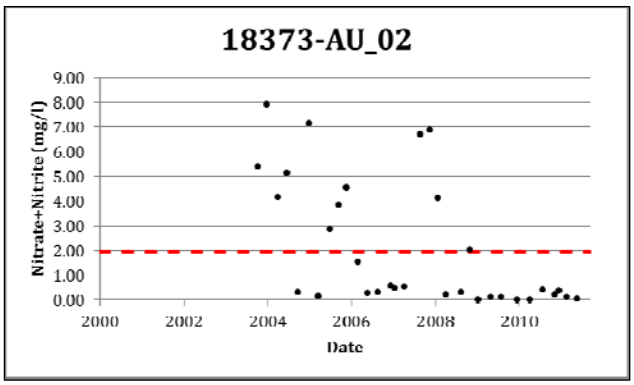

Statistical analysis indicates that there is an increasing trend in pH values in AU_05 with a **t-stat of 2.37** and a **p-value of 0.02.** The increasing trends could be due to the lack of rain. However, all the values are within the pH range.

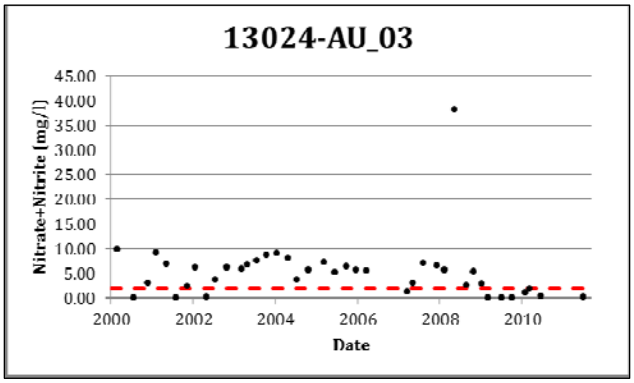
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 44 | <0.02 | 0.808 | 0.026 | 15 | 1 |
| AU-02 | | NC | 27 | <0.02 | 0.106 | 0.022 | 13 | 0 |
| AU-03 | | NC | 24 | <0.05 | 0.12 | 0.05 | 16 | 0 |
| AU-05 | | NC | 28 | <0.05 | <0.05 | 0.05 | 28 | 0 |

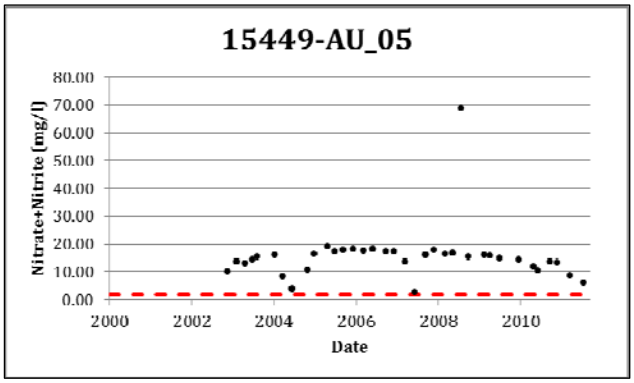
| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | NC | 28 | <2 | 62.4 | 5.78 | 8 | 6 |
| AU-02 | | NC | 27 | <2 | 126 | 4.85 | 10 | 4 |
| AU-03 | | NC | 23 | <3 | 66.1 | 3 | 12 | 5 |
| AU-05 | | NC | 23 | <3 | <3 | 3 | 23 | 0 |

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | **CS** | **44** | **<0.02** | **7.41** | **1.11** | **3** | **20** |
| AU-02 | | **CS** | **27** | **<0.02** | **7.91** | **0.53** | **4** | **11** |
| AU-03 | | **CS** | **24** | **<0.04** | **38.2** | **5.26** | **2** | **17** |
| AU-05 | | **CS** | **27** | **2.72** | **68.7** | **16.1** | **0** | **27** |



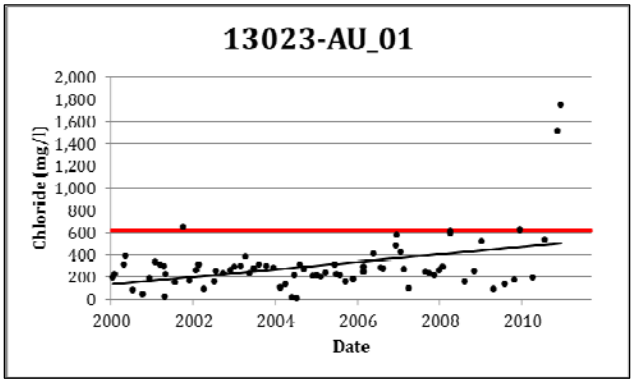



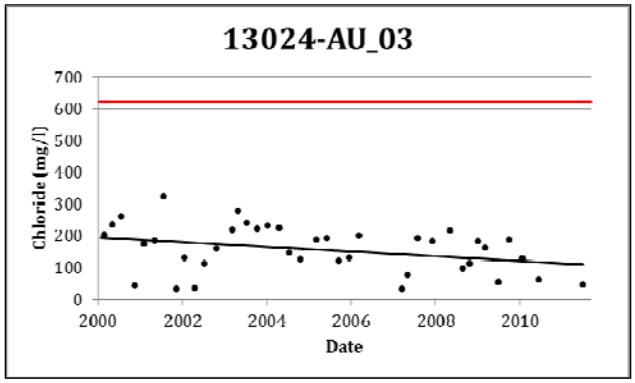




Overall values tend to increase from downstream to upstream and may be related to agricultural runoff. There is a noticeable decrease in values in the lower AUs beginning in 2009 which could possibly be related to changes in WWTF and agricultural practices.

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 28 | <0.04 | 0.456 | 0.138 | 5 | 0 |
| AU-02 | | NC | 27 | <0.04 | 7.18 | 0.096 | 5 | 1 |
| AU-03 | | NC | 22 | <0.05 | 0.2 | 0.075 | 6 | 0 |
| AU-05 | | NC | 27 | <0.02 | <0.02 | 0.02 | 27 | 0 |

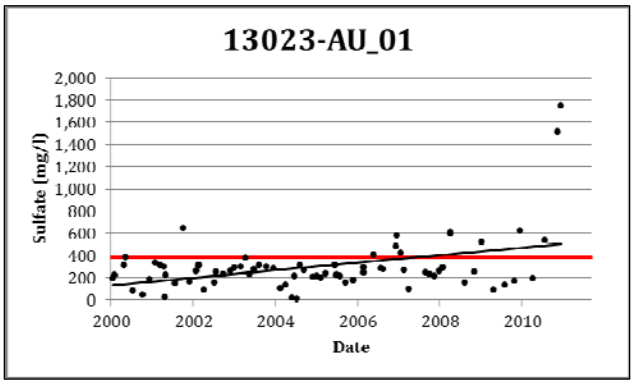
| Chloride | Status | # samples | Min | Max | Average | >620 |
|---|---|---|---|---|---|---|
| 620 mg/l | FS | 121 | 8.1 | 2,600 | 382 | 8 |

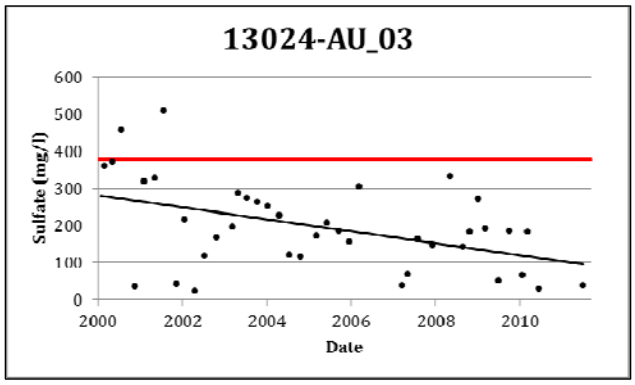



Statistical analysis indicates that there is an increasing trend in chloride values in AU_01 with a **t-stat of 3.71** and a **p-value of 0.00** and a decreasing trend in chloride values in AU_03 with a **t-stat of -2.17** and a **p-value of 0.04.** The increasing trend may be explained by lack of rain to dilute concentrations. There has also been increased oil and gas activity in this area associated with the Eagle Ford over the past few years. There has been speculation of illicit discharge of produced waters which, if it is occurring, would affect chloride, sulfate, and TDS values. The decreasing chloride trend in AU_03 does not seem to correlate to any identifiable sources.

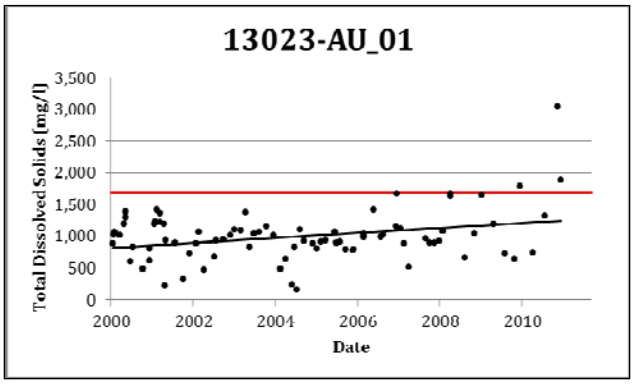
| Sulfate | Status | # samples | Min | Max | Average | >380 |
|---|---|---|---|---|---|---|
| 380 mg/l | FS | 122 | 10.7 | 427 | 187 | 3 |




Statistical analysis indicates that there is an increasing trend in sulfate values in AU_01 with a **t-stat of 3.71** and a **p-value of 0.00** and a decreasing trend in AU_03 with a **t-stat of -3.13** and a **p-value of 0.00.** The three increasing trends may be explained by lack of rain to dilute concentrations. The decreasing trend in AU_03 does not seem to correlate to any identifiable sources.

| TDS | Status | # samples | Min | Max | Average | >1,700 |
|---|---|---|---|---|---|---|
| 1,700 mg/l | FS | 126 | 155 | 5,960 | 1,287 | 22 |




Statistical analysis indicates that there is an increasing trend in TDS values in AU_01 with a **t-stat of 2.87** and a **p-value of 0.01** which may be explained by lack of rain to dilute concentrations.

### Fish Consumption Use

The entire segment is fully supporting for bioaccumulation of toxics in water for fish consumption use.

### Public Water Supply Use

All AUs are fully supporting for surface water human health criteria for public water supply.

# WATERSHED SUMMARIES OF THE NUECES – RIO GRANDE COASTAL BASIN

The Nueces – Rio Grande Coastal Basin lies on the coastal plain and drains into the Laguna Madre, Baffin Bay, and Oso Bay. The total basin drainage area covers approximately 10,400 square miles, encompassing all or part of 12 counties in South Texas. The basin is bordered by: the Nueces River Basin and the San Antonio – Nueces Coastal Basin to the north; bays, estuaries, and the Gulf of Mexico to the east; and the Rio Grande River Basin to the south and southwest.

The inland area of the basin is dominated by large ranches, including the King Ranch. State-operated recreational areas are primarily along the coast and include Mustang Island State Park, Port Isabel Light House State Historic Park in Port Isabel, and the Padre Island National Seashore.

The basin is located in the Western Gulf Coastal Plain ecoregion that is characterized by relatively flat topography with clay and sandy loams that support water tolerant hardwoods, grasslands, cacti, and scrub brush.

## Water Quality Overview of the Nueces-Rio Grande Coastal Basin


Arroyo Colorado in Cameron County

Water in the Arroyo Colorado originates from the various effluent flows from the surrounding communities including wastewater effluent and irrigation return flows. The Arroyo Colorado also receives water diverted from the Rio Grande during flood events. Water quality issues in the Arroyo Colorado include the following: elevated nutrient (nitrogen and phosphorus) and bacteria loads, instances of low DO, high levels of chlorophyll-*a,* and legacy pollutants resulting in fish consumption advisories (the above tidal portion). In 2007, Phase I BMPs of the Arroyo Colorado WPP were initiated. Projects include improved wastewater infrastructure, large and small scale habitat restoration projects, implementation of agricultural best management practices on irrigated crop land, and a comprehensive education and outreach program.


Petronila Creek in Nueces County

Petronila creek is a shallow gradient coastal creek that begins near Banquete and flows approximately 49 miles into Kleberg County and Alazan Bay. The upper half of the watershed is more ephemeral in nature, only flowing in conjunction with rain events. There is an earthen impoundment just west of US 77 near the Lost Creek Colonia that maintains water on a perennial basis. Reports of water quality issues including fish kills have been reported and are usually attributed to pollution associated with runoff from rain events. Water flowing in the lower half of watershed is generally brackish in nature with extremely high concentrations of chloride, sulfate, and TDS associated with historical oil and gas operations in which brine water was discharged into tributaries and drainage ditches that drain into the creek. Brine discharges to the creek were suspended in 1987 but elevated levels of TDS, chloride, and sulfate remain.

## Arroyo Colorado TMDL and WPP

The Arroyo Colorado, an ancient distributary channel of the Rio Grande, extends 90 miles from Mission, Texas to the Laguna Madre in the Rio Grande Valley. Flow in the Arroyo Colorado is sustained by wastewater discharges, agricultural irrigation return flows, urban runoff, and base flows from shallow groundwater. Water quality analyses show that DO levels are sometimes too low downstream of the Port

of Harlingen (on Segment 2201) to provide optimum conditions for fish and other aquatic life. Water quality and fish tissue analyses also indicate that legacy pollutants occur in fish tissues in such concentrations to warrant a fish consumption advisory upstream of the Port of Harlingen. Legacy pollutants are chemicals whose use has been banned or severely restricted, but which still remain in the environment.

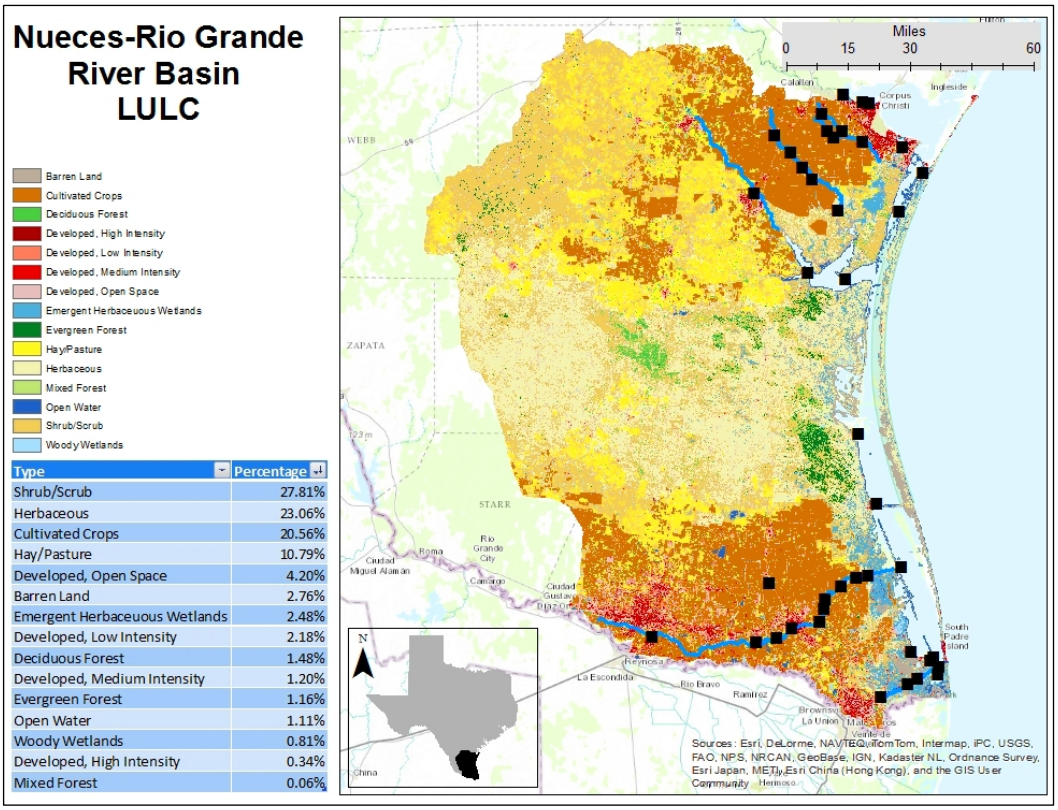
A TMDL was conducted to address the low DO impairments. Various studies to support the TMDL were conducted. The results of the studies and stakeholder input led to the development of a WPP, completed in 2007, for the Arroyo Colorado to improve water quality and habitat. Seven major components of the Arroyo Colorado include:

- Wastewater infrastructure
- Agricultural issues
- Habitat restoration
- Land use
- Refinement of the TMDL analysis
- Monitoring
- Public education

**Petronila Creek Above Tidal TMDL and I-Plan**

Petronila Creek Above Tidal (Segment 2204) is a 44-mile freshwater stream spanning Kleberg and Nueces counties. Located southwest of Corpus Christi, Petronila Creek is part of the Baffin Bay watershed. The 2000 assessment identified chloride, sulfate, and TDS impairments in the creek. The TCEQ developed a TMDL for this parameters, which identified the source as the now illegal practice of discharging produced waters from oil and gas production into water ways and unlined pits. An I-Plan was also developed to begin the restoration process. The Railroad Commission of Texas (RRC) investigated oil field-related salinity contamination and prepared a Soil Feasibility Study. This study recommended excavation of contaminated soils from two of the highest priority areas and the placement of a surface cap in a third area. The RRC also eliminated potential sources of salinity by plugging orphaned or abandoned unplugged wells.

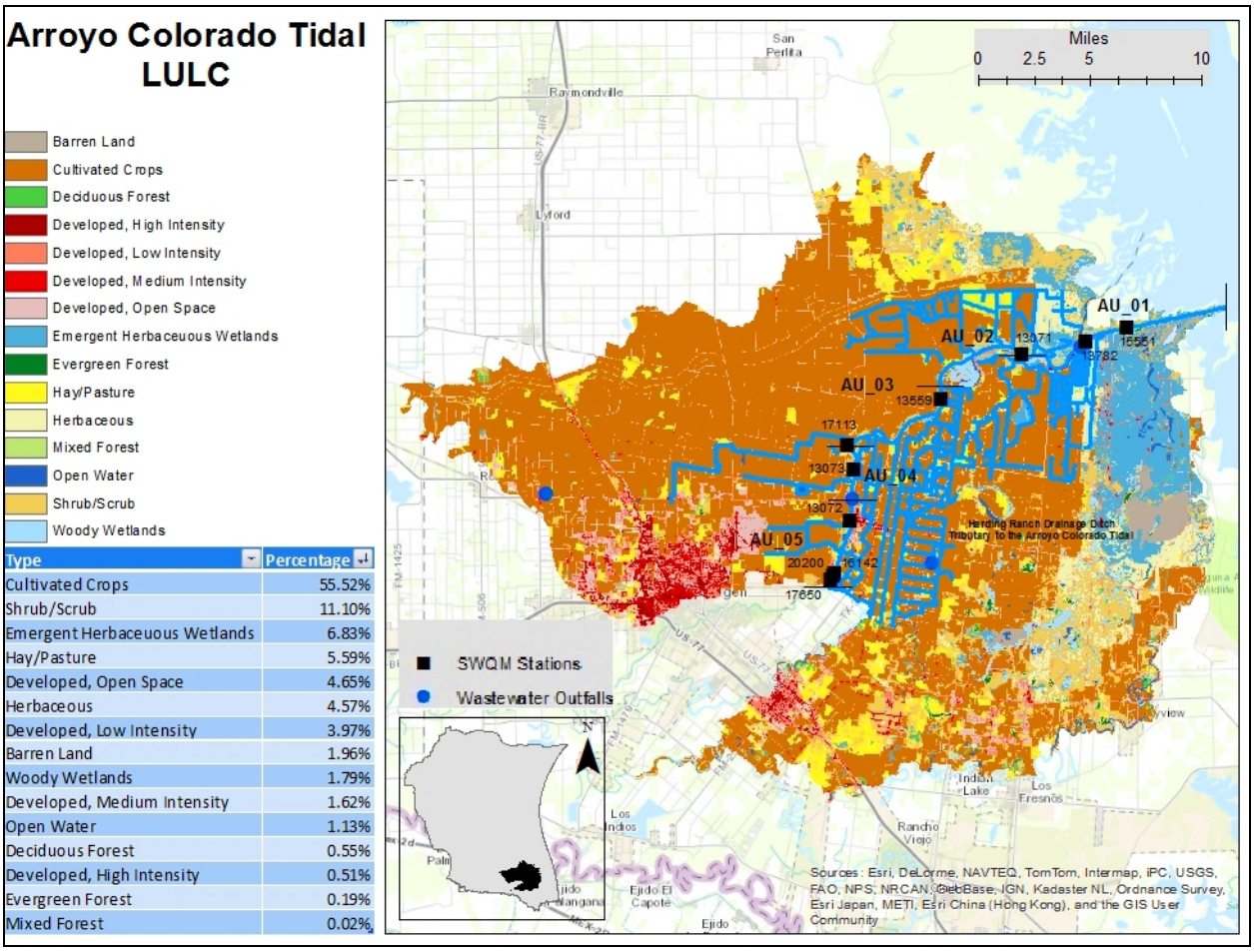
The map below shows all the SWQM sites that are being monitored in FY 2013 within the basin and adjacent bays.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 27.81% |
| Herbaceous | 23.06% |
| Cultivated Crops | 20.56% |
| Hay/Pasture | 10.79% |
| Developed, Open Space | 4.20% |
| Barren Land | 2.76% |
| Emergent Herbaceuous Wetlands | 2.48% |
| Developed, Low Intensity | 2.18% |
| Deciduous Forest | 1.48% |
| Developed, Medium Intensity | 1.20% |
| Evergreen Forest | 1.16% |
| Open Water | 1.11% |
| Woody Wetlands | 0.81% |
| Developed, High Intensity | 0.34% |
| Mixed Forest | 0.06% |

# ARROYO COLORADO TIDAL WATERSHED – SEGMENT 2201

The 26 mile segment extends from the confluence with the Laguna Madre in Cameron / Willacy counties to a point100 m (110 yards) downstream of Cemetery Rd. south of the Port of Harlingen in Cameron County and is divided into five AUs.




| Type | Percentage |
|---|---|
| Cultivated Crops | 55.52% |
| Shrub/Scrub | 11.10% |
| Emergent Herbaceuous Wetlands | 6.83% |
| Hay/Pasture | 5.59% |
| Developed, Open Space | 4.65% |
| Herbaceous | 4.57% |
| Developed, Low Intensity | 3.97% |
| Barren Land | 1.96% |
| Woody Wetlands | 1.79% |
| Developed, Medium Intensity | 1.62% |
| Open Water | 1.13% |
| Deciduous Forest | 0.55% |
| Developed, High Intensity | 0.51% |
| Evergreen Forest | 0.19% |
| Mixed Forest | 0.02% |

| | |
|---|---|
| **Drainage area** | 294,591 acres |
| **Aquifers** | None |
| **Cities** | Santa Rosa, Combes, Harlingen, Rio Hondo, Villa del Sol, Las Yescas, Laureles, Bayview, San Benito, Russelltown, Santa Monica, Lozano |
| **Counties** | Cameron, Hidalgo |
| **EcoRegions** | Lower Rio Grande Alluvial Floodplain, Lower Rio Grande Valley |
| **Climate Annual Averages** | Rain: 23" – 27"; Low: 62° F - 63° F; High: 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption |
| **Permitted WWTFs** | WQ0003596-000 – Taiwan Shrimp Village Association and Arroyo Aquaculture Association: 100,000,000 gpd<br>WQ0004244-000 – Southern Star Inc. : 60,000,000 gpd via unnamed ditch<br>WQ0004792-000 – Military Highway WSC: 1,440,000 gpd via Resaca Del Rancho Viejo<br>WQ0010475-002 – City of Rio Hondo: 400,000 gpd<br>WQ0013462-008 – Military Highway WSC Lago: 510,000 gpd via Resaca Del Rancho Viejo<br>WQ0014558-001 – East Rio Hondo WSC: 160,000 gpd |

## Special Studies

The Arroyo Colorado Tidal watershed is included in the Arroyo Colorado WPP as described in the Nueces – Rio Grande Coastal Basin write-up on Page 110.

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Vincente Drainage Ditch. **AU_02** is the reach from the upstream end of AU_01 to the confluence with an unnamed drainage ditch at latitude/longitude N 26.31°, W 97.53°. **AU_03** is the reach from the upstream end of AU_02 to the confluence with Harding Ranch Ditch. **AU_04** is the reach from the upstream end of AU_03 just upstream of the City of Hondo wastewater discharge point. **AU_05** is the reach from the upstream end of AU_04 to the upstream end of the segment.

The analysis for AU_01 is based on data from **Station 13782**, located near Channel Marker (CM) 16 at Arroyo City. Trend analysis was conducted on data from March 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_02 is based on data from **Station 13071**, located near CM 22 upstream from San Vicente drainage ditch. Trend analysis was conducted on data from March 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_03 is based on data from **Station 13559**, located at CM 27 north of the Willacy/Cameron county line. Trend analysis was conducted on data from March 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_04 is based on data from **Station 13073**, located at Camp Perry north of Rio Hondo. Trend analysis was conducted on data from March 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_05 is based on data from **Station 13072**, located at FM 106 in Rio Hondo. Trend analysis was conducted on data from March 2000 through August 2011. TCEQ is responsible for routine quarterly monitoring at this site.

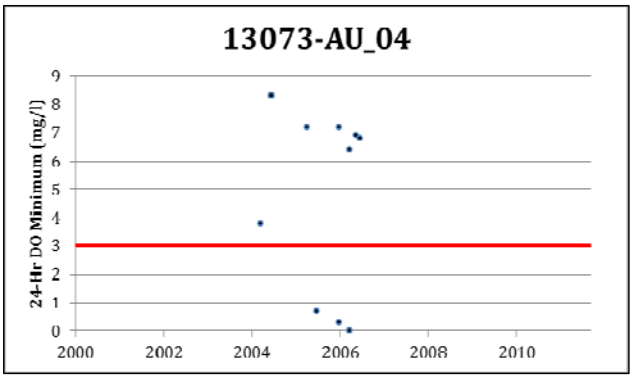
There is a **24-Hr DO minimum impairment** for AU-04 and AU_05. There is a **low DO screening level concern** and a **24-Hr DO average concern** for AU_05. There is a **bacteria concern** for AU_01 and AU_02 and a **bacteria impairment** for AU_03, AU_04, and AU_05. There are **chlorophyll-*a*** and **nitrate concerns** for the entire segment.

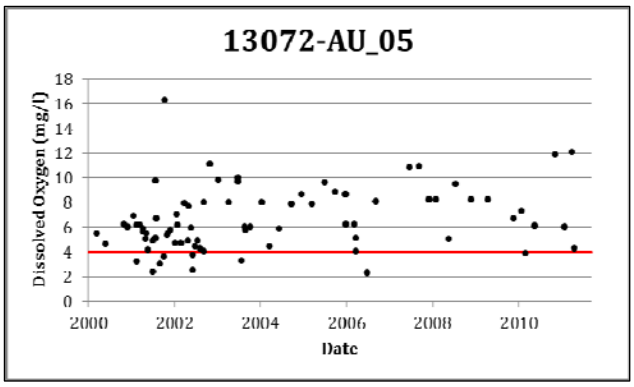
The watershed is primarily croplands that are crossed by numerous irrigation canals. This area is extremely fertile and supplies an abundance of citrus and other crops. There numerous cities and towns, with a portion of Harlingen being located on the western side. Wetlands dominate the areas near the Laguna Madre.

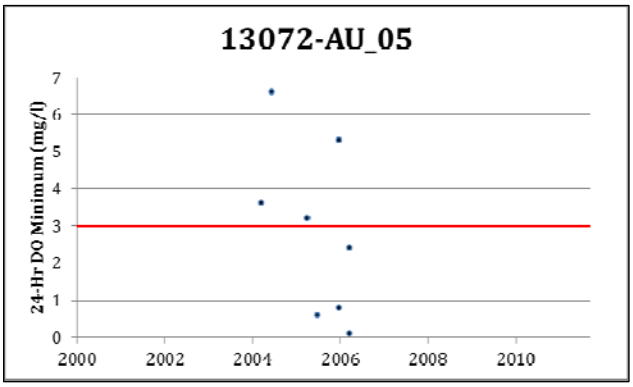
### Aquatic Life Use Assessment

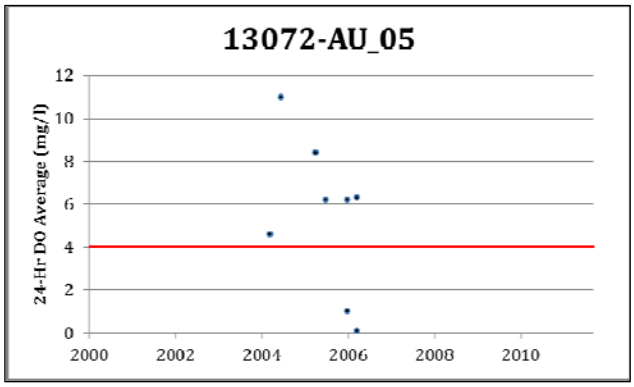
| DO | | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 25 | 4.4 | 16.0 | 10.2 | 0 | 0 |
| | Screening Level 4.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 24 | 4.9 | 15.6 | 9.4 | 0 | 0 |
| | Screening Level 4.0 mg/l | NC | | | | | | |
| AU-03 | Minimum 3.0 mg/l | FS | 24 | 1.2 | 13.3 | 7.6 | 1 | 1 |
| | Screening Level 4.0 mg/l | NC | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| AU-04 | Minimum 3.0 mg/l | FS | 26 | 1.5 | 14.2 | 8.1 | 1 | 2 |
| | Screening Level 4.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | **NS** | **10** | **0.0** | **8.3** | **6.6** | **3** | **NA** |
| | 24-Hr Average 4.0 mg/l | FS | | 0.1 | 13.3 | 8.0 | NA | 2 |
| AU-05 | Minimum 3.0 mg/l | FS | **28** | **2.3** | **10.9** | **8.0** | **1** | **2** |
| | Screening Level 4.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | **NS** | **8** | **0.1** | **6.6** | **2.8** | **4** | **NA** |
| | 24-Hr Average 4.0 mg/l | **CN** | | **0.1** | **11.0** | **6.2** | **NA** | **2** |



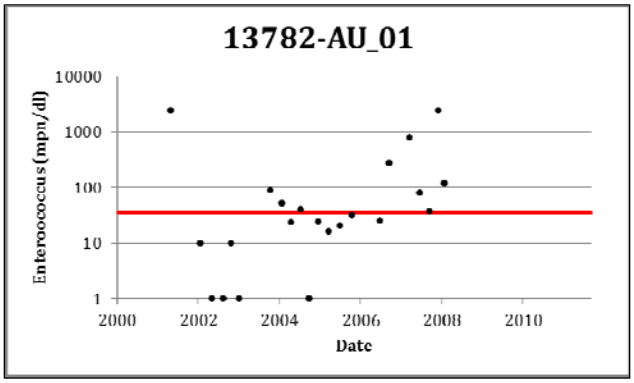



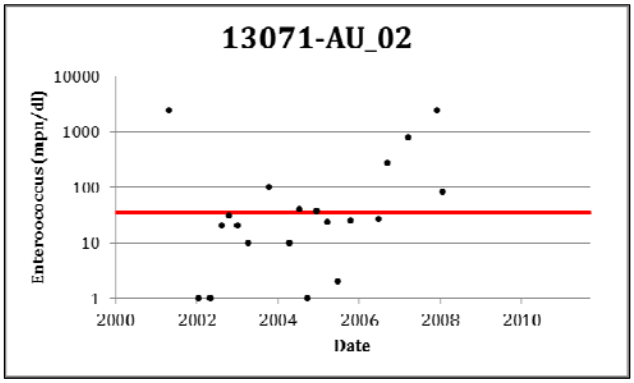



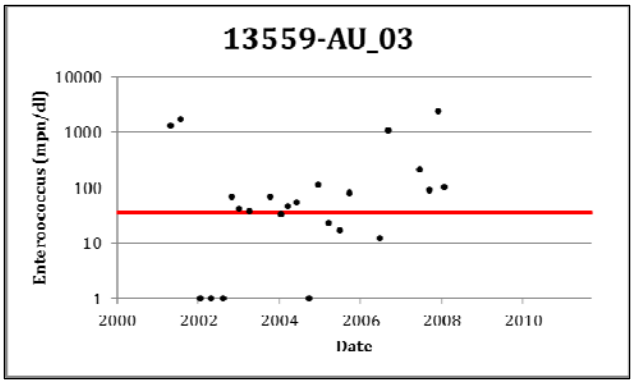

The low DO concerns and impairments occur in the upper two AUs and may be related to high nutrient levels from spilled fertilizers during offloading at the Port of Harlingen. A lot of work has been done since 2006 through the Arroyo Colorado Watershed Partnership (ACWP) and implementation of the WPP, including ways to reduce spillage at the port. Low DO is also attributed to physical modifications of the Arroyo Colorado to facilitate port activities. Additional 24-hr DOs should be taken to see if the implementation of BMPs has had any effect on DO levels.

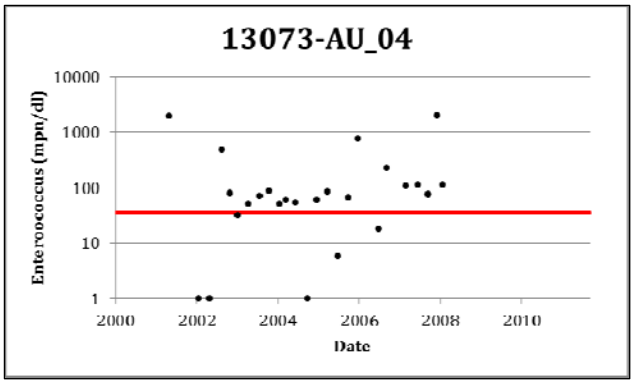
**Recreation Use**

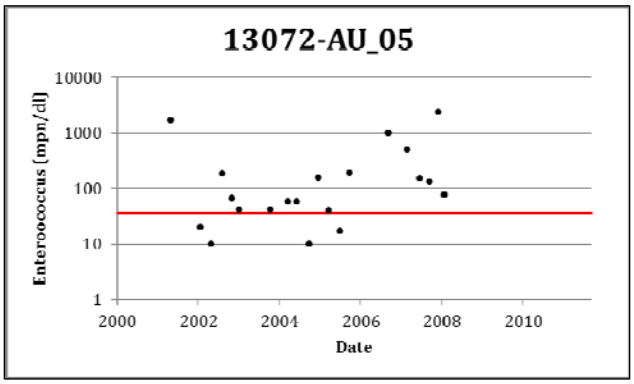
| Enterococcus | | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 35 cfu | CN | 15 | <1 | >2,400 | 51.7 | 1 | 4 |
| AU-02 | | CN | 12 | <1 | >2,400 | 40.4 | 1 | 3 |
| AU-03 | | NS | 14 | <1 | >2,400 | 63.2 | 1 | 6 |
| AU-04 | | NS | 16 | <1 | 2,000 | 68.08 | 1 | 6 |
| AU-05 | | NS | 13 | 10 | >2,400 | 121.19 | 0 | 7 |



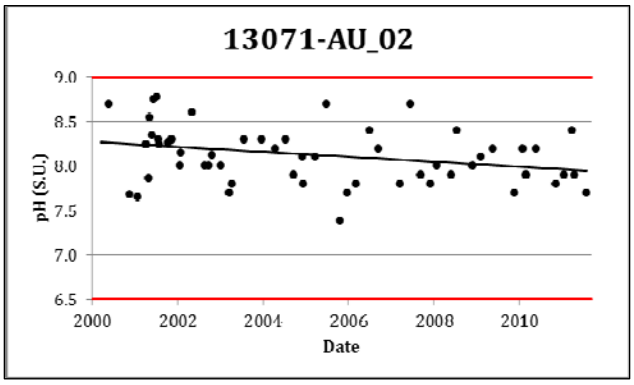




The high levels of bacteria in this segment have several potential sources: WWTF discharge, failing OSSFS, and runoff from the agricultural fields. The bacteria impairments are being addressed in the WPP.

**General Use**

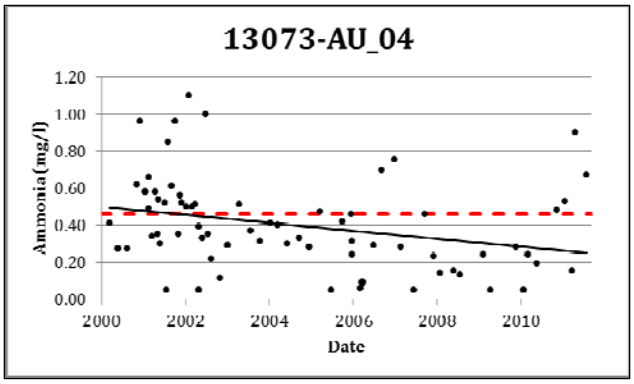
| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU-01 | 35 °C | FS | 26 | 14.2 | 32.9 | 27.3 | 0 |
| AU-02 | | FS | 26 | 14.9 | 32.2 | 27.1 | 0 |
| AU-03 | | FS | 25 | 14.3 | 30.8 | 25.1 | 0 |
| AU-04 | | FS | 28 | 14.3 | 30.9 | 25.6 | 0 |
| AU-05 | | FS | 30 | 14.2 | 31.0 | 25.6 | 0 |

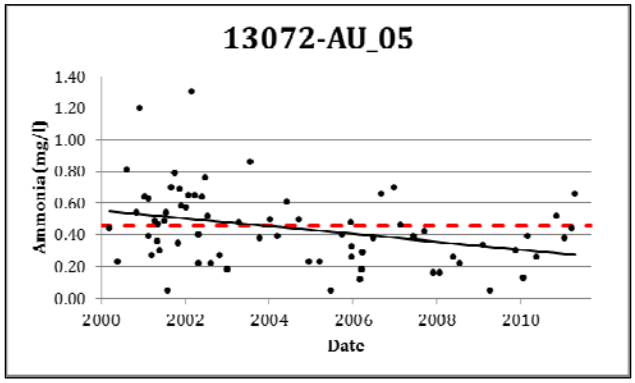
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 26 | 7.7 | 8.8 | 8.2 | 0 | 0 |
| AU-02 | | FS | 26 | 7.4 | 8.7 | 8.0 | 0 | 0 |
| AU-03 | | FS | 25 | 7.6 | 8.1 | 7.8 | 0 | 0 |
| AU-04 | | FS | 29 | 7.6 | 8.3 | 7.9 | 0 | 0 |
| AU-05 | | FS | 29 | 7.2 | 8.1 | 7.8 | 0 | 0 |




Statistical analysis indicates that there is a decreasing trend in pH values in AU_02 with a **t-stat of -2.09** and a **p-value of 0.04.** However, the values are well within the pH range and the decreasing trend is not an issue at this time.

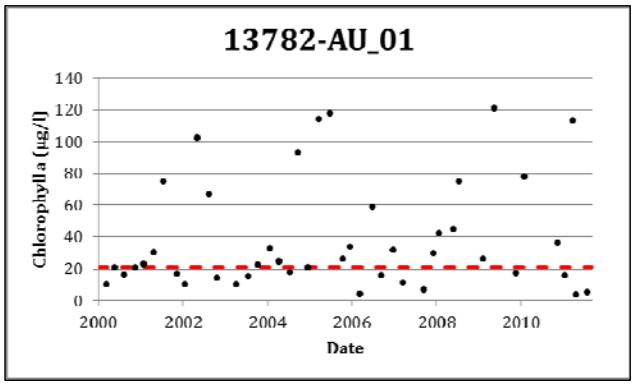
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.46 mg/l | NC | 26 | <0.05 | 0.49 | 0.06 | 12 | 10 |
| AU-02 | | NC | 27 | <0.05 | 0.72 | 0.1 | 10 | 2 |
| AU-03 | | NC | 26 | <0.05 | 0.71 | 0.36 | 2 | 7 |
| AU-04 | | NC | 30 | <0.05 | 0.75 | 0.26 | 4 | 3 |
| AU-05 | | NC | 30 | <0.05 | 0.7 | 0.315 | 2 | 6 |

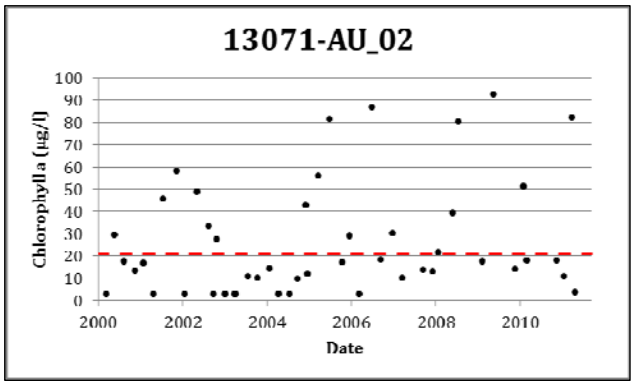


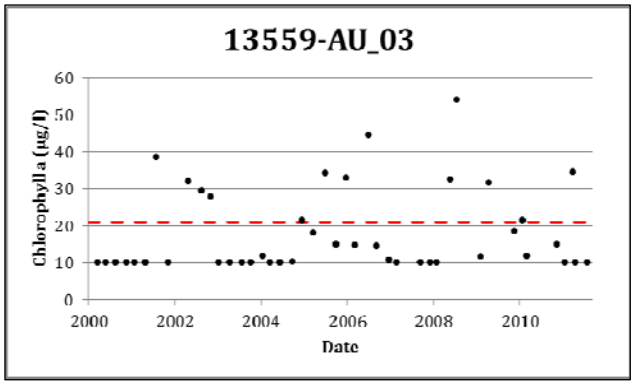



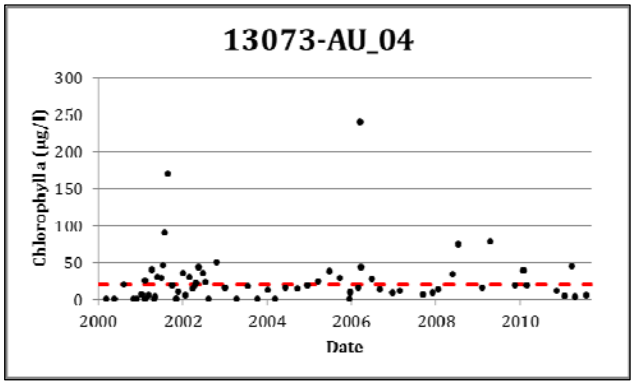

Statistical analysis indicates that there is a decreasing trend in ammonia values in AU_04 with a **t-stat of -2.50** and a **p-value of 0.01** and in AU_05 with a **t-stat of -2.99** and a **p-value of 0.00.** The decrease could be associated with implementation of BMPs at the Port of Harlingen.

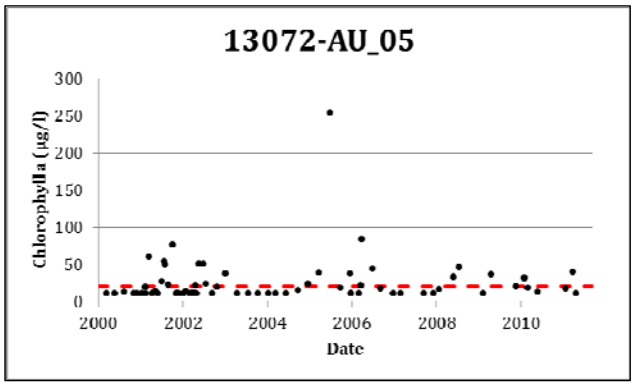
| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >21 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 21 µg/l | CS | 23 | 4.13 | 121 | 31.8 | 0 | 16 |
| AU-02 | | CS | 25 | <3 | 92.7 | 18 | 3 | 11 |
| AU-03 | | CS | 24 | <10 | 54.1 | 14.6 | 6 | 8 |
| AU-04 | | CS | 28 | <10 | 240 | 15.4 | 6 | 10 |
| AU-05 | | CS | 29 | <10 | 254 | 17.1 | 9 | 10 |



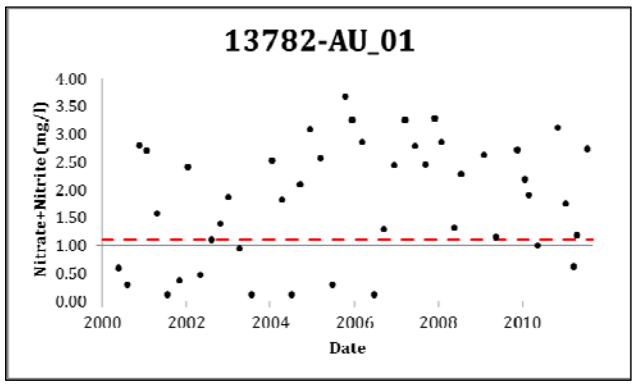



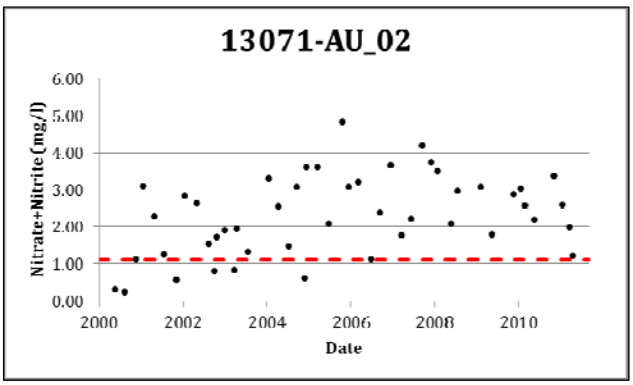



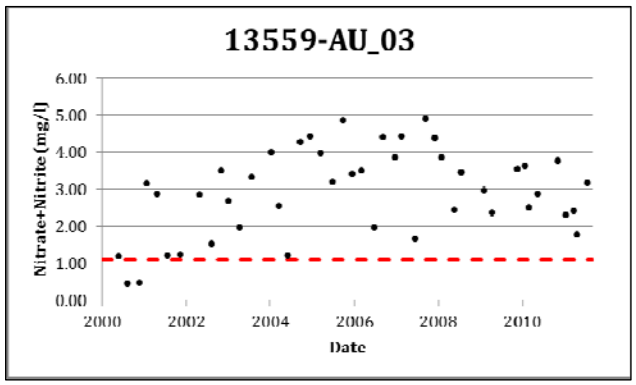



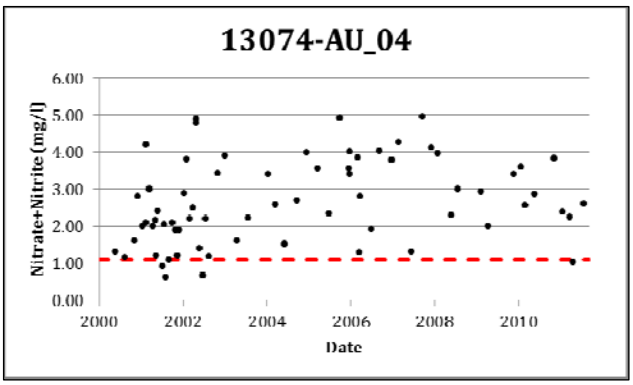

According to the Arroyo Colorado WPP, algal blooms are common in the spring and summer and may be related to the high nitrate levels measured in this segment.

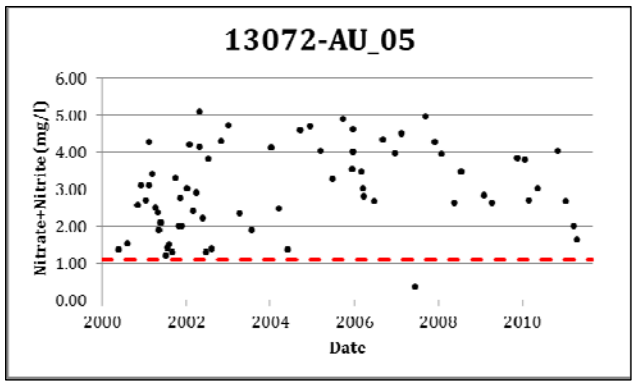
| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.1 mg/l | CS | 26 | <1 | 3.68 | 2.44 | 3 | 22 |
| AU-02 | | CS | 27 | 0.61 | 4.83 | 2.96 | 0 | 26 |
| AU-03 | | CS | 26 | 1.2 | 4.89 | 3.51 | 0 | 26 |
| AU-04 | | CS | 30 | 1.3 | 4.95 | 3.4 | 0 | 30 |
| AU-05 | | CS | 30 | .036 | 4.95 | 3.66 | 0 | 29 |




The high nitrate levels may be related to the Port of Harlingen activities, WWTF discharge, and runoff.

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.66 mg/l | NC | 25 | 0.23 | 0.63 | 0.4 | 0 | 0 |
| AU-02 | | NC | 25 | 0.26 | 0.63 | 0.46 | 0 | 0 |
| AU-03 | | NC | 26 | 0.3 | 0.86 | 0.525 | 0 | 5 |
| AU-04 | | NC | 30 | 0.3 | 0.94 | 0.45 | 0 | 5 |
| AU-05 | | NC | 30 | 0.21 | 0.84 | 0.525 | 0 | 6 |

# HARDING RANCH DRAINAGE DITCH TRIBUTARY – SEGMENT 2201A

The segment is within Cameron County and extends from the confluence with the Arroyo Colorado Tidal to point 20.8 km upstream of FM 508.

## Special Studies

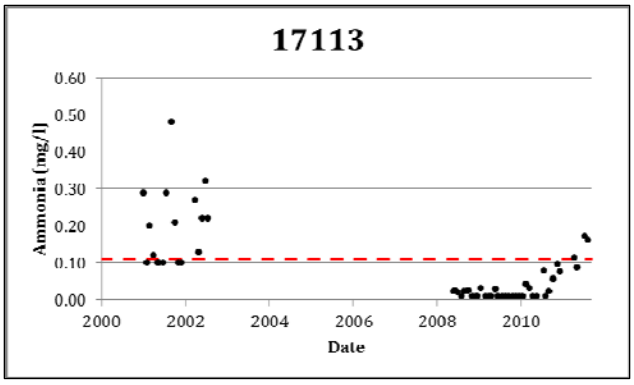
The Harding Ranch Drainage Ditch is included in the Arroyo Colorado WPP as described in the Nueces – Rio Grande Coastal Basin write-up on Page 110.

## Water Quality Analysis

The analysis for this segment is based on data from **Station 17113**, located at FM 1420. Trend analysis is not appropriate due to the large data gap from 2003-2007**.** This site was sampled as part of the Arroyo Colorado TMDL and WPP studies and is not a routine monitoring site. This data on the segment were not used in the 2012 Assessment, but the data presented below are based on the 2012 Assessment time period.

## General Use

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.11 |
|---|---|---|---|---|---|---|---|---|
| 2010 IR | 0.11 mg/l | **CS** | **17** | **<0.1** | **0.48** | **0.2** | **5** | **11** |
| 2012 IR | | NA | 28 | 0.01 | 0.079 | 0.01 | 0 | 0 |




Ammonia was listed as a concern in the 2010 IR based on sampling conducted in 2001-2002 for the Arroyo Colorado TMDL. This concern was carried forward to the 2012 IR. Additional samples were collected in 2008-2011 for the Arroyo Colorado WPP studies. These later data are markedly lower than the earlier data and may be the result of implementation of the Arroyo Colorado WPP.

# UNNAMED DRAINAGE DITCH TRIBUTARY IN CAMERON COUNTY DRAINAGE DISTRICT #3 – SEGMENT 2201B

The segment is within Cameron County and extends from the confluence with the Arroyo Colorado Tidal to point 17.6 km upstream of FM 510.

## Special Studies

The Unnamed Drainage Ditch is included in the Arroyo Colorado WPP as described in the Nueces – Rio Grande Coastal Basin write-up on Page 110.

## Water Quality Analysis

The analysis for this segment is based on data from **Station 18196,** located at FM 510. This site was sampled for baseline data prior to development of a proposed constructed wetland for the Green Valley Farms Colonia. Unfortunately, the funding for this project was not granted. This is not a routine monitoring site.

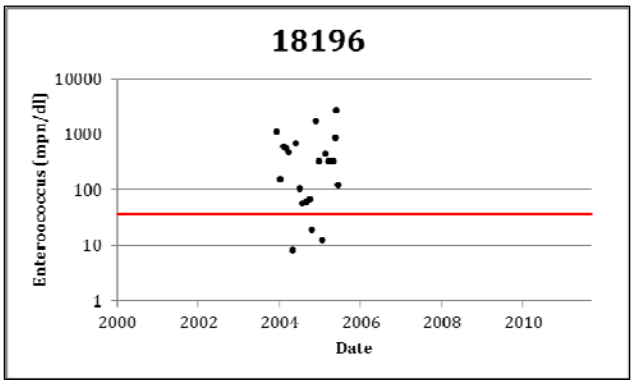
There is a **bacteria impairment** and **chlorophyll-*a*** and **nitrate concerns** for this segment.

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 21 | 3.0 | 9.5 | 6.9 | 0 | 1 |
| Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | **NS** | **21** | **8** | **2,700** | **208.62** | **0** | **15** |

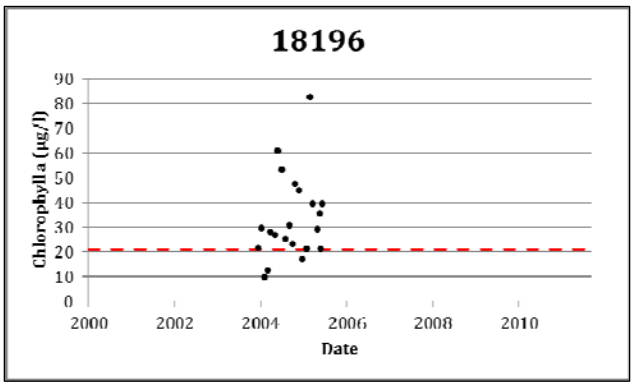



By design, the sampling site was located in order to record bacteria from the Green Valley Farms Colonia to document the need for the constructed wetland. Elevated readings were expected.

### General Use

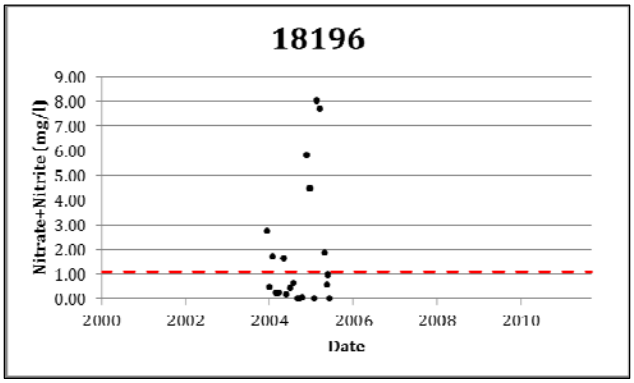
| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 21 | <0.02 | 0.152 | 0.083 | 4 | 0 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >21 |
|---|---|---|---|---|---|---|---|
| 21 µg/l | **CS** | **21** | **9.8** | **82.3** | **29.1** | **0** | **21** |




The sampling location was in a ditch and the elevated values are most likely related to the elevated nitrates from runoff from the surrounding agriculture fields.

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | **CS** | **21** | **<0.02** | **8.034** | **0.564** | **3** | **8** |

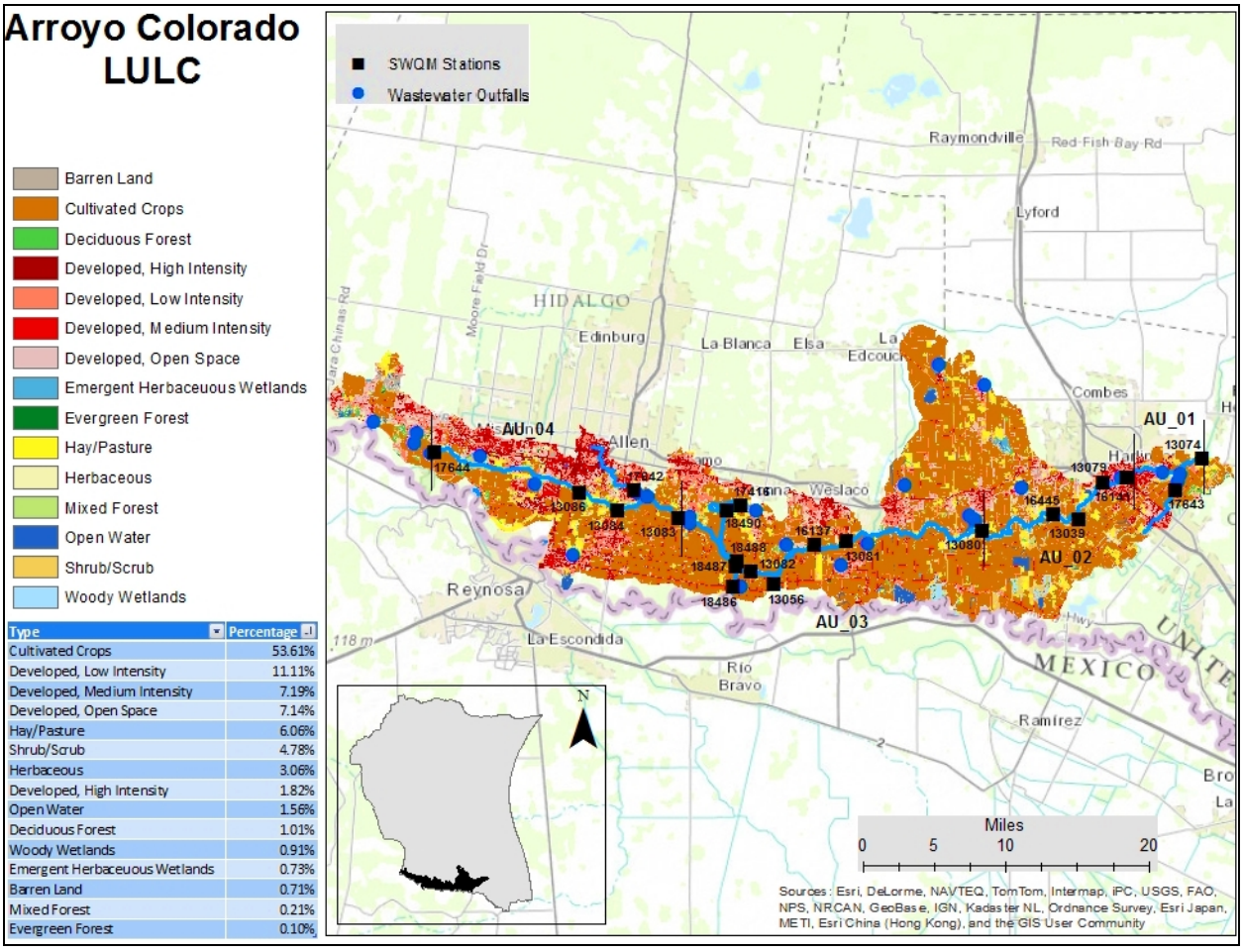



The elevated values are most likely related to the runoff from the surrounding agriculture fields and OSSFs.

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | NC | 21 | 0.13 | 0.4 | 0.242 | 0 | 0 |

# ARROYO COLORADO ABOVE TIDAL – SEGMENT 2202

The 63 mile segment extends from to a point100 m (110 yards) downstream of Cemetery Road south of the Port of Harlingen in Cameron County to FM 2062 in Hidalgo County and is divided into four AUs.




| Type | Percentage |
|---|---|
| Cultivated Crops | 53.61% |
| Developed, Low Intensity | 11.11% |
| Developed, Medium Intensity | 7.19% |
| Developed, Open Space | 7.14% |
| Hay/Pasture | 6.06% |
| Shrub/Scrub | 4.78% |
| Herbaceous | 3.06% |
| Developed, High Intensity | 1.82% |
| Open Water | 1.56% |
| Deciduous Forest | 1.01% |
| Woody Wetlands | 0.91% |
| Emergent Herbaceuous Wetlands | 0.73% |
| Barren Land | 0.71% |
| Mixed Forest | 0.21% |
| Evergreen Forest | 0.10% |

| | |
|---|---|
| **Drainage area** | 252,633 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Harlingen, San Benito, El Camino Angosto, Las Rusias, Arroyo Alto, La Feria, Palm Valley, Santa Rosa, Ratamosa, Mercedes, Llano Grande, Weslaco, Mila Doce, Elsa, Edcouch, La Villa, Donna, Midway South, Scissors, Progresso, South Alamo, Alamo, San Juan, Pharr, North Alamo, McAllen, Las Milpas, Hidalgo, Mission, Palmview, Palmview South, La Joya, Penitas, Grande Acres, |
| **Counties** | Cameron, Hidalgo |
| **EcoRegions** | Lower Rio Grande Allulvial Floodplain, Lower Rio Grande Valley |
| **Climate Annual Averages** | Rain: 23” – 27”; Low: 62° F - 63° F; High: 83° F - 85° F |
| **Water Body Uses** | Aquatic Life, General, Fish Consumption, Recreation, General |

| | |
|---|---|
| **Permitted WWTFs** | WQ0001254-000 – CPL Bates Facility: 2,000,000 gpd via Hidalgo County drainage ditch<br>WQ0001256-000 – CPL La Palma Power Station: 1,120,000 gpd via Cameron County drainage ditch<br>WQ0004051-000 – Frontera Generation Ltd.: 1,400,000 gpd via Main Floodway<br>WQ0004257-000 – Watermill Express: 1,000 gpd via subsurface drainfield<br>WQ0004754-000 – Military Highway WSC Progresso WTP: 520,000 gpd to Llano Grande Lake<br>WQ0004782-000 – North Alamo WSC: 2,000,000 gpd to the North Floodway<br>WQ0004789-000 – North Alamo WSC: 2,000,000 gpd to the North Floodway<br>WQ0004837-000 – La Joya WSC: 432,000 gpd to the North Floodway<br>WQ0004861-000 – TRS Enviroganics: WWTF and WTP sludge<br>WQ0004924-000 – TRS Enviroganics, Inc: WWTF and WTP sludge<br>WQ0010347-001 – City of Mercedes: 5,000,000 gpd via Arroyo Anacuitas<br>WQ0010473-002 – City of San Benito: 2,160,000 gpd<br>WQ0010484-001 – City of Mission: 9,000,000 gpd<br>WQ0010490-002 – City of Harlingen: 3,100,000 gpd<br>WQ0010490-003 – City of Harlingen Water Works Facility #2: 10,000,000 gpd<br>WQ0010504-001 – City of Donna: 2,300,000 gpd to the Llano Grande Lake<br>WQ0010596-001 – City of Pharr: 5,000,000 gpd via Main Floodway<br>WQ0010619-005 – City of Weslaco South Plant: 2,000,000 gpd via South Donna Drain<br>WQ0010633-003 – City of McAllen Facility No. 2: 10,000,000 gpd via unnamed ditch<br>WQ0010697-001 – City of La Feria: 500,000 gpd via ditch<br>WQ0010697-002 – City of La Feria: 1,250,000 gpd via ditch<br>WQ0010972-002 – Palm Valley Estates: 280,000 gpd via irrigation<br>WQ0011080-001 – City of Hidalgo: 2,700,000 gpd via Hidalgo County drainage ditch<br>WQ0011510-002 – City of Elsa: 280,000 gpd via Hidalgo County drainage ditch<br>WQ0011512-001 – City of San Juan: 4,000,000 gpd via Main Floodway<br>WQ0011628-001 – Winter Garden Park Corporation: 11,000 gpd into Reba Bass Lake<br>WQ0012854-001 – Hidalgo County MUD #1: 500,000 gpd via irrigation<br>WQ0013462-001 – Military Highway WSC Progresso: 750,000 gpd<br>WQ0013462-002 – Military Highway WSC La Paloma: 210,000 gpd via irrigation<br>WQ0013462-003 – Military Highway WSC Santa Maria: 230,000 gpd via irrigation<br>WQ0013462-004 – Military Highway WSC San Pedro: 160,000 gpd via irrigation<br>WQ0013462-005 – Military Highway WSC Los Indios: 135,000 gpd via irrigation<br>WQ0013462-006 – Military Highway WSC South Alamo: 510,000 gpd<br>WQ0013523-001 – La Joya ISD La Joya Elementary: 15,000 gpd via subsurface pressure system<br>WQ0013523-002 – La Joya ISD Chapa Elementary: 15,000 gpd via subsurface pressure system<br>WQ0013523-004 – La Joya ISD 11$^{th}$ and 12$^{th}$ Elementary: 15,000 gpd via a subsurface pressure system<br>WQ0013523-010 – La Joya ISD: 20,000 gpd via subsurface low pressure dosed drainfields<br>WQ0013523-011 – La Joya ISD: 12,000 gpd via 8 pressure dosed fields<br>WQ0013523-012 – La Joya ISD: 9,000 gpd via subsurface low pressure dosing drainfields<br>WQ0013523-014 – La Joya ISD: 13,500 gpd<br>WQ0013523-016 – La Joya ISD: 12,000 gpd via subsurface low pressure dosing drainfields<br>WQ0013633-001 – City of Alamo: 2,000,000 gpd via Hidalgo County drainage ditch<br>WQ0013680-001 – Donna ISD Runn Elementary: 17,000 gpd via Donna Irrigation District drainage ditch<br>WQ0013680-002 – Donna ISD Munoz Elementary: 2,500 gpd via subsurface drainfields<br>WQ0013680-003 – Donna ISD Garza Elementary: 12,500 gpd via subsurface drainfields<br>WQ0014178-001 – US Fish and Wildlife Service Santa Ana National Wildlife Refuge: 1,500 gpd via evaporation<br>WQ0014415-003 – Agua Special Utility District: 7,550,000 gpd (pending)<br>WQ0014454-001 – City of San Benito: 3,750,000 gpd via drainage ditch<br>WQ0014558-001 – East Rio Hondo WSC: 1,600,000 gpd |

## Special Studies

The Arroyo Colorado Above Tidal watershed is included in the Arroyo Colorado WPP as described in the Nueces – Rio Grande Coastal Basin write-up on Page 110.

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with Little Creek just upstream of State Loop 499. **AU_02** is the reach from the upstream end of AU_01 to the confluence with La Feria Main Canal just upstream of Dukes Highway. **AU_03** is the reach from the upstream end of AU_02 to the confluence with La Cruz Resaca just downstream of FM 907. **AU_04** is the reach from the upstream end of AU_03 to the upstream end of the segment at FM 2062.


Station 13079

The analysis for AU_01 is based on data from **Station 13074**, located at Cemetery Road bridge at Port Harlingen. Trend analysis was conducted on data from March 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_02 is based on data from **Station 13079**, located at US 77 in Harlingen. Trend analysis was conducted on data from February 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_03 is based on data from **Station 13081**, located at FM 1015 south of Weslaco. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_04 is based on data from **Station 13084**, located at US 281 south of Pharr. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There is a **bacteria impairment**, and **chlorophyll-a, nitrate,** and **total phosphorus concerns** for the entire segment. There are impairments for **DDE, mercury**, and **Polychlorinated Biphenyls** (**PCBs) in edible fish tissue.**

The watershed is primarily croplands, but is rapidly becoming urbanized. It is one of the fastest growing areas in the state. Known as "The Valley," the corridor along US 83 is populated by a number of cities, some immediately adjacent to another city. A portion of Harlingen is located on the eastern side.

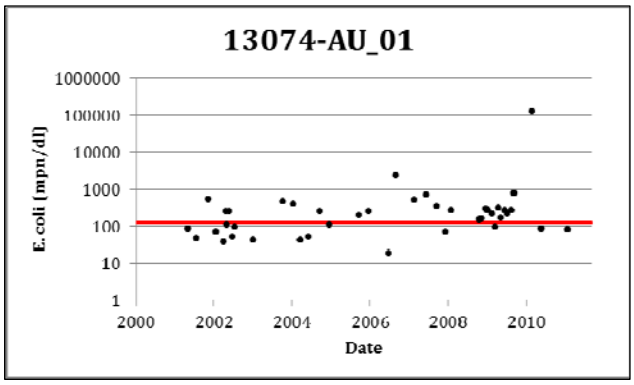
## Aquatic Life Use Assessment

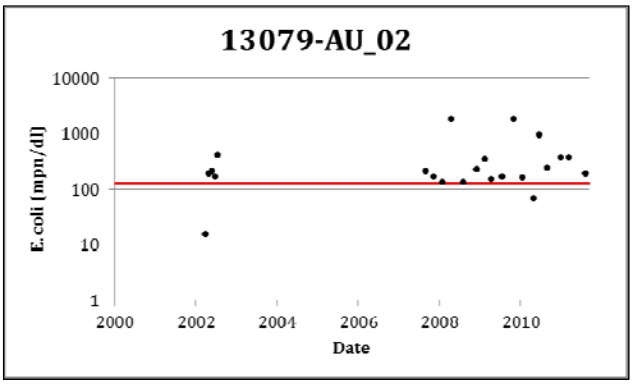
| DO | | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 41 | 4.1 | 9.1 | 6.9 | 0 | 0 |
| | Screening Level 4.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 22 | 4.2 | 9.8 | 5.3 | 0 | NA |
| | 24-Hr Average 4.0 mg/l | FS | | 4.8 | 10.3 | 5.9 | NA | 0 |
| AU-02 | Minimum 3.0 mg/l | FS | 42 | 4.1 | 9.2 | 7.4 | 0 | 0 |
| | Screening Level 4.0 mg/l | NC | | | | | | |
| AU-03 | Minimum 3.0 mg/l | FS | 40 | 3.2 | 13.3 | 7.7 | 0 | 2 |
| | Screening Level 4.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 3.0 mg/l | FS | 11 | 2.3 | 7.4 | 5.2 | 1 | NA |
| | 24-Hr Average 4.0 mg/l | FS | | 3.0 | 8.5 | 7.5 | NA | 1 |
| AU-04 | Minimum 3.0 mg/l | FS | 36 | 3.9 | 12.2 | 7.0 | 0 | 2 |
| | Screening Level 4.0 mg/l | NC | | | | | | |

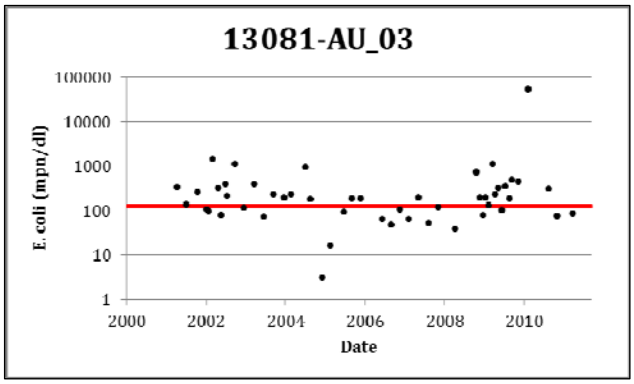
AU_02 is fully supporting / has no concerns for toxic substances in water for aquatic life use.

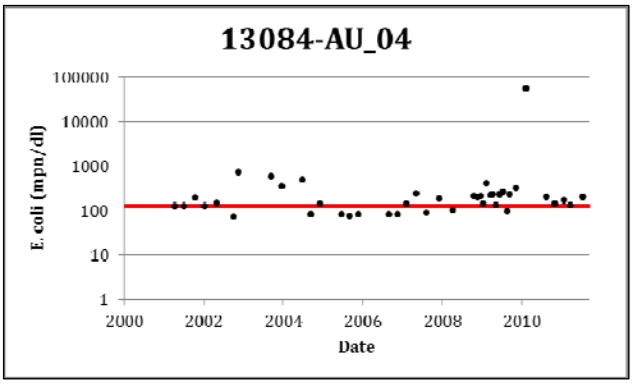
## Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 126 cfu/100 ml | NS | 28 | 19 | 130,000 | 259.43 | 0 | 6 |
| AU-02 | | NS | 13 | 69 | 1,850 | 270.75 | 0 | 3 |
| AU-03 | | NS | 32 | 3 | 52,000 | 172.65 | 0 | 6 |
| AU-04 | | NS | 29 | 76 | 55,000 | 200.19 | 0 | 3 |



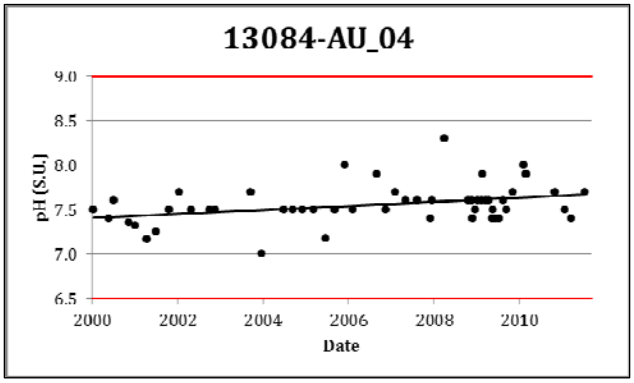




As noted above, there are numerous WWTFs that discharge directly into the Arroyo Colorado or irrigate within the watershed. There are also a number of colonias within the watershed. The ACWP has been working with these facilities to provide wastewater service to some of the colonias. Several of the WWTFs have also constructed wetlands to provide additional treatment of the effluent prior to discharge. A review of previous assessments shows that the geomeans have improved since implementation of the WPP and should continue to improve.

## General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU-01 | 35 °C | FS | 42 | 13.0 | 30.5 | 25.6 | 0 |
| AU-02 | | FS | 41 | 13.0 | 30.8 | 24.8 | 0 |
| AU-03 | | FS | 40 | 10.9 | 32.5 | 24.8 | 0 |
| AU-04 | | FS | 35 | 12.1 | 32.4 | 23.9 | 0 |

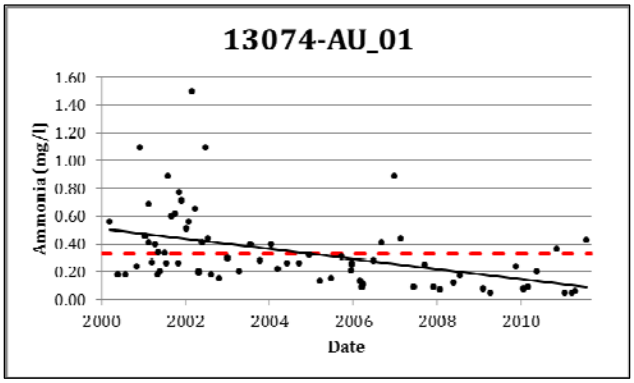
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 42 | 7.4 | 8.2 | 7.7 | 0 | 0 |
| AU-02 | | FS | 40 | 7.5 | 8.0 | 7.8 | 0 | 0 |
| AU-03 | | FS | 39 | 7.1 | 8.6 | 7.8 | 0 | 0 |
| AU-04 | | FS | 35 | 7.0 | 8.3 | 7.6 | 0 | 0 |

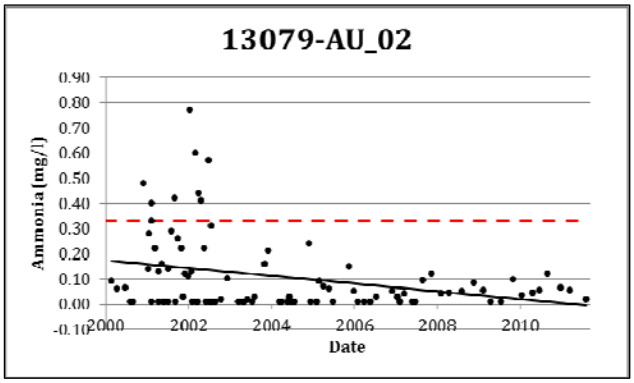



Statistical analysis indicates that there is an increasing trend in pH values in AU_04 with a **t-stat of 2.66** and a **p-value of 0.01.**

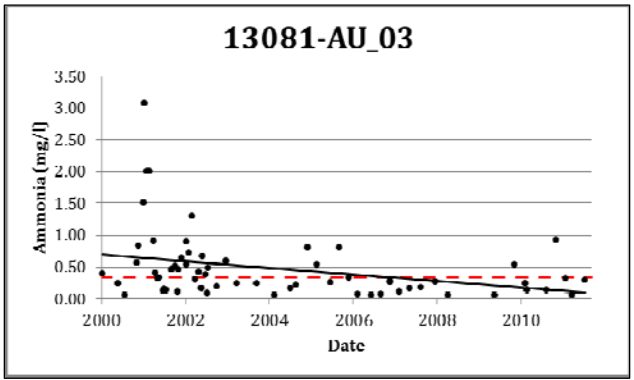
This could be because of the increased amount of wastewater being discharged as colonias are brought online.

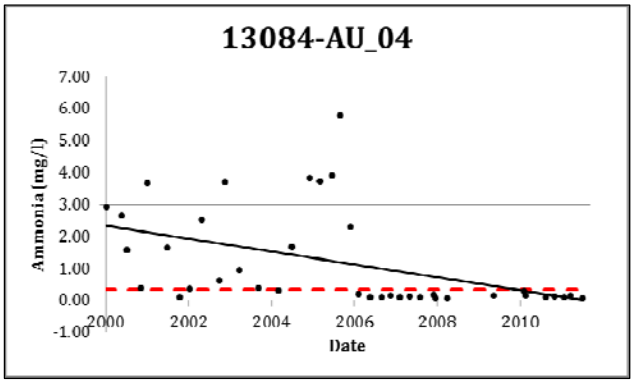
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 30 | <0.05 | 0.89 | 0.205 | 1 | 4 |
| AU-02 | | NC | 41 | <0.01 | 0.24 | 0.035 | 16 | 0 |
| AU-03 | | NC | 22 | <0.05 | 0.81 | 0.165 | 3 | 4 |
| AU-04 | | NC | 21 | 0.05 | 5.77 | 0.14 | 0 | 6 |



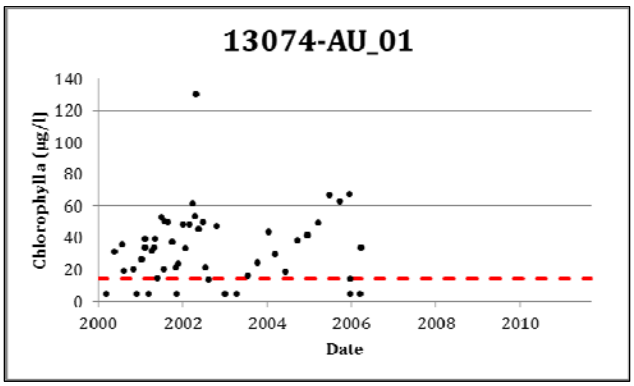



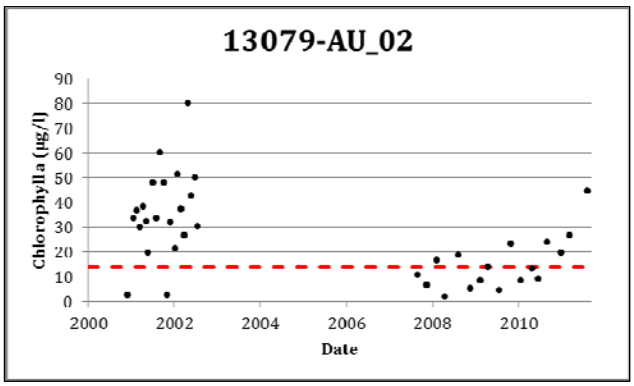

Statistical analysis indicates that there is a decreasing trend in ammonia values in AU_01 with a **t-stat of -4.11** and a **p-value of 0.04,** in AU_02 with a **t-stat of -3.25** and a **p-value of 0.00,** in AU_03 with a **t-stat of -2.70** and a **p-value of 0.01,** and in AU_04 with a **t-stat of -3.08** and a **p-value of 0.00.** Implementation of improvements to WWTFs, as outlined in the WPP, is likely a reason for the decrease in ammonia values.

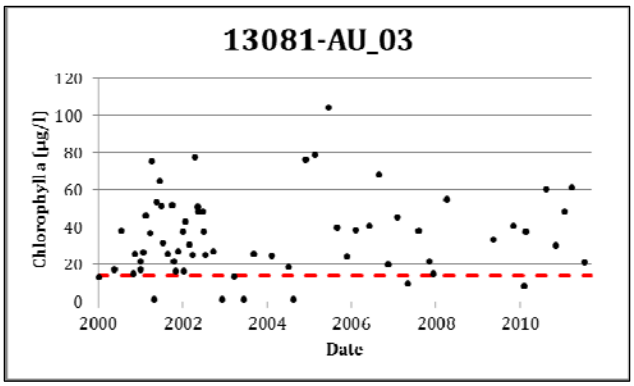


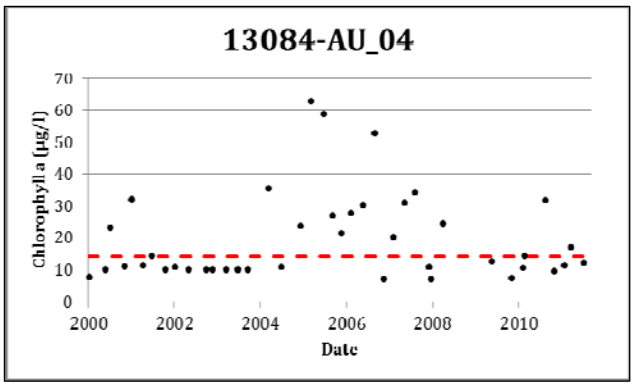



| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | CS | 13 | <5 | 67.6 | 38.7 | 2 | 10 |
| AU-02 | | CS | 13 | <2 | 23.4 | 9 | 1 | 3 |
| AU-03 | | CS | 23 | <1 | 104 | 37.9 | 1 | 20 |
| AU-04 | | CS | 22 | 6.96 | 62.8 | 23.95 | 0 | 15 |



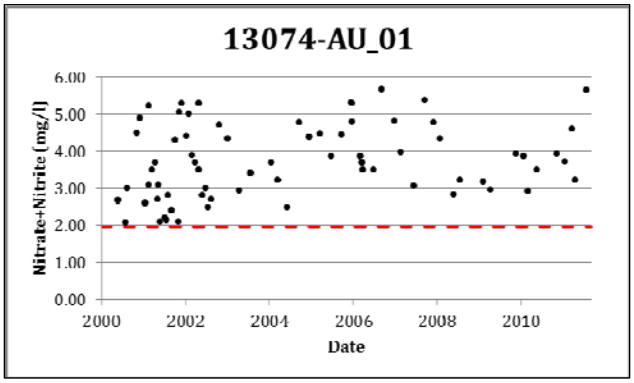



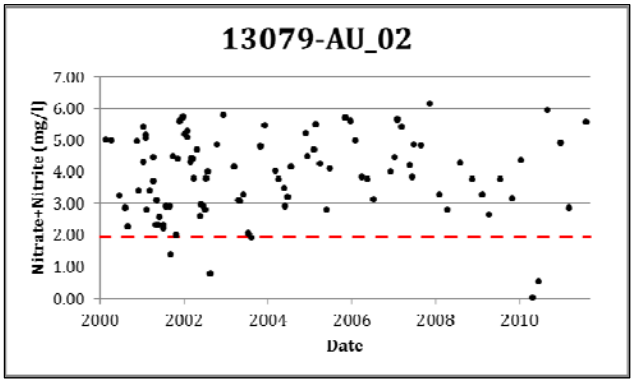



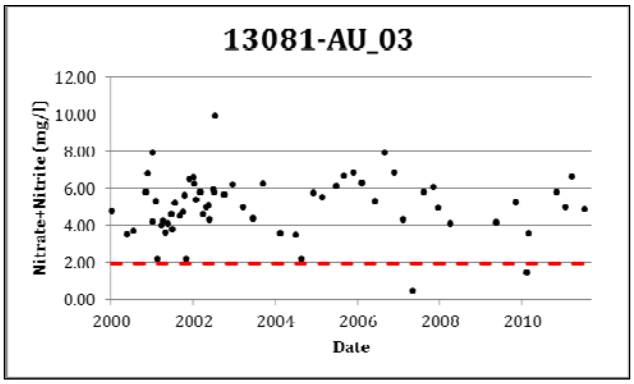



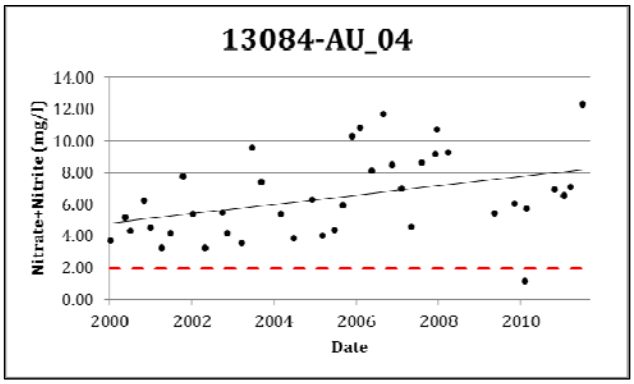

The high chlorophyll-*a* values are most likely related to the high nutrients in the stream as shown on the data plots for nitrates and total phosphorus on the following pages.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | CS | 30 | 2.5 | 5.66 | 3.875 | 0 | 30 |
| AU-02 | | CS | 41 | <0.02 | 6.14 | 4.1 | 1 | 39 |
| AU-03 | | CS | 22 | 0.46 | 7.93 | 5.26 | 0 | 20 |
| AU-04 | | CS | 21 | 1.13 | 11.7 | 6.26 | 0 | 20 |



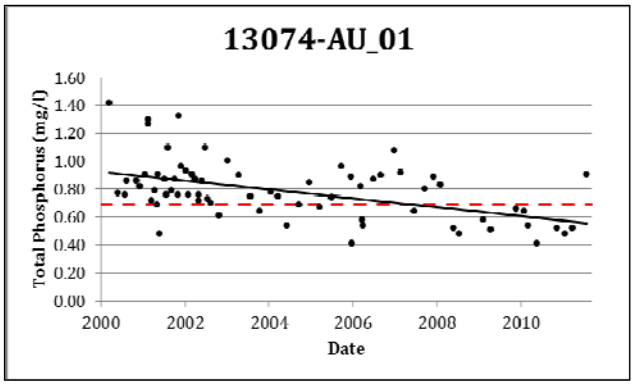



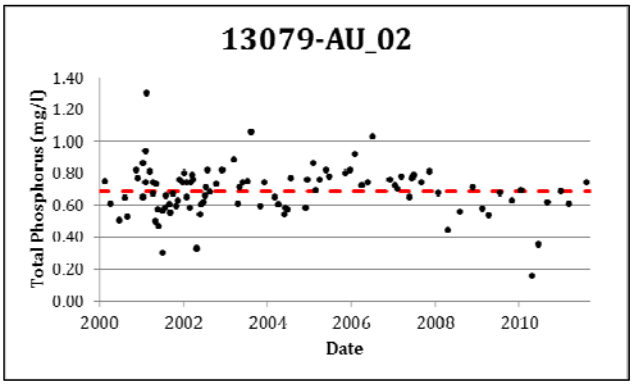



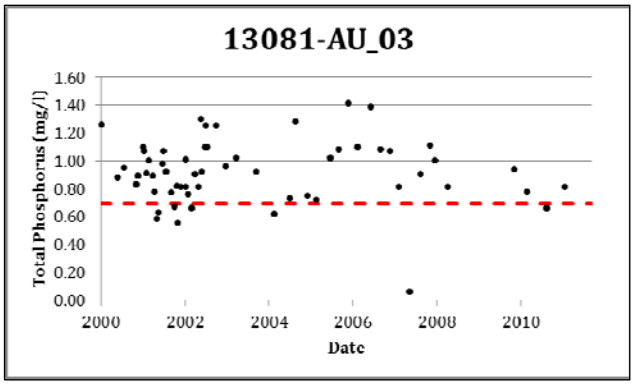



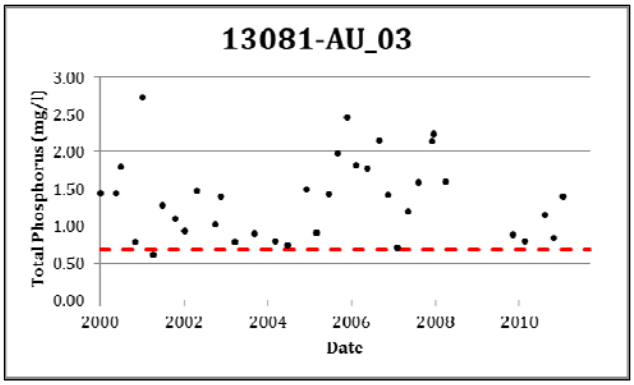

In addition to the concerns in all four AUs, statistical analysis indicates that there is an increasing trend in nitrate values in AU_04 with a **t-stat of 2.60** and a **p-value of 0.01.** The high levels are most likely related to the numerous WWTFs and agricultural runoff.

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | CS | 30 | 0.41 | 1.08 | 0.68 | 0 | 14 |
| AU-02 | | CS | 41 | 0.155 | 1.03 | 0.713 | 0 | 22 |
| AU-03 | | CS | 21 | <0.06 | 1.41 | 0.94 | 1 | 18 |
| AU-04 | | CS | 20 | 0.7 | 2.46 | 1.455 | 0 | 20 |



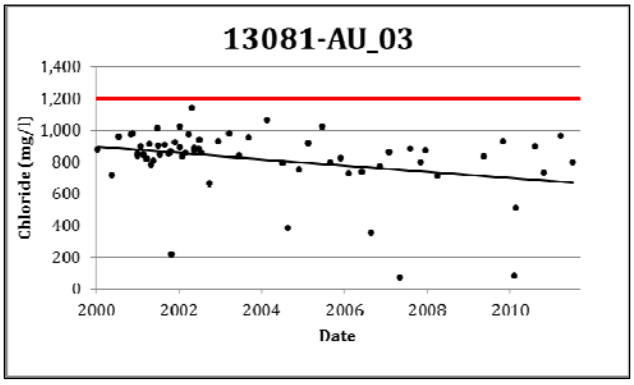



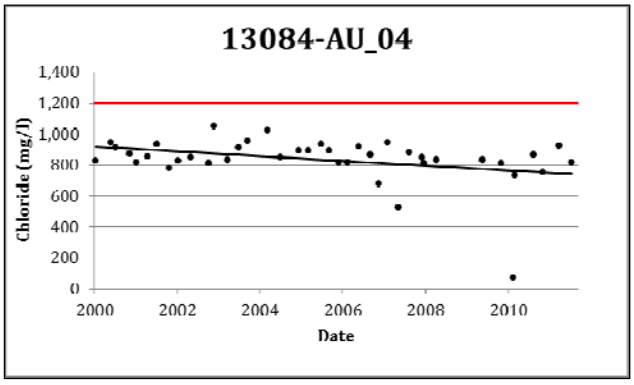




In addition to the concerns in all four AUs, statistical analysis indicates that there is a decreasing trend in total phosphorus values in AU_01 with a **t-stat of -2.85** and a **p-value of 0.01.** The high levels are most likely related to the numerous WWTFs and agricultural runoff. The decreasing trend may be due to WWTF improvements.

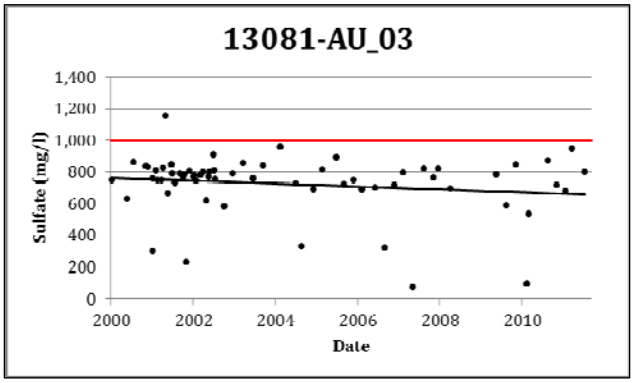
| Chloride | Status | # samples | Min | Max | Average | >1,200 |
|---|---|---|---|---|---|---|
| 1,200 mg/l | FS | 110 | 72.4 | 1060 | 748.51 | 0 |

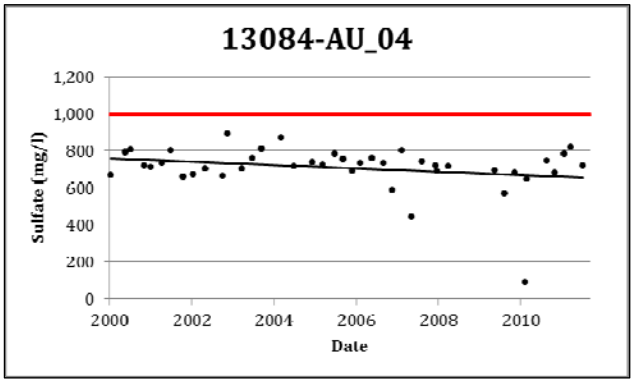



Statistical analysis indicates that there is a decreasing trend in chloride values in AU_03 with a **t-stat of -2.59** and a **p-value of 0.01** and in chloride values in AU_04 with a **t-stat of -2.21** and a **p-value of 0.01.** The decreasing trends may be due to WWTF improvements.

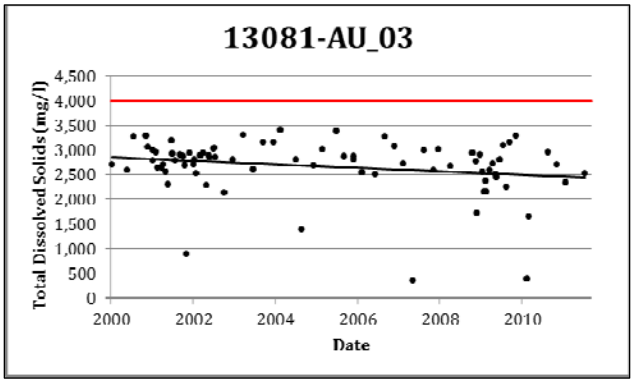
| Sulfate | Status | # samples | Min | Max | Average | >1,000 |
|---|---|---|---|---|---|---|
| 1,000 mg/l | FS | 111 | 75 | 953 | 702.39 | 0 |




Statistical analysis indicates that there is a decreasing trend in sulfate values in AU_03 with a **t-stat of -2.42** and a **p-value of 0.02** and in AU_04 with a **t-stat of -2.75** and a **p-value of 0.01.** The decreasing trends may be due to WWTF improvements.

| TDS | Status | # samples | Min | Max | Average | >4,000 |
|---|---|---|---|---|---|---|
| 4,000 mg/l | FS | 142 | 348 | 5680 | 2620 | 2 |




Statistical analysis indicates that there is a decreasing trend in TDS values in AU_03 with a **t-stat of -2.08** and a **p-value of 0.03.** The decreasing trend may be due to WWTF improvements.

## Fish Consumption Use

The entire segment is non-supporting for Dichlorodiphenylethylene, mercury, and PCBs in edible fish tissue, but fully supporting for bioaccumulation of toxics in water for fish consumption use.

# DONNA RESERVOIR– SEGMENT 2202A

The segment is an off-channel irrigation reservoir filled with water pumped from the Rio Grande near the City of Donna in Hidalgo County.

## Water Quality Analysis

The analysis for this segment is based on the combined data from **Station 17416**, located near the northeast corner of the reservoir, **Station 18486,** located in the Donna Irrigation Canal south of US 281**, Station 18487,** located in the Donna Irrigation Canal downstream of the syphon outlet**, Station 18488,** located in the Donna Irrigation Canal north of the syphon outlet, and **Station 18490**, located mid-reservoir. One DO measurement was taken at each site in December 2005 – January 2006. There are no routine monitoring sites on this segment.

## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | NC | 5 | 7.5 | 11.2 | 10.6 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |

## Fish Consumption Use Assessment

The segment has been impaired for PCBs in edible fish tissue since the 1996 Assessment. A TMDL was conducted and an I-Plan was approved in 2001. This pollutant is considered a background source that reflects the site-specific application histories and loss rates. Any continuing source of pollutant loadings occur from nonpoint source runoff, leaching, or erosion of sinks that may exist within the watershed. Residual PCB contamination from a site near the Donna Canal is likely to remain a continuing source until site investigation and remediation is completed. No authorized point source discharges of this pollutant are allowed by law. The I-Plan is available at www.tceq.texas.gov/waterquality/tmdl/07-arroyoleg.html.

# UNNAMED DRAINAGE DITCH TRIBUTARY TO ARROYO COLORADO – SEGMENT 2202B

The approximate half-mile segment is within Cameron County and drains into the Arroyo Colorado in Harlingen.

## Special Studies

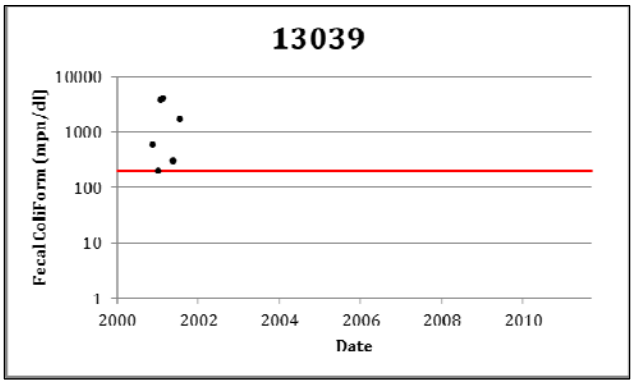
The Unnamed Drainage Ditch is included in the Arroyo Colorado WPP as described in the Nueces – Rio Grande Coastal Basin write-up on Page 110.

## Water Quality Analysis

The analysis for this segment is based from **Station 13039**, located at Rangerville Road. Data for the three parameters detailed below were collected in 2000-2002. The studies targeted runoff events from agricultural fields. Additional ammonia data were collected in 2009-2011, but the large data gap prohibits reliable trend analysis. These data were collected to support the Arroyo Colorado TMDL and WPP process. There are no routine monitoring sites on this segment.

### Recreation Use

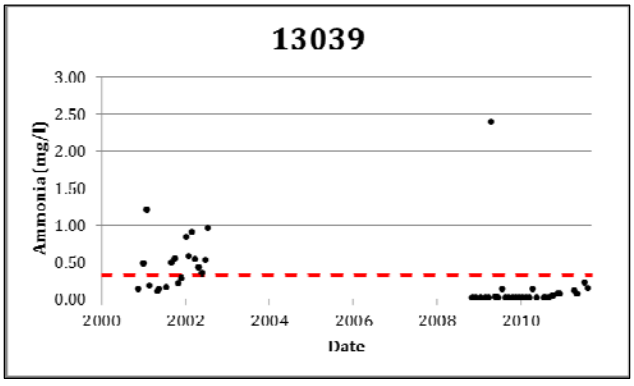
| Fecal Coliform | Status | # samples | Min | Max | Geomean | ND | >400 |
|---|---|---|---|---|---|---|---|
| Geomean 200 cfu | CS | 6 | 200 | 4,000 | 988 | 0 | 4 |




The bacteria concern is carried forward based on the 2000-2002 data. No *E. coli* data have been collected to confirm or remove this concern. A possible source includes contributions from wildlife that frequent the agriculture fields.

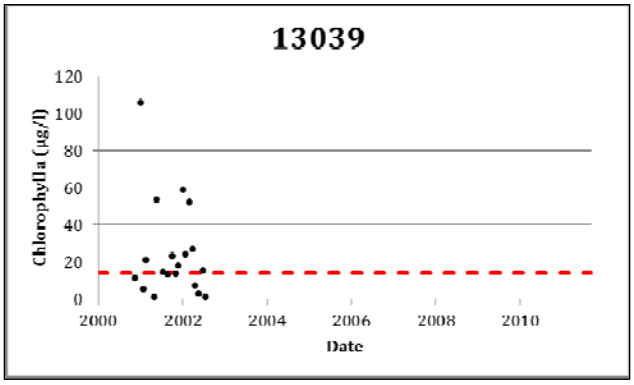
### General Use

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|
| 0.33 mg/l | **CS** | **21** | **0.01** | **2.39** | **0.01** | **0** | **1** |




The data within the assessment period do not support the concern status, however, since there is such a large data gap, the ammonia concern is carried forward based on the 2000-2002 data. The lower, more recent values may be the result of the implementation of better agricultural practices.

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|
| 14.1 µg/l | **CS** | **19** | **<1** | **106** | **15.1** | **2** | **11** |




The chlorophyll-*a* concern is carried forward based on the 2000-2002 data. No additional data have been collected to confirm or remove this concern. The values are most likely related to the crops on the fields.

# UNNAMED DRAINAGE DITCH TRIBUTARY TO ARROYO COLORADO – SEGMENT 2202C

The segment is within Hidalgo County and extends from the confluence with the Arroyo Colorado southeast of Donna to a point 1.8 km upstream of US 281.

## Special Studies

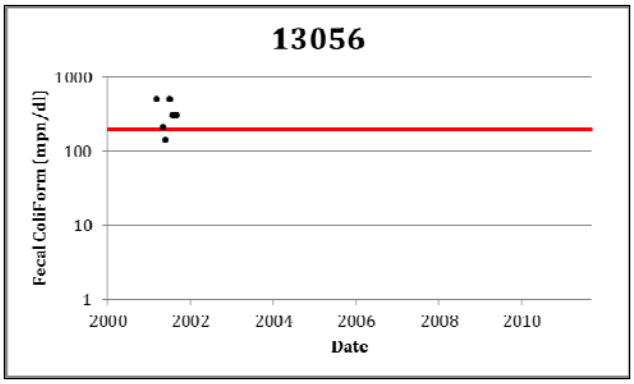
The Unnamed Drainage Ditch is included in the Arroyo Colorado TMDL as described in the Nueces – Rio Grande Coastal Basin write-up on Page 110.

## Water Quality Analysis

The analysis for this segment is based from **Station 13056**, located at Gate 12 south of US 281 collected in 2001-2002 to support the Arroyo Colorado TMDL process. The studies targeted runoff events from agricultural fields. There are no routine monitoring sites on this segment.

### Recreation Use

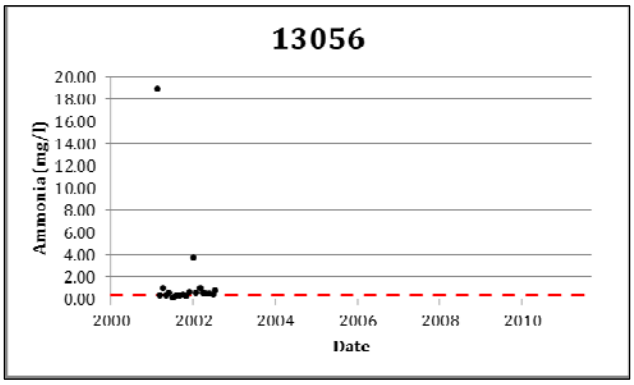
| Fecal Coliform | Status | # samples | Min | Max | Geomean | ND | >400 |
|---|---|---|---|---|---|---|---|
| Geomean 200 cfu | **CS** | **6** | **140** | **500** | **295** | **0** | **2** |




The bacteria concern is carried forward based on the 2001-2002 data. No *E. coli* data have been collected to confirm or remove this concern. A possible source includes contributions from wildlife that frequent the agriculture fields.

### General Use

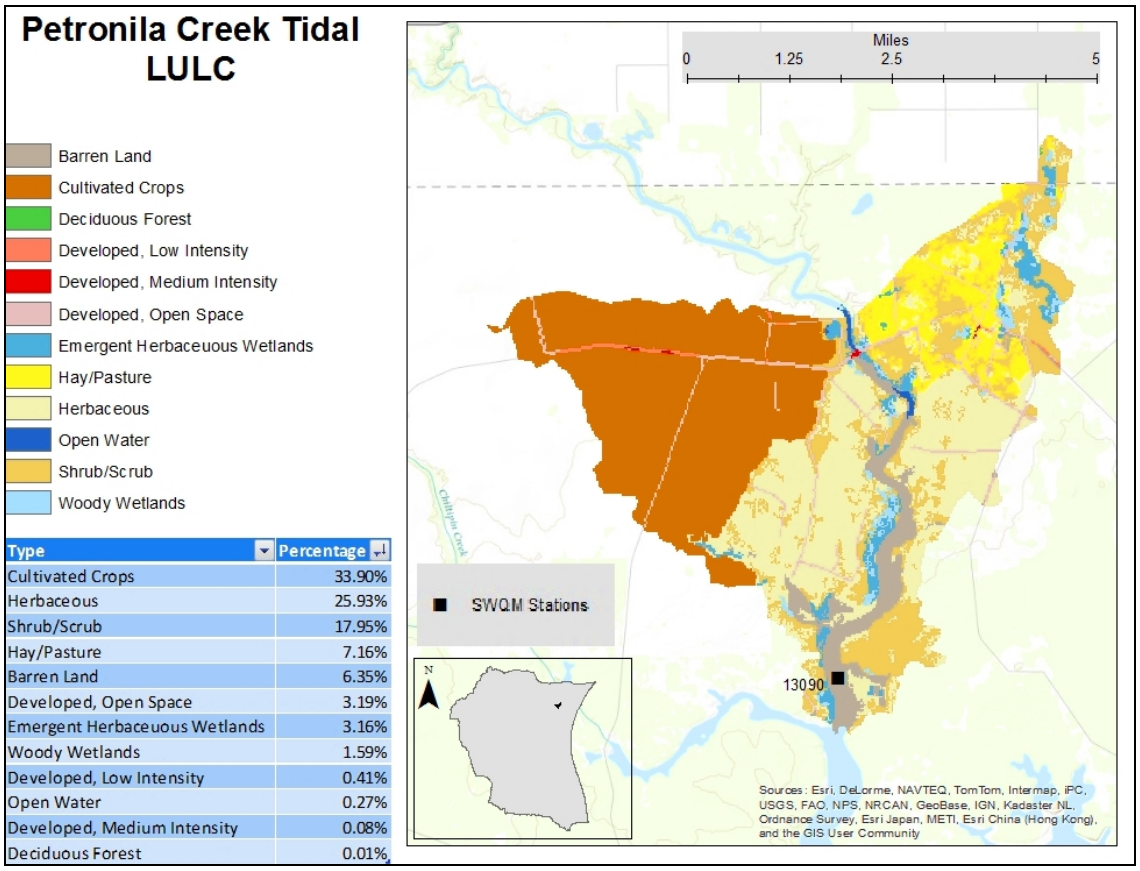
| Ammonia | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|
| 0.33 mg/l | **CS** | **19** | **0.12** | **18.9** | **0.44** | **0** | **14** |




The ammonia concern is carried forward based on the 2001-2002 data. No additional data have been collected to confirm or remove this concern. Additional data need to be collected to see if implementation of better agricultural practices has reduced the ammonia runoff.

# PETRONILA CREEK TIDAL WATERSHED – SEGMENT 2203

The 14 mile segment is within the King Ranch in Kleberg County and extends from the confluence with Chiltipin Creek a point 0.6 miles upstream of a private road crossing near the Laureles Ranch Division and is a single AU.




| Type | Percentage |
|---|---|
| Cultivated Crops | 33.90% |
| Herbaceous | 25.93% |
| Shrub/Scrub | 17.95% |
| Hay/Pasture | 7.16% |
| Barren Land | 6.35% |
| Developed, Open Space | 3.19% |
| Emergent Herbaceuous Wetlands | 3.16% |
| Woody Wetlands | 1.59% |
| Developed, Low Intensity | 0.41% |
| Open Water | 0.27% |
| Developed, Medium Intensity | 0.08% |
| Deciduous Forest | 0.01% |

| | |
|---|---|
| **Drainage area** | 10,918 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | None |
| **Counties** | Kleberg, Nueces |
| **EcoRegions** | Laguna Madre Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Praries |
| **Climate Annual Averages** | Rain: 31"; Low: 61° F - 64° F; High: 80° F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | None |

## Water Quality Analysis

The analysis for AU_01 is based on data from **Station 13090**, located upstream of the confluence with Tunas Creek. Trend analysis was conducted on data from April 2000 through October 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There is a **bacteria impairment** and a **chlorophyll-*a* concern** for this segment.

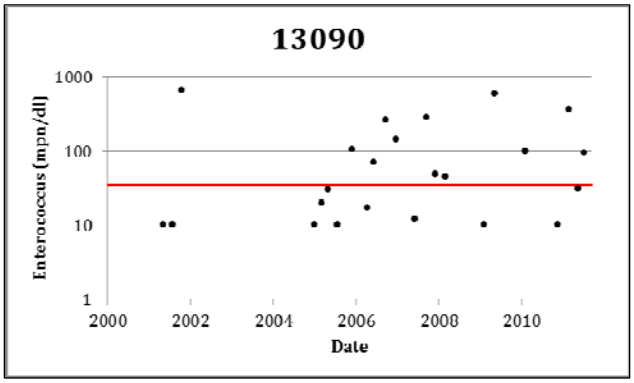
The watershed for this segment, which is located almost completely within the King Ranch, is primarily brush and pasture immediately adjacent to the creek, with crops in the west. There are no communities within this watershed.

## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 24 | 2.3 | 14.3 | 9.3 | 1 | 1 |
| Screening Level 5.0 mg/l | NC | | | | | | |

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | **NS** | **16** | **<10** | **600** | **49.55** | **2** | **6** |




Possible sources for bacteria at this location include livestock and wildlife.

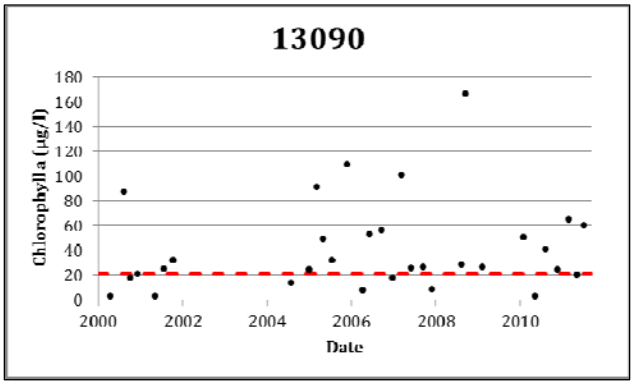
## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 24 | 11.8 | 34.8 | 27.8 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 24 | 7.0 | 9.7 | 8.3 | 0 | 3 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 22 | <0.05 | 2.81 | 0.05 | 18 | 1 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >21 |
|---|---|---|---|---|---|---|---|
| 21 µg/l | **CS** | **20** | **<3** | **166** | **29.7** | **1** | **15** |



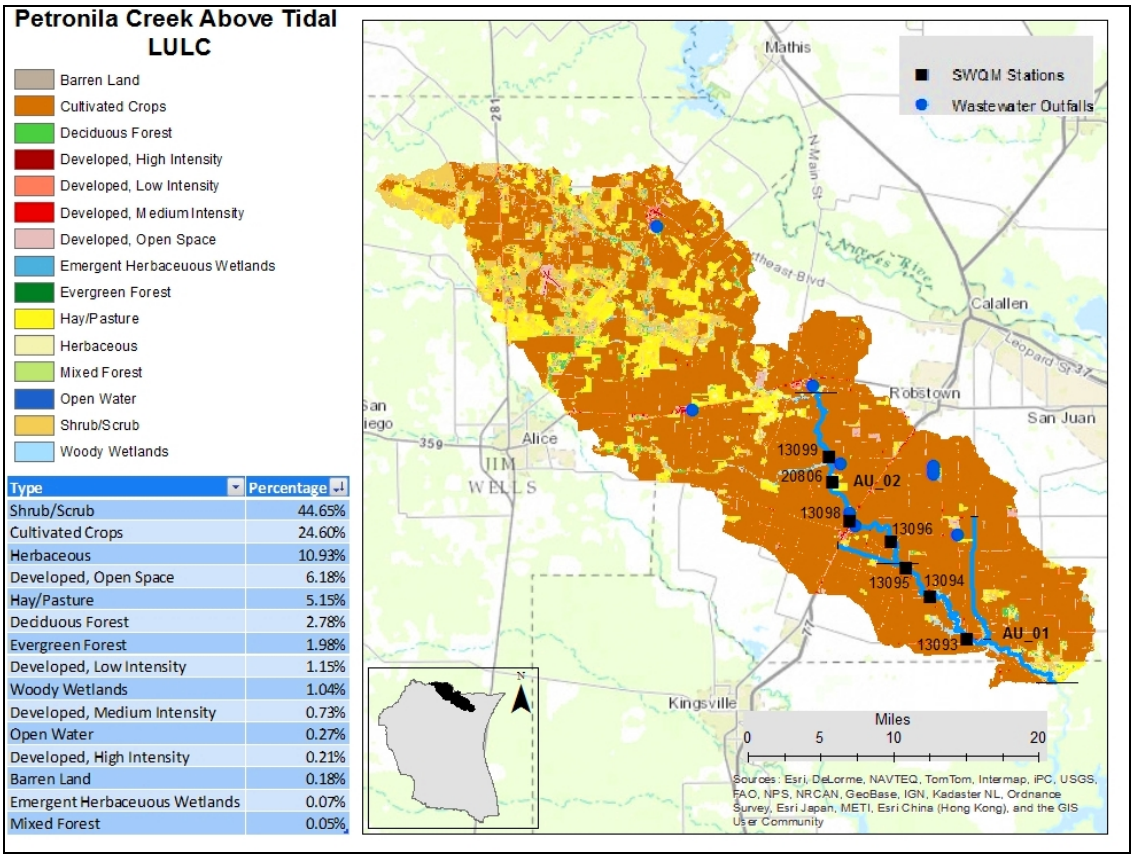

The high chlorophyll-*a* values could be related to agricultural runoff.

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | NC | 23 | <0.04 | 0.29 | 0.04 | 19 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | NC | 21 | 0.07 | 0.51 | 0.2 | 0 | 0 |

# PETRONILA CREEK ABOVE TIDAL WATERSHED – SEGMENT 2204

The 35 mile segment extends from a point 0.6 miles upstream of a private road crossing near the Laureles Ranch Division in Kleberg County to the confluence of Agua Dulce and Banquete Creeks in Nueces County and is divided into two AUs.




| | |
|---|---|
| **Drainage area** | 1,867,755 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Petronila, Bishop, Robstown, Driscoll, Rancho Banquete, Tierra Grande, Chapman Ranch, Agua Dulce, Alfred, Orange Grove |
| **Counties** | Jim Wells, Nueces, Kleberg |
| **EcoRegions** | Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 31"; Low: 61° F - 63° F; High: 81°F - 82° F |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0002888-000 – US Ecology Texas: storm water via Nueces County drainage ditch<br>WQ0010140-001 – City of Agua Dulce: 160,000 gpd via Agua Dulce Creek<br>WQ0010592-001 – City of Orange Grove: 200,000 gpd via Agua Dulce Creek<br>WQ0011541-001 – City of Driscoll: 100,000 gpd<br>WQ0011583-001 – Nueces County WCID #5: 100,000 gpd via Banquete Creek<br>WQ0011689-001 – Coastal Bend Youth City: 15,000 gpd via drainage ditch<br>WQ0011754-001 – Bishop Consolidated ISD: 8,000 gpd via drainage ditch<br>WQ0014802-001 – LCS Corrections Services, Inc.: 150,000 gpd via drainage ditch<br>WQ0014981-001 – Teen Challenge of Texas: 15,000 gpd |

## Special Studies

Petronila Creek was the subject of a TMDL and the accompanying I-Plan is currently under review as described in the Nueces – Rio Grande Coastal Basin write up as described on Page 111.

## Water Quality Analysis

**AU_01** is the reach from the downstream end of the segment to the confluence with 2204A, an unnamed drainage ditch tributary at N-97.7, W27.65. **AU_02** is the reach from the upstream end of AU_01 to the upstream end of the segment at the confluence of Agua Dulce and Banquete Creeks.



The analysis for AU_01 is based on data from **Station 13094**, located at FM 892. Trend analysis was conducted on data from January 2000 through December 2011. NRA is responsible for routine quarterly monitoring at this site.

The analysis for AU_02 is based on data from **Station 13096**, located at FM 665 east of Driscoll. There is insufficient data for trend analysis. NRA is responsible for routine quarterly monitoring at this site.

A **chlorophyll-*a* concern** and **chloride, sulfate**, and **TDS impairments** exist for the entire segment.

The land use within the watershed is primarily croplands which surround the numerous small towns and communities within.

### Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 3.0 mg/l | FS | 40 | 3.8 | 15.4 | 8.4 | 0 | 1 |
| | Screening Level 4.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 3.0 mg/l | FS | 33 | 2.8 | 22.8 | 10.2 | 1 | 2 |
| | Screening Level 4.0 mg/l | NC | | | | | | |

### Recreation Use

| *E. coli* | | Status | # samples | Min | Max | Geomean | ND | >394 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean | FS | 11 | <1 | >2,400 | 90.42 | 1 | 4 |
| AU-02 | 126 cfu/100 ml | FS | 10 | <1 | 6,000 | 115.76 | 2 | 6 |

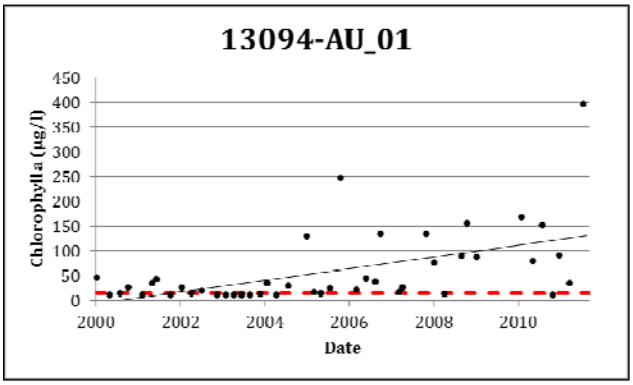
### General Use

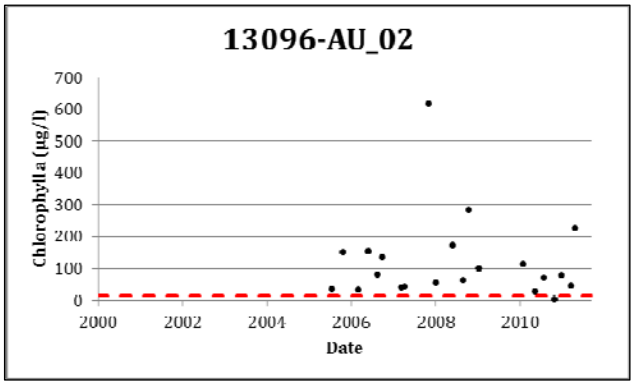
| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU-01 | 35 °C | FS | 40 | 10.2 | 32.0 | 22.7 | 0 |
| AU-02 | | FS | 33 | 9.7 | 34.3 | 24.9 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 40 | 6.6 | 8.3 | 7.6 | 0 | 0 |
| AU-02 | | FS | 33 | 7.1 | 10.2 | 7.8 | 0 | 1 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.33 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.33 mg/l | NC | 26 | <0.02 | 0.17 | 0.05 | 20 | 0 |
| AU-02 | | NC | 19 | <0.02 | 0.1 | 0.02 | 13 | 0 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >14.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 14.1 µg/l | **CS** | **24** | **<10** | **247** | **40.35** | **1** | **20** |
| AU-02 | | **CS** | **17** | **27.2** | **618** | **80.4** | **0** | **17** |



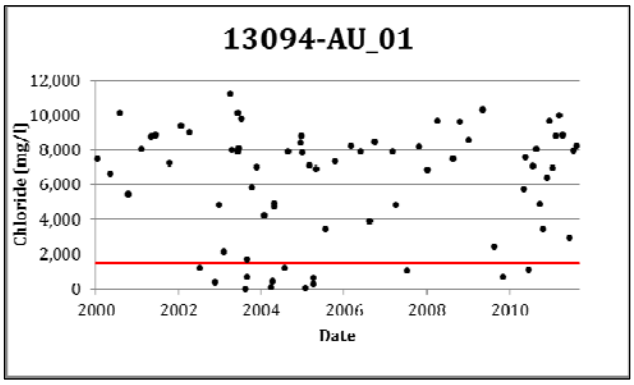



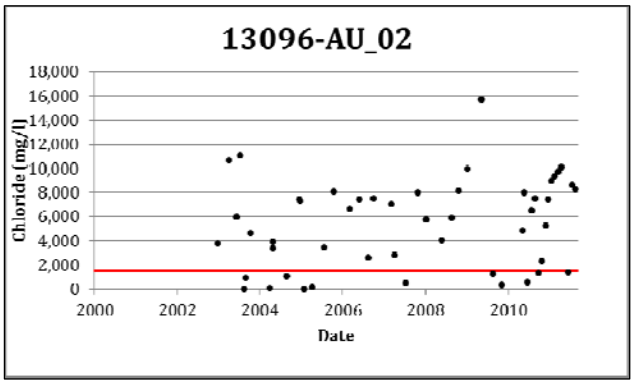

In addition to concerns in both AUs, statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values in AU_01 with a **t-stat of 4.01** and a **p-value of 0.00.** The high values may be related to the lack of rain and therefore lack of dilution of concentrations in the creek.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >1.95 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 1.95 mg/l | NC | 27 | <0.04 | 1.27 | 0.05 | 12 | 0 |
| AU-02 | | NC | 20 | <0.04 | 1.75 | 0.225 | 8 | 0 |

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.69 mg/l | NC | 25 | <0.05 | 0.55 | 0.09 | 7 | 0 |
| AU-02 | | NC | 19 | <0.06 | 0.53 | 0.18 | 1 | 0 |

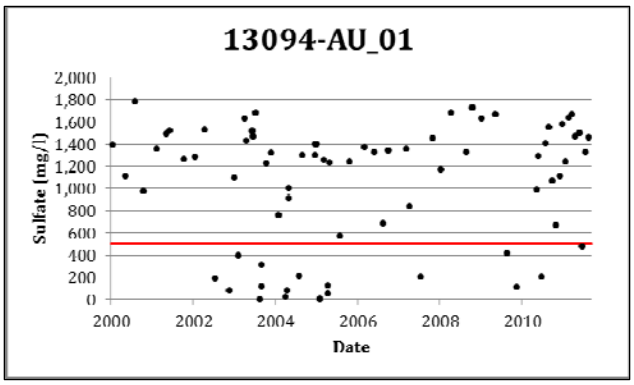
| Chloride | Status | # samples | Min | Max | Average | >1,200 |
|---|---|---|---|---|---|---|
| 1,200 mg/l | **NS** | **71** | **8** | **15,700** | **5,012** | **52** |

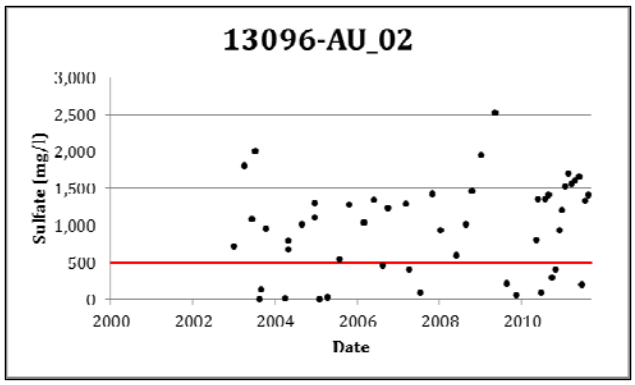



A TMDL and I-Plan for chloride, sulfate, and TDS were completed in 2005. The cause of the impairments for these parameters is attributed to historic oil and gas practices of discharging the produced waters into open pits and into the creek. The RRC ended the open pit practice in 1969, but it may not have been enforced until 1987 when discharges into the creek were prohibited. Even though these values are extremely high, they are lower than when the pit and discharge practices were occurring. Implementation of the I-Plan is proceeding, but it will probably take several years before significant improvements in the water quality are observed.

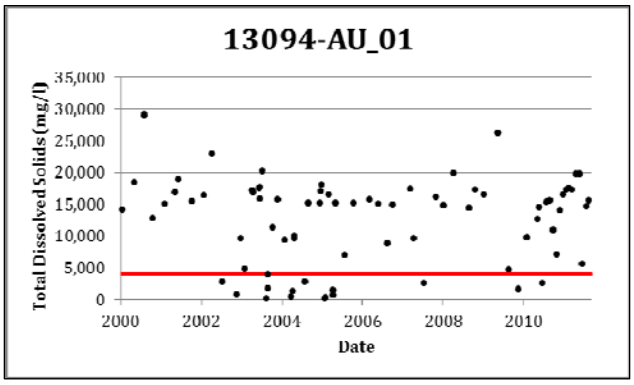
| Sulfate | Status | # samples | Min | Max | Average | >1,000 |
|---|---|---|---|---|---|---|
| 1,000 mg/l | NS | 71 | 3 | 2,520 | 884 | 36 |

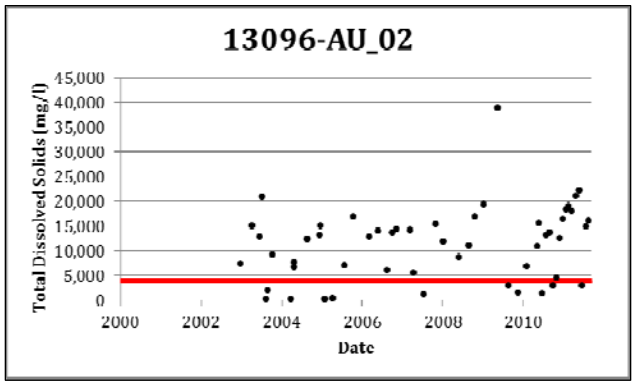



The source of the sulfate is the same as for chloride discussed above.

| TDS | Status | # samples | Min | Max | Average | >4,000 |
|---|---|---|---|---|---|---|
| 4,000 mg/l | NS | 74 | 130 | 38,800 | 10,512 | 55 |




In addition to the impairment, statistical analysis indicates that there is an increasing trend in TDS values in AU_02 with a **t-stat of 2.19** and a **p-value of 0.03.** The source of the TDS is the same as for chloride discussed above.

# WATERSHED SUMMARIES OF THE BAYS AND ESTUARIES

The characteristics of the bays and estuaries along the south Texas coast vary greatly. The systems in the north receive more freshwater inflows than those in the south. The Laguna Madre (Segment 2491) extends from Corpus Christi Bay (Segment 2481) south to Port Isabel, and is one of the few hypersaline systems in the world.

## Nueces Bay - Senate Bill (SB) 3

SB 3 of the 80th Texas Legislature established a process for the development and implementation of environmental flow standards applicable to major river basins and estuarine systems across the State of Texas. The Environmental Flows Recommendations Report for the Nueces River and Corpus Christi and Baffin Bays Basin and Bay Area was submitted to the TCEQ in October 2011. This report concluded that the Nueces Bay and Delta region is an unsound ecological environment. This conclusion was based on the substantial alterations in freshwater reaching the bay and delta which have led to a failure to sustain a healthy complement of native species and its associated beneficial physical processes. The full report is available at www.tceq.state.tx.us/assets/public/permitting/watersupply/water_rights/eflows/20111028nuecesbbest_recommendations.pdf.

The recommended inflow attainment frequencies needed to restore the bay and delta to pre-Choke Canyon Reservoir conditions could not happen without removing the Coastal Bend's primary water supply as described in the Lower Nueces River WPP write up on Page 26. Therefore, the goal of the Nueces River and Corpus Christi and Baffin Bays Basin and Bay Stakeholder Committee is to return the bay and delta to ecological conditions existing prior to the construction of Choke Canyon Reservoir, to the extent possible, while preserving existing water rights and yield of the system.

## Oso Bay and Oso Creek TMDL

Oso Bay (Segment 2485) is an enclosed, shallow body of water situated along the southern shore of Corpus Christi Bay, with a surface area of approximately seven square miles. The bay exchanges saltwater with Corpus Christi Bay (Segment 2481) and receives fresh water from Oso Creek (Segment 2485A), a stream whose flow is effluent dominated. Water quality testing found that concentrations of bacteria are elevated in both the bay and the creek, which may pose a risk to people who swim or wade in them. In 2006, the TCEQ separated development of the TMDLs for the bay and the creek, with the advice and consent of the stakeholder advisory group. The TMDLs are being drafted and processed as separate, but related documents. The TCEQ adopted the Oso Bay TMDL on August 22, 2007 and the EPA approved it in June 2008. The TSSWCB is conducting additional studies of bacteria sources and quantities in the Oso Creek watershed. TMDL development for the creek will proceed when those studies have provided sufficient information. The TCEQ contracted with TAMUCC to collect fecal coliform and Enterococcus samples from the bay. TMDL development for the creek will proceed, in coordination with the TSSWCB, as these studies provide sufficient information.

## Oso Bay and Laguna Madre TMDL

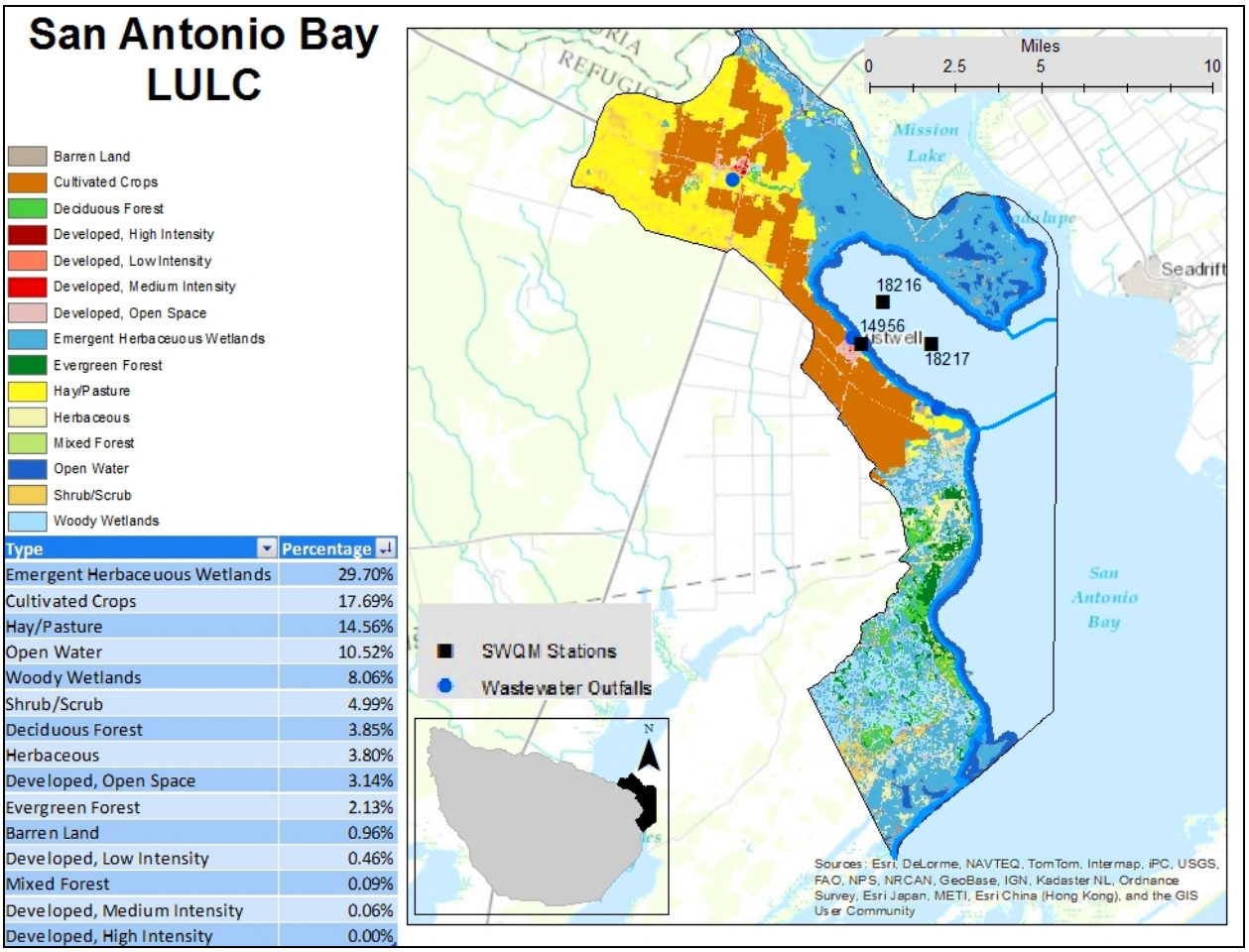
Oso Bay (Segment 2485) is an enclosed, shallow body of water situated along the southern shore of Corpus Christi Bay (Segment 2481), with a surface area of approximately seven square miles. The Laguna Madre (Segment 2491) is one of only five hypersaline estuaries in the world. The Laguna Madre is a shallow, bar-built coastal lagoon with limited freshwater inflow. The state of Texas requires that the water quality in Oso Bay and Laguna Madre be suitable for swimming, wading, fishing, a healthy aquatic ecosystem, and for growing and harvesting clams, mussels, or oysters. However, water quality testing found that DO levels are sometimes lower than the standard established to assure a healthy aquatic ecosystem. Beginning in 2001, the TMDL team conducted a project to survey DO concentrations in the two water bodies. The results indicate that low DO levels continue to exist, but are likely due to natural conditions, and the 24-Hr minimum DO criteria for these two water bodies was reduce to 2.0 mg/l.

## Baffin Bay Group

Researchers, federal and state agencies, commercial fisherman, recreational fisherman, hotel and bed and breakfast owners, citizens living on Baffin Bay, ranchers, business owners, and other interested stakeholders have formed the Baffin Bay Group to identify the issues in Baffin Bay (Segment 2482), characterize problems, and develop solutions. For more information, visit www.cbbep.org/projectsbaffinbay.html.

## SAN ANTONIO BAY / HYNES BAY WATERSHED– SEGMENT 2462

The 83,976 acre segment is primarily in Refugio and Calhoun Counties and includes Guadalupe Bay and is a single AU. The official boundary for the San Antonio – Nueces Coastal Basin includes all of Hynes Bay and only a portion of San Antonio Bay.




| Type | Percentage |
|---|---|
| Emergent Herbaceuous Wetlands | 29.70% |
| Cultivated Crops | 17.69% |
| Hay/Pasture | 14.56% |
| Open Water | 10.52% |
| Woody Wetlands | 8.06% |
| Shrub/Scrub | 4.99% |
| Deciduous Forest | 3.85% |
| Herbaceous | 3.80% |
| Developed, Open Space | 3.14% |
| Evergreen Forest | 2.13% |
| Barren Land | 0.96% |
| Developed, Low Intensity | 0.46% |
| Mixed Forest | 0.09% |
| Developed, Medium Intensity | 0.06% |
| Developed, High Intensity | 0.00% |

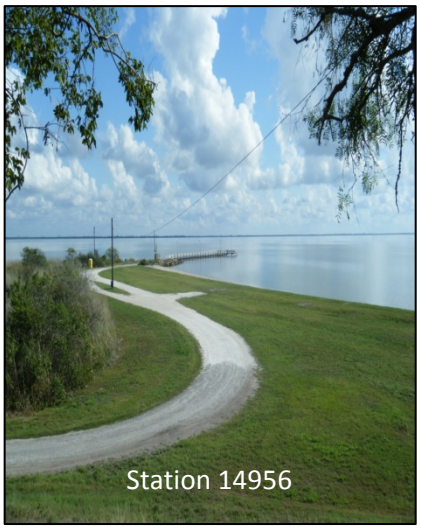
| | |
|---|---|
| **Drainage area** | 69,939 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Austwell |
| **Counties** | Aransas, Refugio |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 41"; Low: 62° F - 63° F; High: 78°F - 80° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters |
| **Permitted WWTFs** | WQ0003995-000 – Austwell Aqua Farm, Inc. : 3,700.000 gpd<br>WQ0004917-000 – Aransas National Wildlife Refuge: 937 gpd via subsurface application<br>WQ0010256-001 – Refugio WCID No. 1: 75,000 gpd<br>WQ0011117-001 – City of Austwell: 60,000 gpd |

## Water Quality Analysis

The analysis for this segment is based on data from **Station 14956**, located at the TPWD boat ramp in Austwell. Data from additional stations were used for the 2012 IR. In some cases, the analysis for Station 14956 alone could result in a concern, but the additional values reduced the percent of exceedances and therefore did not identify a concern. Trend analysis was conducted on data from January 2000 through September 2011. NRA is responsible for routine quarterly monitoring at this site.

There is a **chlorophyll-*a* concern** for this segment.

The watershed around the bay is primarily wetlands, with croplands in the north and west areas, especially around Tivoli and Austwell.




### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 28 | 4.6 | 11.5 | 7.0 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |

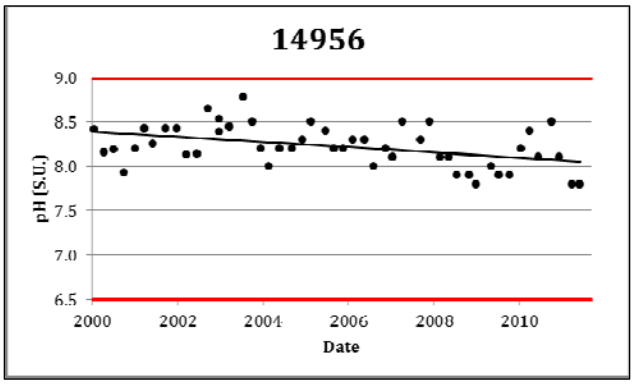
### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 27 | <1 | 980 | 10.09 | 3 | 4 |

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 28 | 7.2 | 30.3 | 22.2 | 0 |

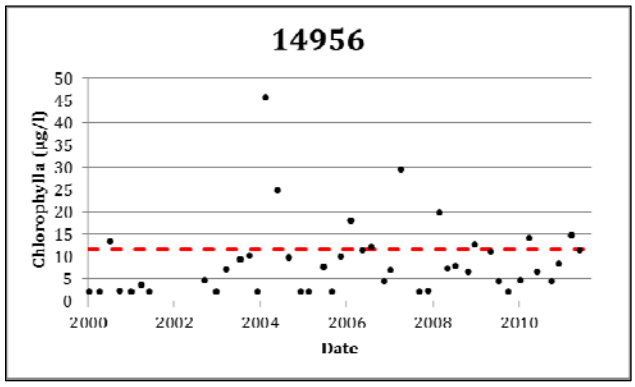
| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 28 | 7.8 | 8.5 | 8.2 | 0 | 0 |




Statistical analysis indicates that there is a decreasing trend in pH values with a **t-stat of -3.21** and a **p-value of 0.00.** The values are well within the pH range, and not a concern.

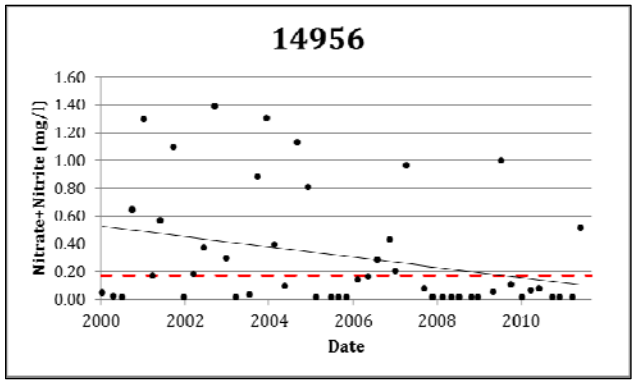
| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 28 | <0.02 | 0.3 | 0.032 | 8 | 7 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | **CS** | **28** | **<2** | **45.6** | **7.5** | **6** | **8** |



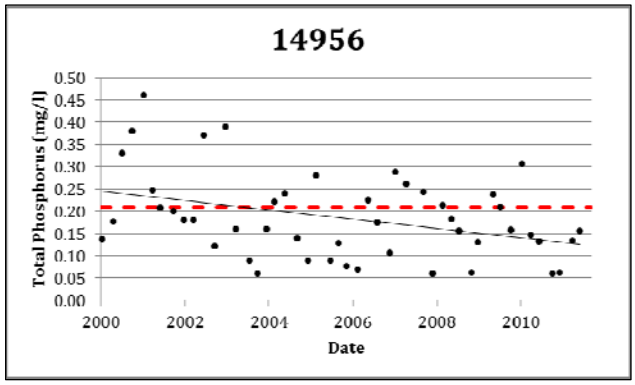

The elevated chlorophyll-*a* values may be related to the high nitrate levels possibly associated with agricultural runoff and WWTF discharges.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 28 | <0.02 | 1.3 | 0.08 | 11 | 10 |




Statistical analysis indicates that there is a decreasing trend in nitrate values with a **t-stat of -2.11** and a **p-value of 0.04.** The Austwell Aqua Farm may have reduced or suspended their production even though the WWTF permit is still active. This could be the reason the nitrates are decreasing.

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 28 | <0.06 | 0.306 | 0.158 | 1 | 10 |



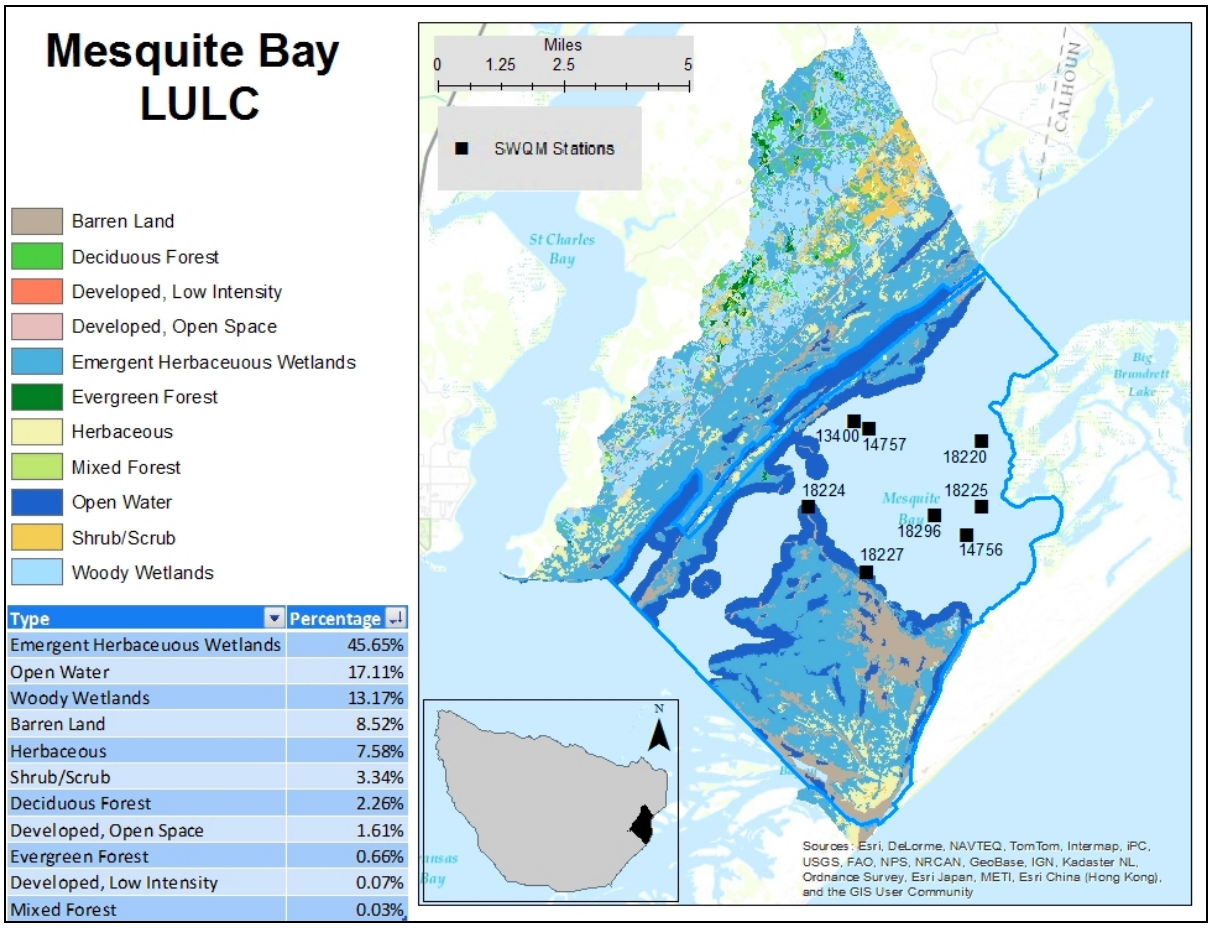

Statistical analysis indicates that there is a decreasing trend in total phosphorus values with a **t-stat of -2.14** and a **p-value of 0.04.** The explanation for this decrease is the same as the above for nitrates.

## Oyster Waters Use

The Department of State Health Services (DSHS) has listed Hynes Bay and the remainder of San Antonio Bay within the San Antonio – Nueces Coastal Basin as fully supporting for oyster waters use.

# MESQUITE BAY WATERSHED – SEGMENT 2463

This 25,372 acre segment is in Aransas County and is a single AU.




| Type | Percentage |
|---|---|
| Emergent Herbaceuous Wetlands | 45.65% |
| Open Water | 17.11% |
| Woody Wetlands | 13.17% |
| Barren Land | 8.52% |
| Herbaceous | 7.58% |
| Shrub/Scrub | 3.34% |
| Deciduous Forest | 2.26% |
| Developed, Open Space | 1.61% |
| Evergreen Forest | 0.66% |
| Developed, Low Intensity | 0.07% |
| Mixed Forest | 0.03% |

| | |
|---|---|
| **Drainage area** | 37,323 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | None |
| **Counties** | Aransas |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes |
| **Climate Annual Averages** | Rain: 37” - 39”; Low: 63° F - 64° F; High: 78°F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters |
| **Permitted WWTFs** | None |

## Water Quality Analysis

The analysis for this segment is based on data from **Station 13400**, located south of Intracoastal Waterway (ICWW) Marker 13. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

All water quality standards are being met in this segment. The watershed around the bay is primarily wetlands and open water. A large portion of the Aransas Wildlife Refuge lies within the watershed, but no communities.

## Aquatic Life Use Assessment

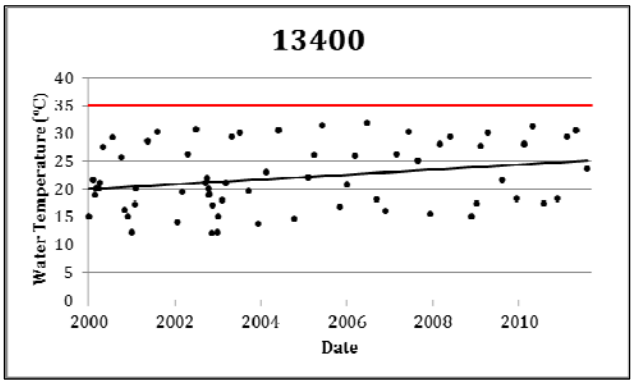
| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 28 | 4.4 | 10.9 | 7.6 | 0 | 1 |
| Screening Level 5.0 mg/l | NC | | | | | | |

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 25 | <1 | 280 | 3.81 | 11 | 2 |

## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 28 | 13.7 | 31.9 | 24.0 | 0 |




Statistical analysis indicates that there is an increasing trend in water temperature values with a **t-stat of 2.15** and a **p-value of 0.04.** Temperature values remain below the criteria. This slight increase does not warrant a concern at this time.

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 28 | 7.6 | 8.6 | 8.2 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 28 | <0.05 | 0.29 | 0.05 | 22 | 2 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 28 | <3 | 31 | 4.74 | 6 | 5 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 26 | <0.04 | 0.75 | 0.04 | 22 | 2 |

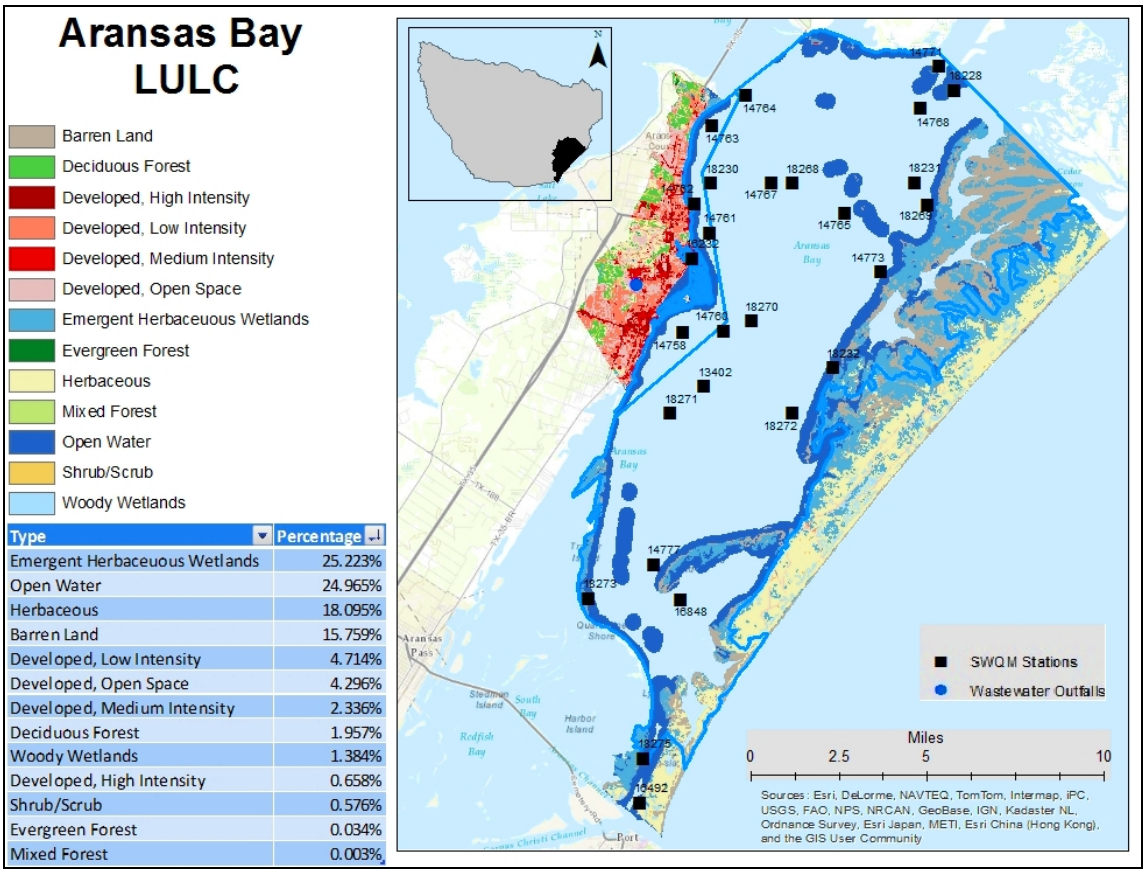
| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 27 | <0.05 | 0.32 | 0.1 | 3 | 2 |

## Oyster Waters Use

DSHS has listed the bay as fully supporting for oyster waters use.

# ARANSAS BAY WATERSHED– SEGMENT 2471

This 64,688 acre segment is in Aransas County and is a single AU.




| Type | Percentage |
|---|---|
| Emergent Herbaceuous Wetlands | 25.223% |
| Open Water | 24.965% |
| Herbaceous | 18.095% |
| Barren Land | 15.759% |
| Developed, Low Intensity | 4.714% |
| Developed, Open Space | 4.296% |
| Developed, Medium Intensity | 2.336% |
| Deciduous Forest | 1.957% |
| Woody Wetlands | 1.384% |
| Developed, High Intensity | 0.658% |
| Shrub/Scrub | 0.576% |
| Evergreen Forest | 0.034% |
| Mixed Forest | 0.003% |

| | |
|---|---|
| **Drainage area** | 85,724 acres |
| **Aquifers** | None |
| **Cities** | Aransas Pass, Fulton, Rockport |
| **Counties** | Aransas |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes |
| **Climate Annual Averages** | Rain: 37"; Low: 63° F - 65° F; High: 77°F - 78° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters |
| **Permitted WWTFs** | WQ0011624-001 – Aransas County MUD #1: 263,000 gpd via irrigation |

## Water Quality Analysis

The analysis for this segment is based on data from **Station 13402**, located at the intersection of the ICWW and the Lydia Ann Channel south of Rockport. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

All water quality standards are being met in this segment. However, there is a **bacteria concern** for Rockport Beach Park.

The watershed around the bay is primarily wetlands with the exception of the Rockport / Fulton area along the western shore.

## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 28 | 6.0 | 11.5 | 7.6 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 22 | <1 | 210 | 2.17 | 12 | 1 |

### General Use

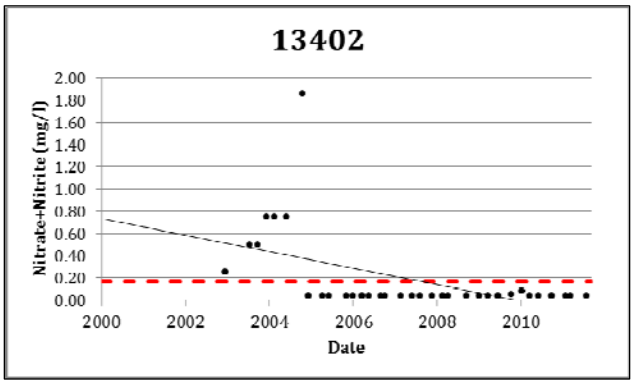
| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 28 | 7.5 | 32.1 | 25.8 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 27 | 7.3 | 8.6 | 8.2 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 28 | <0.05 | 0.21 | 0.05 | 24 | 2 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 28 | <3 | 13.6 | 3.13 | 14 | 1 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 27 | <0.04 | 1.86 | 0.04 | 23 | 3 |




Statistical analysis indicates that there is a decreasing trend in nitrate values with a **t-stat of -3.32** and a **p-value of 0.00.** The trend is due to some high readings early in the dataset. All values since 2005 have been very low or non-detects.

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 28 | <0.05 | 0.17 | 0.06 | 15 | 0 |

### Oyster Waters Use

DSHS has listed the bay as fully supporting for oyster waters use.

### Recreational Beaches

The Texas Beach Watch data has identified a concern for bacteria at the Rockport Beach Park for contact recreation.

# LITTLE BAY – SEGMENT 2471A

This 226 acre segment is in Rockport in Aransas County and is a single AU. The location is included in the map for Aransas Bay, Segment 2471.

| | |
|---|---|
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0010054-001 – City of Rockport: 2,500,000 gpd to Little Bay to Aransas Bay and via irrigation |

## Water Quality Analysis

The analysis for this segment is based on data from **Station 16232**, located at Broadway and the inlet canal to Canoe Lake in Rockport. There is an insufficient time period for trend analysis as routine monitoring did not begin until December 2004. TCEQ is responsible for routine quarterly monitoring at this site.

There is a **chlorophyll-*a* concern** for this segment.

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 25 | 3.7 | 18.6 | 8.2 | 0 | 1 |
| Screening Level 4.0 mg/l | NC | | | | | | |

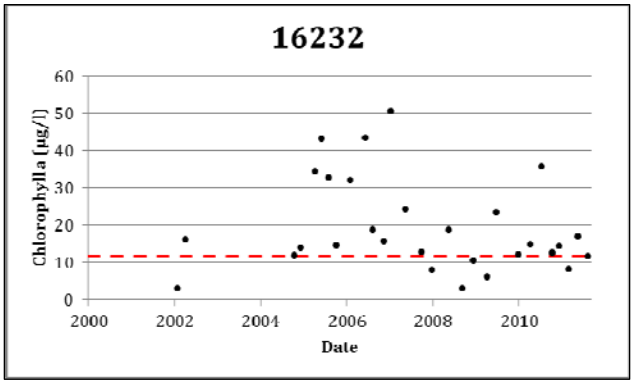
### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 19 | <10 | >2,400 | 17.34 | 7 | 1 |

### General Use

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 23 | <0.05 | 0.12 | 0.05 | 20 | 1 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | **CS** | **22** | **<3** | **50.4** | **17.05** | **1** | **18** |



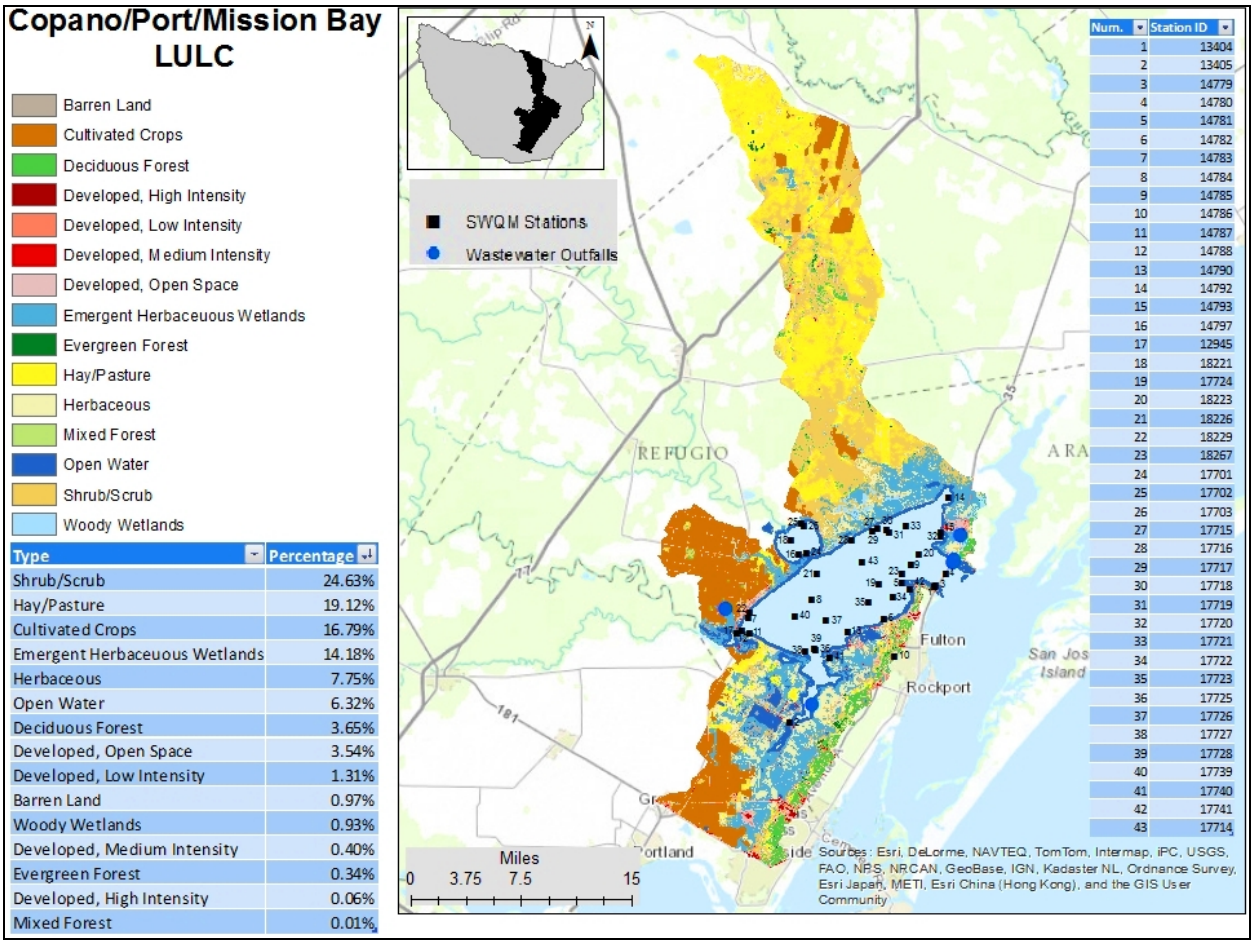

The high chlorophyll-a values may be related to the limited circulation and flushing of the bay, resulting in increased concentrations.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 24 | <0.04 | 0.4 | 0.04 | 15 | 2 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 22 | <0.06 | 0.2 | 0.1 | 1 | 0 |

# COPANO BAY WATERSHED– SEGMENT 2472

The 138,021 acre segment is in Aransas County and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 24.63% |
| Hay/Pasture | 19.12% |
| Cultivated Crops | 16.79% |
| Emergent Herbaceuous Wetlands | 14.18% |
| Herbaceous | 7.75% |
| Open Water | 6.32% |
| Deciduous Forest | 3.65% |
| Developed, Open Space | 3.54% |
| Developed, Low Intensity | 1.31% |
| Barren Land | 0.97% |
| Woody Wetlands | 0.93% |
| Developed, Medium Intensity | 0.40% |
| Evergreen Forest | 0.34% |
| Developed, High Intensity | 0.06% |
| Mixed Forest | 0.01% |

| Num. | Station ID |
|---|---|
| 1 | 13404 |
| 2 | 13405 |
| 3 | 14779 |
| 4 | 14780 |
| 5 | 14781 |
| 6 | 14782 |
| 7 | 14783 |
| 8 | 14784 |
| 9 | 14785 |
| 10 | 14786 |
| 11 | 14787 |
| 12 | 14788 |
| 13 | 14790 |
| 14 | 14792 |
| 15 | 14793 |
| 16 | 14797 |
| 17 | 12945 |
| 18 | 18221 |
| 19 | 17724 |
| 20 | 18223 |
| 21 | 18226 |
| 22 | 18229 |
| 23 | 18267 |
| 24 | 17701 |
| 25 | 17702 |
| 26 | 17703 |
| 27 | 17715 |
| 28 | 17716 |
| 29 | 17717 |
| 30 | 17718 |
| 31 | 17719 |
| 32 | 17720 |
| 33 | 17721 |
| 34 | 17722 |
| 35 | 17723 |
| 36 | 17725 |
| 37 | 17726 |
| 38 | 17727 |
| 39 | 17728 |
| 40 | 17739 |
| 41 | 17740 |
| 42 | 17741 |
| 43 | 17714 |

| | |
|---|---|
| **Drainage area** | 249,235 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Bayside |
| **Counties** | Aransas, Goliad, Refugio |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 35" - 37"; Low: 59° F - 64° F; High: 78°F - 82° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters |
| **Permitted WWTFs** | WQ0004290-000 – Holiday Beach WSC: 120,000 gpd via mud flats<br>WQ0004788-000 – Sherwin Alumina Inc. sludge<br>WQ0004956-000 – Aransas Bay Utilities Co.: 61,000 gpd<br>WQ0010705-001 – City of Taft: 900,000 gpd via mud flats<br>WQ0011280-001 – Aransas County Airport: 3,600 gpd via evaporation<br>WQ0013892-001 – Town of Bayside: 64,200 gpd<br>WQ0014925-001 – RR Development Texas II, Inc.: 550,000 gpd |

## Special Studies

A TMDL for Copano Bay was conducted as described in the San Antonio – Nueces Basin write-up on Page 8.

## Water Quality Analysis

The analysis for this segment is based on data from **Station 12945**, located at FM 126 south of Bayside (except 24-Hr DO), **Station 13405**, located in Port Bay at SH 118 (24-Hr DO), and **Station 14783**, located east of Bayside. Trend analysis was conducted on data from January 2000 through September 2011. NRA is responsible for routine quarterly monitoring at sites 12945 and 13405. TCEQ is responsible for routine quarterly monitoring at site 14783.


Station 12945


Station 13405

There is a **bacteria in oyster waters impairment** for parts of the bay system.

The watershed immediately around the bay is mostly wetlands. Inland around Bayside is primarily croplands, and the Copano Creek drainage is mostly pasture and brush.

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 28 | 4.0 | 11.4 | 6.8 | 0 | 5 |
| Screening Level 5.0 mg/l | NC | | | | | | |
| 24-Hr Minimum 3.0 mg/l | NC | 4 | 4.1 | 6.5 | 5.8 | 0 | NA |
| 24-Hr Average 4.0 mg/l | NC | | 6.7 | 7.7 | 7.5 | NA | 0 |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 28 | <1 | 940 | 18.11 | 1 | 6 |

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 28 | 8.9 | 32.6 | 22.0 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 28 | 7.4 | 8.3 | 8.1 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 28 | <0.02 | 0.305 | 0.022 | 12 | 3 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 28 | <2 | 36.3 | 7.82 | 6 | 5 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 28 | <0.02 | 0.42 | 0.02 | 22 | 3 |

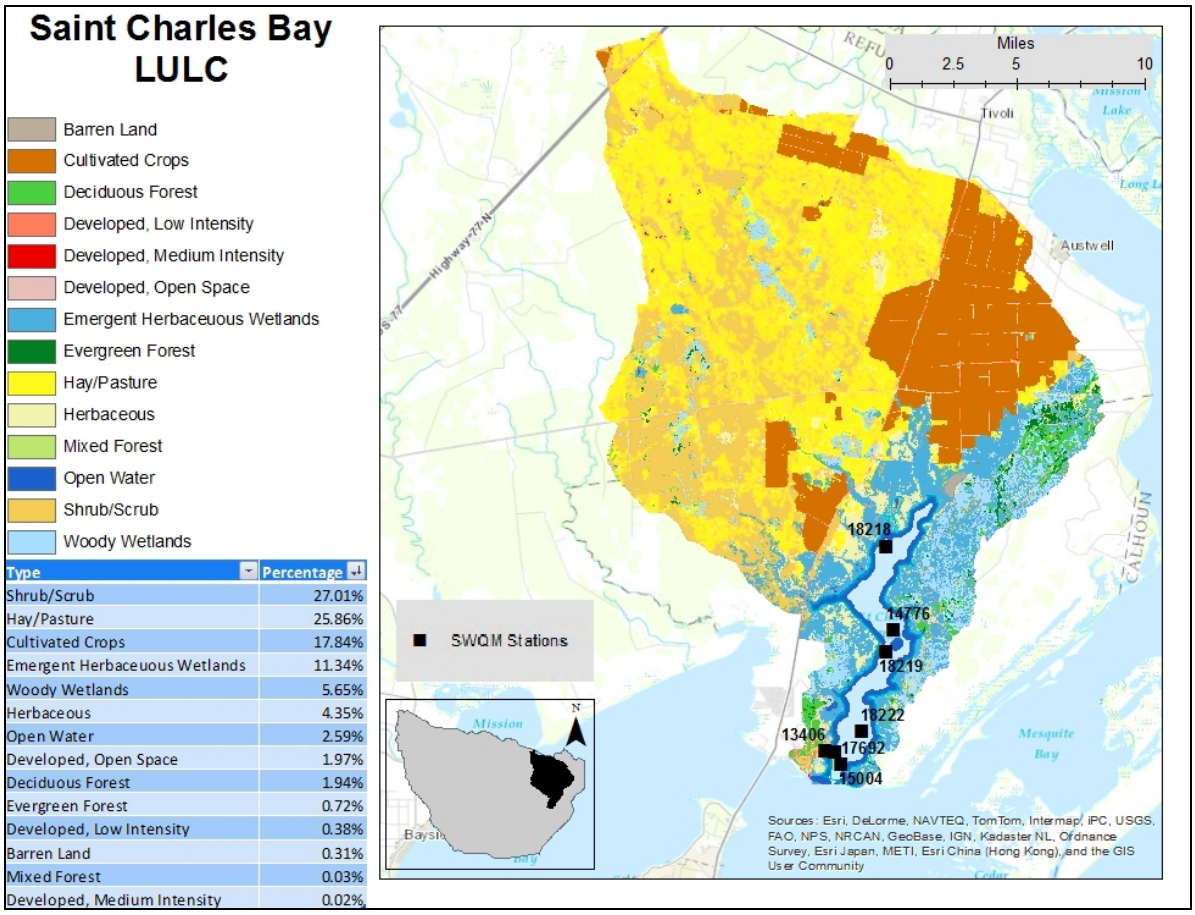
| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 28 | 0.065 | 0.328 | 0.124 | 0 | 4 |

### Oyster Waters Use

DSHS has listed Mission Bay, the Aransas River arm, Port Bay, and the eastern shoreline as non-supporting for oyster waters use. Copano Bay is fully supporting.

# ST. CHARLES BAY WATERSHED– SEGMENT 2473

The 8,608 acre segment is in Aransas County and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 27.01% |
| Hay/Pasture | 25.86% |
| Cultivated Crops | 17.84% |
| Emergent Herbaceuous Wetlands | 11.34% |
| Woody Wetlands | 5.65% |
| Herbaceous | 4.35% |
| Open Water | 2.59% |
| Developed, Open Space | 1.97% |
| Deciduous Forest | 1.94% |
| Evergreen Forest | 0.72% |
| Developed, Low Intensity | 0.38% |
| Barren Land | 0.31% |
| Mixed Forest | 0.03% |
| Developed, Medium Intensity | 0.02% |

| | |
|---|---|
| **Drainage area** | 162,401 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | None |
| **Counties** | Aransas, Refugio |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 37” - 39”; Low: 60° F - 64° F; High: 78°F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters |
| **Permitted WWTFs** | None |

## Water Quality Analysis

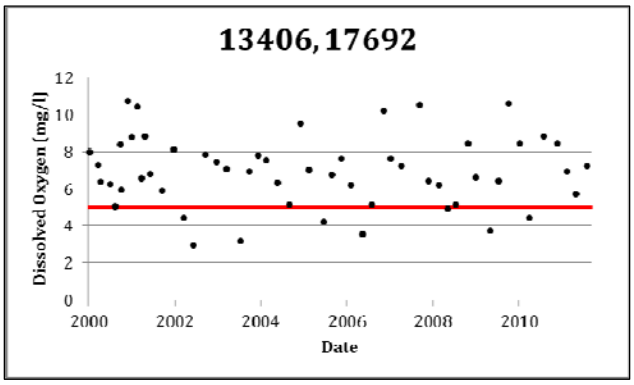
The analysis for this segment is based on data from **Station 13406**, located at 4th St. in Lamar northeast of Goose Island State Park (2000-2010) and **Station 17692**, located northeast of Hail Point on Lamar Peninsula (2010-2011). Trend analysis was conducted on data from January 2000 through November 2011. Station 17692 replaced Station 13406 as the routine quarterly monitoring location to be more representative of the bay, and TCEQ is responsible for this monitoring.

There is a **low DO screening level concern** for the bay.

The watershed immediately around the bay is mostly wetlands and includes a portion of the Aransas Wildlife Refuge. Inland areas to the north are primarily croplands, and the areas northwest are mostly pasture and brush.

## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | **28** | **3.5** | **10.6** | **6.6** | **2** | **5** |
| Screening Level 5.0 mg/l | **CS** | | | | | | |




The low DO values are all measured at Station 13406 which was off a pier close to land. Continued monitoring and 24-Hr DO studies at Station 17692 will determine whether or not a DO concern actually exists.

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 28 | <1 | 5,500 | 12.308 | 5 | 5 |

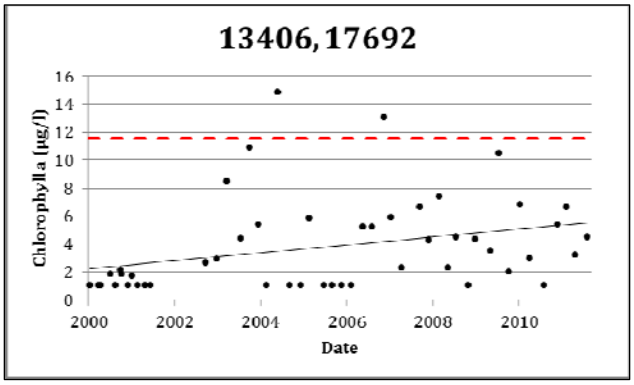
## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 28 | 8.0 | 30.4 | 22.8 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 28 | 7.8 | 8.3 | 8.0 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 28 | <0.02 | 0.404 | 0.03 | 9 | 3 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 28 | <2 | 14.9 | 5 | 9 | 2 |




Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with a **t-stat of 2.16** and a **p-value of 0.04.** The higher values tend to occur during droughts and therefore less rain to flush the system. The values are still below the screening level and not a concern at this time.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 28 | <0.02 | 0.15 | 0.02 | 27 | 0 |

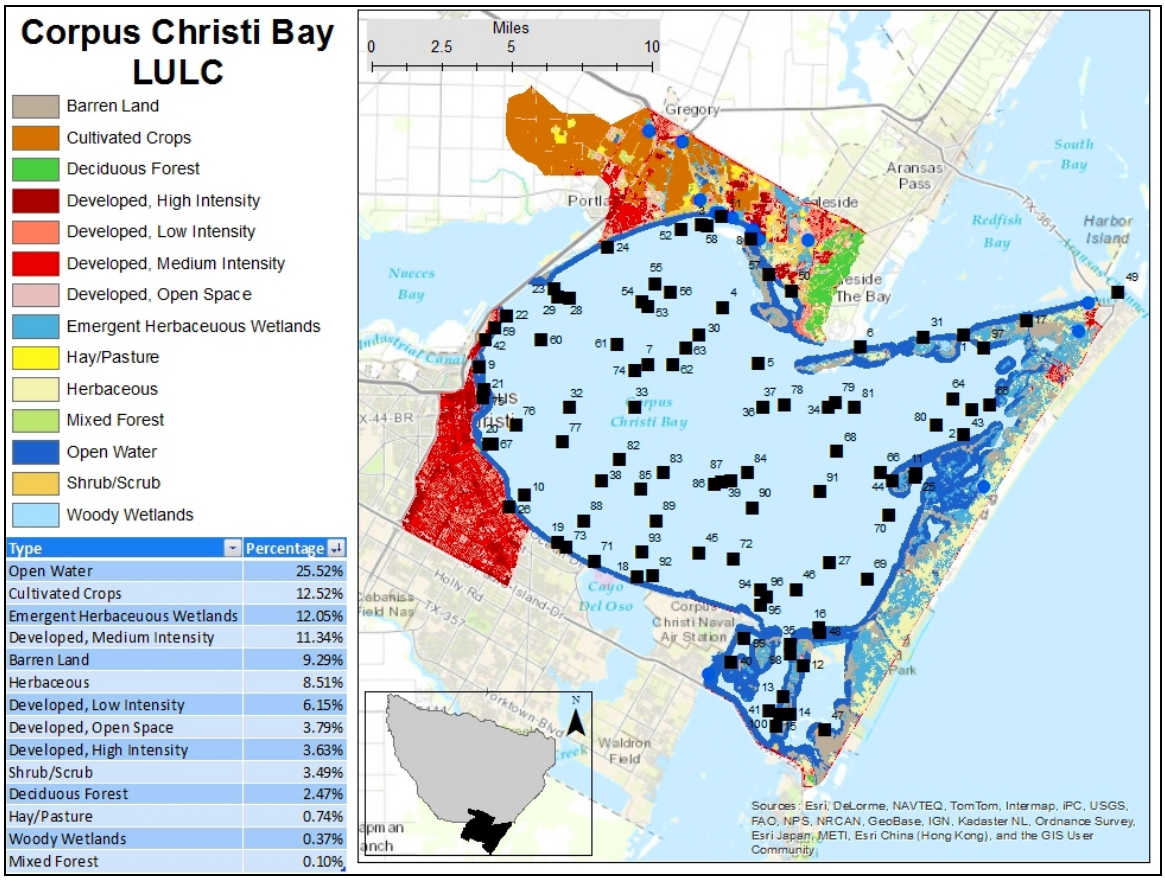
| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 28 | <0.04 | 0.348 | 0.076 | 8 | 1 |

## Oyster Waters Use

DSHS has listed the bay as fully supporting for oyster waters use.

# CORPUS CHRISTI BAY WATERSHED– SEGMENT 2481

The 26,397 acre segment is in Nueces County and is divided into three AUs.




| Type | Percentage |
|---|---|
| Open Water | 25.52% |
| Cultivated Crops | 12.52% |
| Emergent Herbaceuous Wetlands | 12.05% |
| Developed, Medium Intensity | 11.34% |
| Barren Land | 9.29% |
| Herbaceous | 8.51% |
| Developed, Low Intensity | 6.15% |
| Developed, Open Space | 3.79% |
| Developed, High Intensity | 3.63% |
| Shrub/Scrub | 3.49% |
| Deciduous Forest | 2.47% |
| Hay/Pasture | 0.74% |
| Woody Wetlands | 0.37% |
| Mixed Forest | 0.10% |

| REF | STA. ID |
|---|---|
| 1 | 14825 |
| 2 | 14826 |
| 3 | 14827 |
| 4 | 14828 |
| 5 | 14829 |
| 6 | 14830 |
| 7 | 13407 |
| 8 | 13409 |
| 9 | 13410 |
| 10 | 13411 |
| 11 | 14355 |
| 12 | 16849 |
| 13 | 16850 |
| 14 | 16851 |
| 15 | 16852 |
| 16 | 16853 |
| 17 | 16854 |
| 18 | 14818 |
| 19 | 14819 |
| 20 | 14820 |
| 21 | 14821 |
| 22 | 14822 |
| 23 | 14823 |
| 24 | 14824 |
| 25 | 14469 |

| REF | STA. ID |
|---|---|
| 26 | 14955 |
| 27 | 17791 |
| 28 | 18277 |
| 29 | 18237 |
| 30 | 18239 |
| 31 | 18240 |
| 32 | 18241 |
| 33 | 18242 |
| 34 | 18243 |
| 35 | 18062 |
| 36 | 18279 |
| 37 | 18280 |
| 38 | 18281 |
| 39 | 18282 |
| 40 | 18284 |
| 41 | 18064 |
| 42 | 18451 |
| 43 | 18244 |
| 44 | 18245 |
| 45 | 18246 |
| 46 | 18247 |
| 47 | 18250 |
| 48 | 17099 |
| 49 | 13419 |
| 50 | 14979 |

| REF | STA. ID |
|---|---|
| 76 | 17763 |
| 77 | 17764 |
| 78 | 17765 |
| 79 | 17766 |
| 80 | 17767 |
| 81 | 17768 |
| 82 | 17773 |
| 83 | 17774 |
| 84 | 17775 |
| 85 | 17777 |
| 86 | 17778 |
| 87 | 17779 |
| 88 | 17781 |
| 89 | 17782 |
| 90 | 17783 |
| 91 | 17784 |
| 92 | 17787 |
| 93 | 17789 |
| 94 | 17792 |
| 95 | 17793 |
| 96 | 17794 |
| 97 | 17761 |
| 98 | 18061 |
| 99 | 18063 |
| 100 | 18065 |

| REF | STA. ID |
|---|---|
| 51 | 17747 |
| 52 | 17748 |
| 53 | 17749 |
| 54 | 17750 |
| 55 | 17751 |
| 56 | 17752 |
| 57 | 17753 |
| 58 | 17754 |
| 59 | 17755 |
| 60 | 17756 |
| 61 | 17757 |
| 62 | 17759 |
| 63 | 17760 |
| 64 | 17769 |
| 65 | 17770 |
| 66 | 17771 |
| 67 | 17772 |
| 68 | 17776 |
| 69 | 17780 |
| 70 | 17785 |
| 71 | 17786 |
| 72 | 17788 |
| 73 | 17790 |
| 74 | 17758 |
| 75 | 17762 |

| | |
|---|---|
| **Drainage area** | 144,878 acres |
| **Aquifers** | None |
| **Cities** | Corpus Christi, Gregory, Ingleside, Ingleside-on-the-Bay, Port Aransas, Portland |
| **Counties** | Nueces |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 33" - 35"; Low: 63° F - 65° F; High: 77°F - 80° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Recreational Beaches |
| **Permitted WWTFs** | WQ0001207-000 – Koch Pipeline Company, LP (Flint Hill Resources): storm water<br>WQ0001651-000 – E. I. Du Pont De Nemours & Co.: 4,610,000 gpd via submerged pipe in La Quinta Channel and storm water<br>WQ0002317-000 – US Department of the Navy Corpus Christi Naval Air Station (NAS): 1,500,000 gpd<br>WQ0003083-000 – Occidental Chemical Corporation: 2,240,000 gpd via submerged pipeline in La Quinta Channel<br>WQ0003966-000 – Reynolds Metal Company: 1,000 metric tons per year on closed bauxite tailing beds<br>WQ0004165-000 – Texas A&M University System: 2,000,000 gpd<br>WQ0004606-000 – Reynolds Metals Co.: storm water and leachate<br>WQ0004646-000 – Sherwin Alumina LP: storm water<br>WQ0010092-001 – City of Gregory: 320,000 gpd via Green Lake<br>WQ0010422-001 – City of Ingleside: 1,200,000 gpd via Kinney Bayou<br>WQ0010846-001 – Nueces Co. WCID No. 4 Mustang Island North Plant: 1,880,000 gpd via mud flats<br>WQ0010846-002 – Nueces Co. WCID No. 4 Mustang Island South Plant: 1,200,000 gpd to Shamrock Cove |

## Water Quality Analysis

**AU_01** is from the Corpus Christi Ship Channel east to Pelican Island, south to Demit Island, including the La Quinta Ship Channel and the Corpus Christi Ship Channel adjacent to Redfish Bay. **AU_02** is from the Corpus Christi Ship Channel east to Pelican Island, south to Demit Island including the Oso Bay and City of Corpus Christi areas. **AU_03** is from the Pelican Island south to Demit Island to Mustang Island and the area along Mustang Island State Park to the Corpus Christi Ship Channel.

The analysis for AU_01 is based on data from **Station 13407**, located at CM 62. Trend analysis was conducted on data from March 2000 through September 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_02 is based on data from **Station 13411**, located northeast of the intersection of Doddridge and Ocean Dr. in Corpus Christi. Trend analysis was conducted on data from April 2000 through September 2011. TCEQ is responsible for routine quarterly monitoring at this site.

The analysis for AU_03 is based on data from **Station 14355**, located east of Shamrock Island. Trend analysis was conducted on data from February 2000 through December 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There are **bacteria impairments** at Cole Park and Ropes Park and a **bacteria concern** at Poenisch Park.

The east shore of the bay, the backside of Padre Island, is predominately wetlands. The City of Corpus Christi is along the south and east shores, and the City of Portland and industry line the north shore. Croplands north of the City of Portland are also within the watershed. Constructed drainage within the City of Corpus Christi channels a large portion of storm water to the Corpus Christi Inner Harbor (Segment 2484), Oso Bay (Segment 2485), and Oso Creek (Segment 2485A), and away from Corpus Christi Bay.

### Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 4.0 mg/l | FS | 28 | 4.2 | 10.0 | 7.4 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-02 | Minimum 4.0 mg/l | FS | 27 | 4.5 | 10.4 | 7.3 | 0 | 1 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| AU-03 | Minimum 4.0 mg/l | FS | 28 | 5.6 | 13.0 | 7.0 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

AU_01 is fully supporting for toxic substances in water and has no concerns for toxic substances in sediment for aquatic life use.

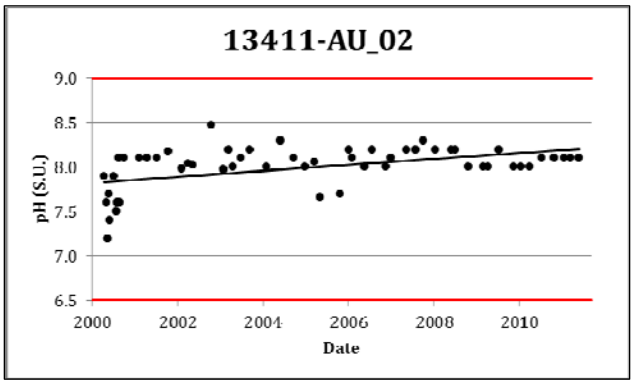
### Recreation Use

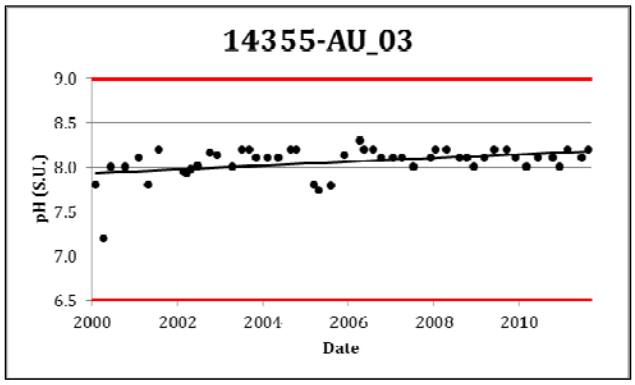
| Enterococcus | | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 35 cfu/100 ml | FS | 23 | <10 | 63 | 12.88 | 16 | 0 |
| AU-02 | | FS | 22 | <10 | 2,489 | 21.35 | 12 | 3 |
| AU-03 | | FS | 23 | <10 | 280 | 13.85 | 17 | 2 |

### General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU-01 | 35 °C | FS | 28 | 10.4 | 30.8 | 23.6 | 0 |
| AU-02 | | FS | 27 | 11.1 | 31.4 | 24.1 | 0 |
| AU-03 | | FS | 28 | 13.1 | 31.5 | 25.0 | 0 |

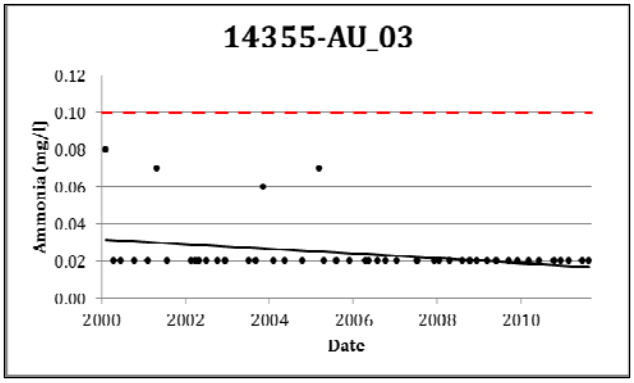
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 28 | 7.7 | 8.4 | 8.1 | 0 | 0 |
| AU-02 | | FS | 27 | 7.7 | 8.3 | 8.1 | 0 | 0 |
| AU-03 | | FS | 28 | 7.7 | 8.3 | 8.1 | 0 | 0 |



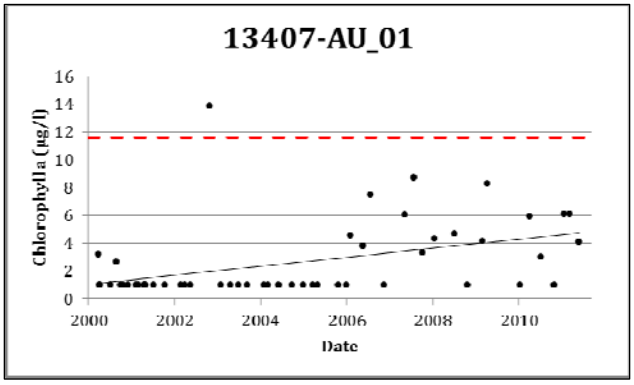

Statistical analysis indicates that there is an increasing trend in pH values in AU_02 with a **t-stat of 3.98** and a **p-value of 0.00** and in AU_03 with a **t-stat of 2.92** and a **p-value of 0.01.** There is no obvious reason for these trends. However, the increase is slight and not a concern at this time.

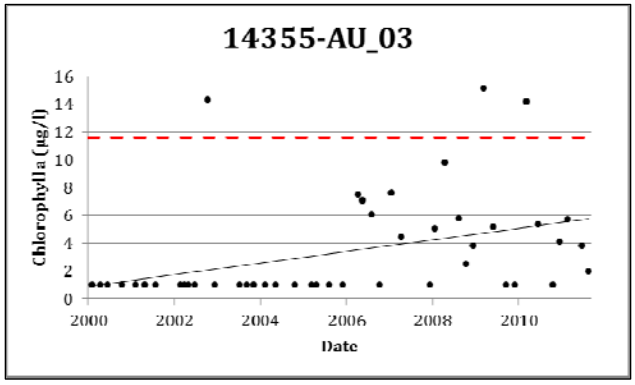
| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.1 mg/l | NC | 28 | <0.05 | 0.38 | 0.05 | 24 | 1 |
| AU-02 | | NC | 27 | <0.05 | 0.14 | 0.05 | 22 | 1 |
| AU-03 | | NC | 26 | <0.02 | 0.07 | 0.02 | 24 | 0 |




Statistical analysis indicates that there is a decreasing trend in ammonia values in AU_03 with a **t-stat of -2.15** and a **p-value of 0.04.** Since all but four of the values are non-detects, the trend is the result of the relatively high, but below the screening level, values in the first half of the data set.

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 11.6 µg/l | NC | 24 | <3 | 8.73 | 3.01 | 12 | 0 |
| AU-02 | | NC | 24 | <3 | 12.4 | 3 | 12 | 1 |
| AU-03 | | NC | 26 | <3 | 15.1 | 3.4 | 13 | 2 |




Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values in AU_01 with a **t-stat of 3.20** and a **p-value of 0.00** and in AU_03 with a **t-stat of 2.76** and a **p-value of 0.01.** The sudden increase in values in 2006 coincides with a change in the method used for analysis. This newer method provides for more reliable results at lower concentrations. The non-detects for the trend analysis were converted from <10 µg/l to <3 µg/l for consistency. Therefore, a real trend may not even exist.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.17 mg/l | NC | 26 | <0.04 | 0.05 | 0.04 | 24 | 0 |
| AU-02 | | NC | 26 | <0.04 | 0.13 | 0.04 | 22 | 0 |
| AU-03 | | NC | 26 | <0.04 | <0.04 | 0.04 | 26 | 0 |

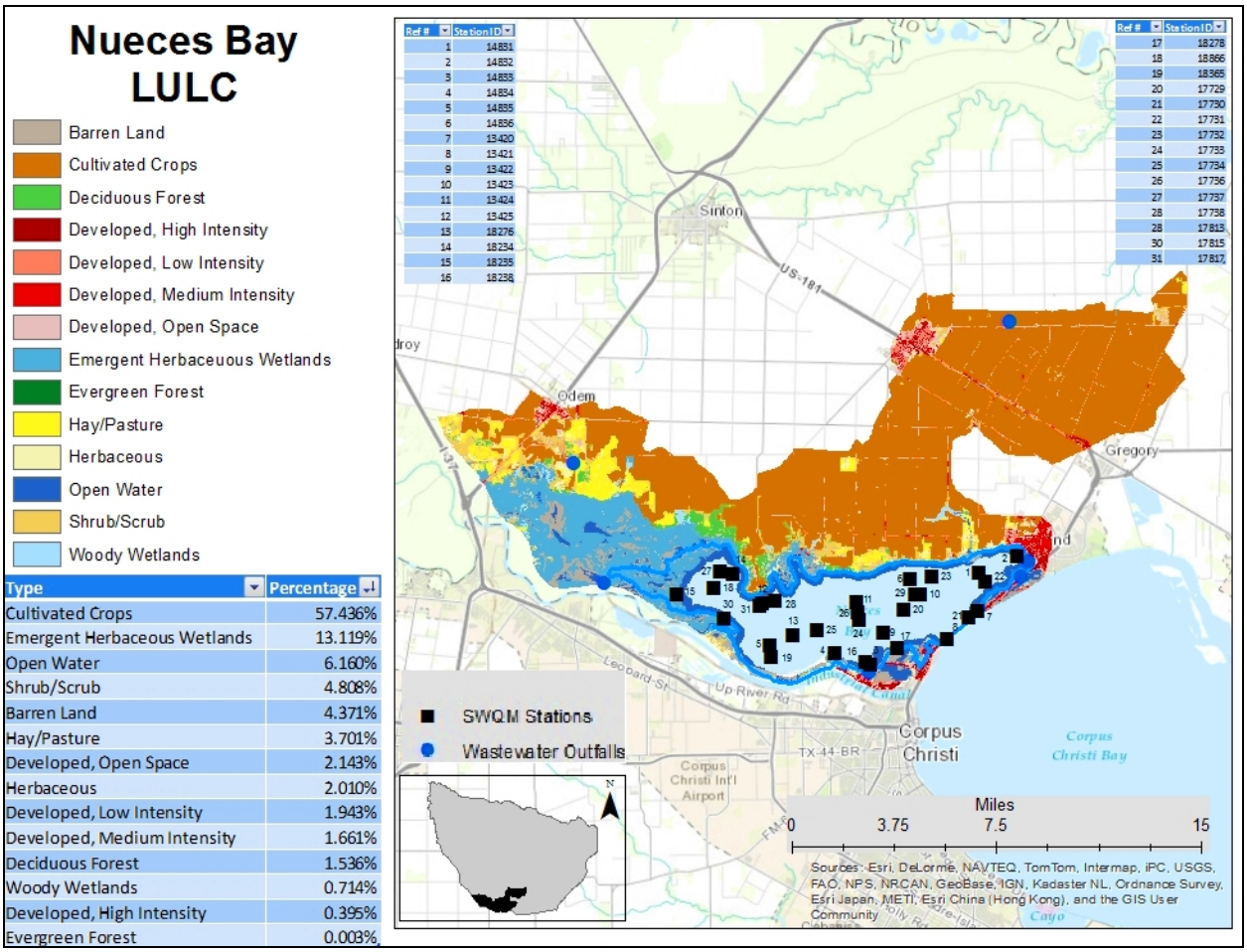
| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.21 mg/l | NC | 26 | <0.05 | 0.15 | 0.05 | 17 | 0 |
| AU-02 | | NC | 26 | <0.05 | 0.19 | 0.06 | 11 | 0 |
| AU-03 | | NC | 26 | <0.05 | 0.14 | 0.05 | 17 | 0 |

**Oyster Waters Use** DSHS has listed the bay as fully supporting for oyster waters use.

**Recreational Beaches** The Texas Beach Watch data has identified impairments for bacteria at Cole Park and Ropes Park and a concern for bacteria at Poenisch Park for contact recreation. Corpus Christi Marina, Corpus Christi Beach, McGee Beach, Emerald Beach, University Beach, and Packery Channel Park are fully supporting for contact recreation.

# NUECES BAY WATERSHED– SEGMENT 2482

The 19,500 acre segment is in Nueces County and is a single AU.




| Type | Percentage |
|---|---|
| Cultivated Crops | 57.436% |
| Emergent Herbaceous Wetlands | 13.119% |
| Open Water | 6.160% |
| Shrub/Scrub | 4.808% |
| Barren Land | 4.371% |
| Hay/Pasture | 3.701% |
| Developed, Open Space | 2.143% |
| Herbaceous | 2.010% |
| Developed, Low Intensity | 1.943% |
| Developed, Medium Intensity | 1.661% |
| Deciduous Forest | 1.536% |
| Woody Wetlands | 0.714% |
| Developed, High Intensity | 0.395% |
| Evergreen Forest | 0.003% |

| | |
|---|---|
| **Drainage area** | 92,834 acres |
| **Aquifers** | None |
| **Cities** | Corpus Christi, Odem, Portland, Taft |
| **Counties** | Nueces, San Patricio |
| **EcoRegions** | Floodplains and Low Terraces, Mid-Coast Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 33” - 35”; Low: 61° F - 64° F; High: 79°F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption, Oyster Waters, Fish Consumption, Recreational Beaches |
| **Permitted WWTFs** | WQ0001244-000 – Nueces Bay WLE LP: 500,000,000 gpd once through cooling water and previously monitored effluent<br>WQ0010237-002 – City of Odem: 475,000 gpd via Rincon Bayou<br>WQ0010478-001 – City of Portland WWTP: 2,500,000 gpd via drainage ditch<br>WQ0011096-001 – Sublight Enterprises, Inc. (Portland Inn): 9,000 gpd. |

## Special Studies

The SB3 Environmental Flows Process found the Nueces Bay and Delta area to be an unsound ecological environment as described in the Bays and Estuaries write up on Page 141.

## Water Quality Analysis

The analysis for this segment is based on data from **Station 13422**, located near the south shoreline at the east overhead power line. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

All water quality parameters met the standards. However, there is an **impairment for zinc in edible oyster tissue**.

The watershed for the bay includes the Nueces Delta to the east and primarily croplands to the north. The City of Corpus Christi and the Corpus Christi Inner Harbor (Segment 2484) are located just south of the bay.

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 34 | 5.2 | 11.2 | 7.5 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 24 | <1 | 690 | 7.72 | 11 | 5 |

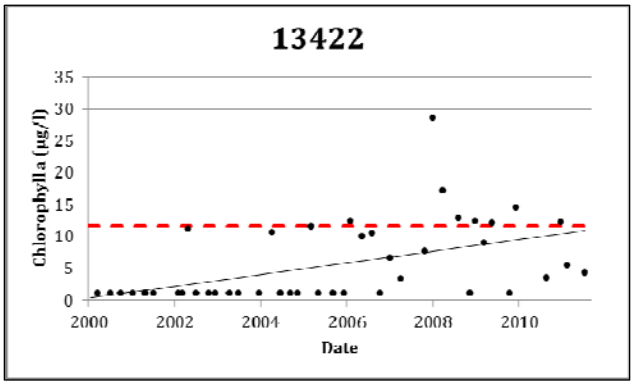
### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 34 | 11.2 | 30.9 | 23.1 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 34 | 7.5 | 8.5 | 8.1 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 28 | <0.04 | 0.4 | 0.04 | 23 | 3 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 25 | <3 | 28.6 | 7.68 | 10 | 7 |




Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with a **t-stat of 3.49** and a **p-value of 0.00.** The increase in values in 2006 coincides with a change in method used for analysis. This newer method provides for more reliable results at lower concentrations. For the trend analysis, all values measured below the LOQ were converted from <10 µg/l to <1 µg/l for consistency. Therefore, a real trend may not even exist.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 27 | <0.04 | 0.11 | 0.04 | 23 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 25 | <0.05 | 0.574 | 0.12 | 2 | 3 |

## Oyster Waters Use

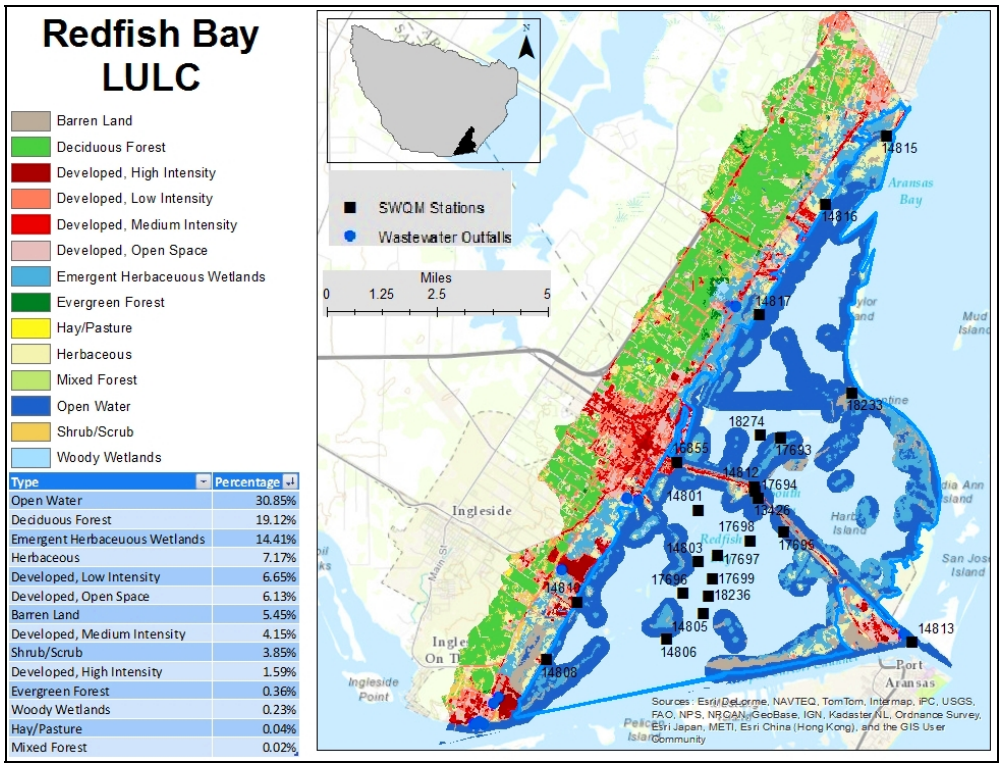
DSHS has listed the bay as non-supporting for zinc in edible tissue for oyster waters use.

## Recreational Beaches

Nueces Bay Park is fully supporting for contact recreation.

# REDFISH BAY WATERSHED– SEGMENT 2483

The 26,229 acre segment is in Nueces County and is a single AU.



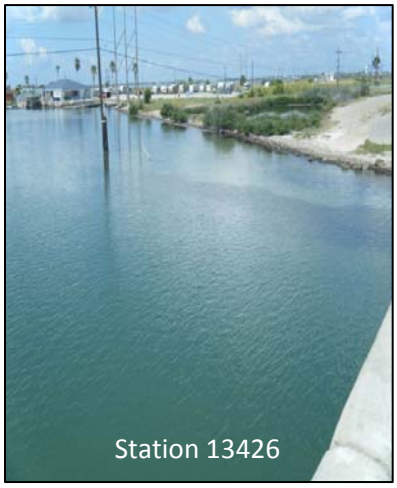

| Type | Percentage |
|---|---|
| Open Water | 30.85% |
| Deciduous Forest | 19.12% |
| Emergent Herbaceuous Wetlands | 14.41% |
| Herbaceous | 7.17% |
| Developed, Low Intensity | 6.65% |
| Developed, Open Space | 6.13% |
| Barren Land | 5.45% |
| Developed, Medium Intensity | 4.15% |
| Shrub/Scrub | 3.85% |
| Developed, High Intensity | 1.59% |
| Evergreen Forest | 0.36% |
| Woody Wetlands | 0.23% |
| Hay/Pasture | 0.04% |
| Mixed Forest | 0.02% |

| | |
|---|---|
| **Drainage area** | 45,936 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Aransas Pass |
| **Counties** | Aransas, Nueces |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes |
| **Climate Annual Averages** | Rain: 35” - 37”; Low: 64° F - 65° F; High: 77°F - 78° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters, Recreational Beaches |
| **Permitted WWTFs** | WQ0002077-000 – Evonik Degussa Corporation: storm water<br>WQ0003012-000 – Gulf Marine Fabricators: 4,000 gpd<br>WQ0010521-002 – City of Aransas Pass: 1,600,000 gpd.<br>WQ0012064-001 –Gulf Marine Fabricators: 12,000 gpd via drainage ditch<br>WQ0012731-001 – Martin Operating Partnership, LP: 3,800 gpd |

## Water Quality Analysis

The analysis is based on data from **Station 13426**, located on SH 361 at the third bridge between Aransas Pass and Port Aransas. NRA is responsible for routine quarterly monitoring at this site. Trend analysis was conducted on data from January 2000 through September 2011.

All water quality parameters met the standards. However, there is an **impairment for bacteria in oyster waters** for the bay.


Station 13426

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 28 | 5.1 | 11.1 | 7.1 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |
| 24-Hr Minimum 4.0 mg/l | NC | 4 | 4.6 | 8.8 | 5.1 | 0 | NA |
| 24-Hr Average 5.0 mg/l | NC | | 6.4 | 10.2 | 6.6 | NA | 0 |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 28 | <1 | 50 | 2.7 | 7 | 0 |

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 28 | 7.6 | 31.5 | 23.3 | 0 |

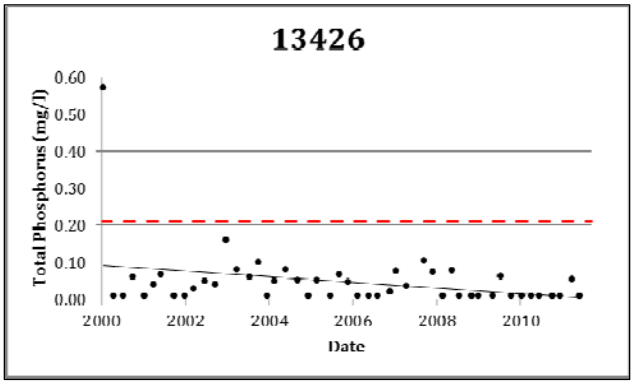
| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 28 | 7.9 | 8.3 | 8.2 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 28 | <0.02 | 0.265 | 0.02 | 21 | 1 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 28 | 2.14 | 9.91 | 5.06 | 13 | 0 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 28 | <0.02 | 0.1 | 0.02 | 27 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 28 | <0.04 | 0.104 | 0.04 | 17 | 0 |




Statistical analysis indicates that there is a decreasing trend in total phosphorous values with a **t-stat of -2.19** and a **p-value of 0.03.** The first value of this dataset was verified, but is an anomaly. Without it, the trend does not exist.

### Oyster Waters Use

DSHS has listed the bay as non-supporting for oyster waters use.

### Recreational Beaches

Lighthouse Lake is fully supporting for contact recreation.

# CONN BROWN HARBOR – SEGMENT 2483A

The 63 acre segment is in Nueces County and is a single AU. The location is included in the map for Redfish Bay, Segment 2483.

| | |
|---|---|
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption |
| **Permitted WWTFs** | WQ0002007-000 – Liberty Seafood: 1,000,000 gpd |

**Water Quality Analysis**
The analysis is based on data from **Station 18848**, located mid-harbor. NRA began routine quarterly monitoring at this site in October 2006. Additional data was available for DO, water temperature, and pH from **Station 13287**, located at the south end of the harbor. There is insufficient data for trend analysis.

There is a **copper in water impairment** for the harbor.


## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 37 | 4.9 | 11.0 | 7.0 | 0 | 0 |
| Screening Level 4.0 mg/l | NC | | | | | | |
| 24-Hr Minimum 3.0 mg/l | NC | 10 | 4.2 | 7.4 | 5.3 | 0 | NA |
| 24-Hr Average 4.0 mg/l | NC | | 5.1 | 8.0 | 6.7 | NA | 0 |

The harbor is non-supporting for copper with respect to toxic substances in water for aquatic life use.

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 17 | <1 | 610 | 4.52 | 4 | 0 |

## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | NA | 37 | 9.6 | 32.8 | 27.7 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | NA | 37 | 7.8 | 9.3 | 8.3 | 0 | 2 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 17 | <0.02 | 0.387 | 0.029 | 7 | 2 |

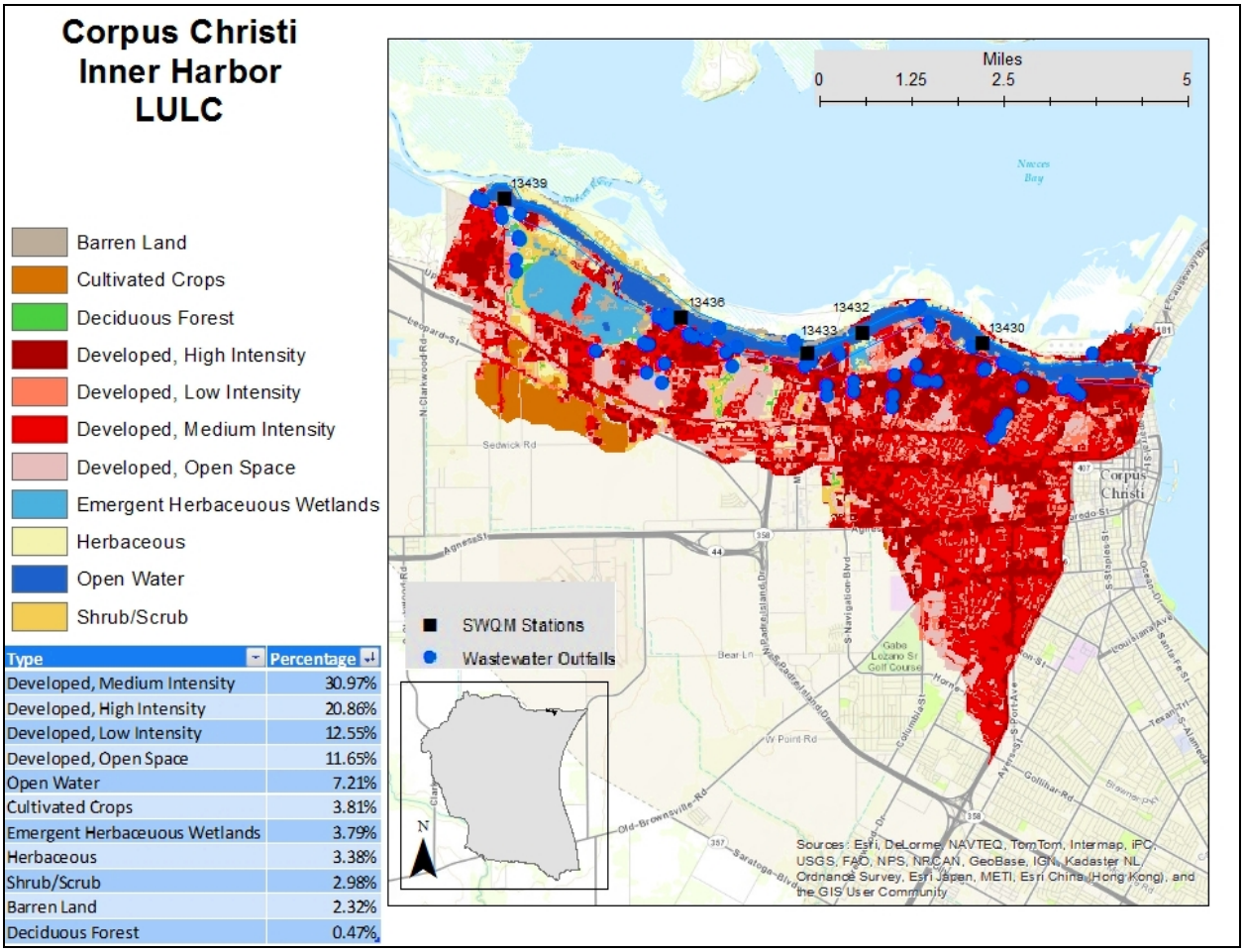
| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 17 | 2.78 | 19.8 | 6.02 | 0 | 2 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 17 | <0.02 | <0.02 | 0.02 | 17 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 17 | <0.06 | 0.318 | 0.06 | 14 | 1 |

## CORPUS CHRISTI INNER HARBOR WATERSHED– SEGMENT 2484

The 1,361 acre segment is in Nueces County and is a single AU.




| Type | Percentage |
|---|---|
| Developed, Medium Intensity | 30.97% |
| Developed, High Intensity | 20.86% |
| Developed, Low Intensity | 12.55% |
| Developed, Open Space | 11.65% |
| Open Water | 7.21% |
| Cultivated Crops | 3.81% |
| Emergent Herbaceuous Wetlands | 3.79% |
| Herbaceous | 3.38% |
| Shrub/Scrub | 2.98% |
| Barren Land | 2.32% |
| Deciduous Forest | 0.47% |

| | |
|---|---|
| **Drainage area** | 13,360 acres |
| **Aquifers** | None |
| **Cities** | Corpus Christi |
| **Counties** | Nueces |
| **EcoRegions** | Mid-Coast Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 33"; Low: 62° F - 64° F; High: 79°F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption |

| | |
|---|---|
| **Permitted WWTFs** | WQ0000314-000 – Encycle / Texas, Inc.: 320,000 gpd and storm water<br>WQ0000349-000 – Elementis Chromium LP: 20,000,000 gpd<br>WQ0000457-000 – Flint Hills Resources LP: 2,160,000 gpd<br>WQ0000465-000 – Coastal Refining and Marketing: 3,000,000 gpd and storm water<br>WQ0000467-000 – Citgo Refining and Chemicals: 5,300,000 gpd and storm water<br>WQ0000531-000 – Flint Hills Resources LP: 145,000 gpd via irrigation and storm water<br>WQ0001909-000 – Valero Refining Company-Texas: 50,000 gpd and storm water<br>WQ0002070-000 – Williams Terminals Holdings: 1,060,000 gpd via drainage ditch<br>WQ0002075-000 – Equistar Chemicals LP: 2,000,000 gpd<br>WQ0002506-000 – Star Fire Port Services: storm water and via evaporation<br>WQ0002540-000 – Coastal Refining and Marketing: storm water<br>WQ0002614-000 – Citgo Refining and Chemicals: storm water<br>WQ0002720-000 – BTB Refining LCC: 120,000 gpd via underground pipe and storm water<br>WQ0003137-000 – Markwest Company: 288,000 gpd plus 100,000 gpd via irrigation<br>WQ0003562-000 – Citgo Refining and Chemicals: storm water<br>WQ0004158-000 – Corpus Christi Cogeneration: 11,000,000 gpd.<br>WQ0004889-000 – John Bludworth Shipyard, LLC: ballast water<br>WQ0004977-000 – Citgo Refining and Chemical Co, LPP : ballast water<br>WQ0010401-005 – City of Corpus Christi Broadway Plant: 10,000,000 gpd. |

### Water Quality Analysis

The analysis is based on data from **Station 13430**, located in the Avery Turning Basin, the closest site to Corpus Christi Bay. Trend analysis was conducted on data from April 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There are **ammonia, chlorophyll-*a*,** and **nitrate concerns** for the harbor.

The watershed for the harbor lies entirely with the Corpus Christi city limits.

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <2 | <3 |
|---|---|---|---|---|---|---|---|
| Minimum 2.0 mg/l | FS | 34 | 5.0 | 9.4 | 7.2 | 0 | 0 |
| Screening Level 3.0 mg/l | NC | | | | | | |

The harbor is fully supporting / has no concerns for toxic substances in water and has no concerns for toxic substances in sediment for aquatic life use.

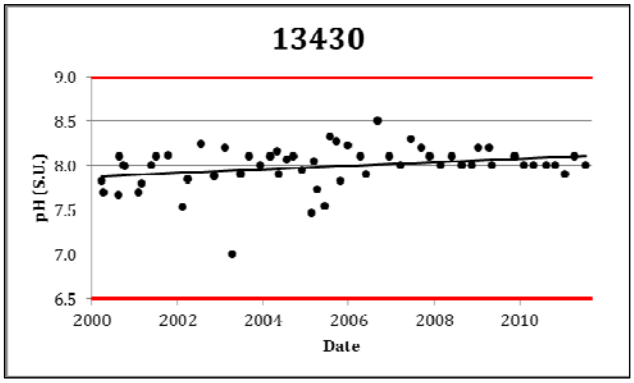
### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 24 | <1 | 144 | 23.21 | 10 | 3 |

### General Use

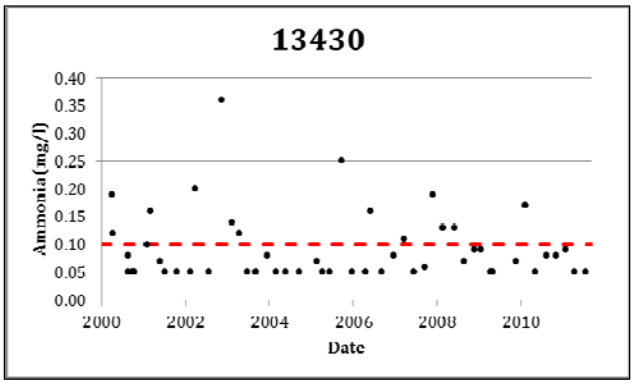
| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 34 | 13.2 | 31.2 | 24.0 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 34 | 7.5 | 8.5 | 8.1 | 0 | 0 |



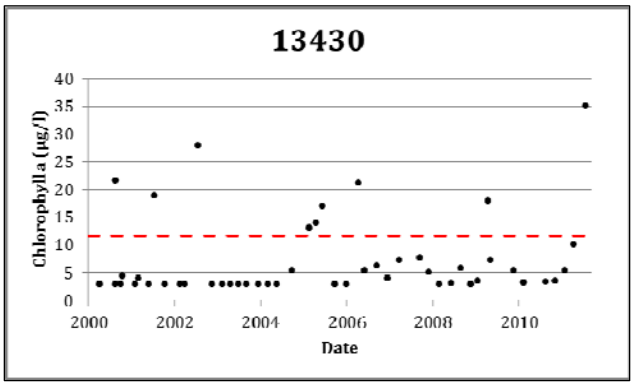

Statistical analysis indicates that there is an increasing trend in pH values with a **t-stat of 2.22** and a **p-value of 0.03.** There is no obvious reason for this trend. However, the values are well within the pH range and not a concern at this time.

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | **CS** | **28** | **<0.05** | **0.25** | **0.07** | **12** | **7** |



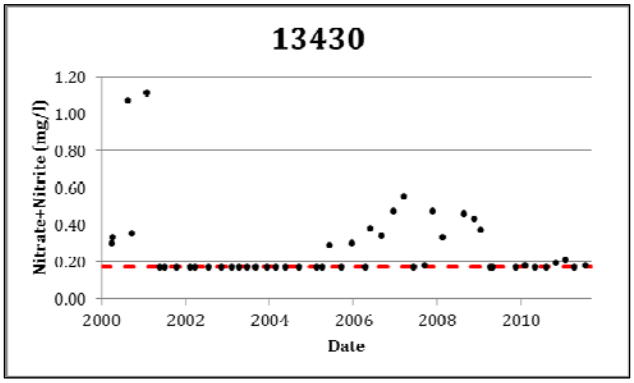

The high ammonia levels are most likely related to industrial discharges.

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | **CS** | **26** | **<3** | **21.2** | **5.19** | **7** | **5** |




There is minimal plant life in and around the harbor, so the reason for this chlorophyll-*a* concern in unknown.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | **CS** | **27** | **<0.17** | **0.55** | **0.17** | **13** | **13** |




The high nitrates levels are most likely related to industrial discharges.

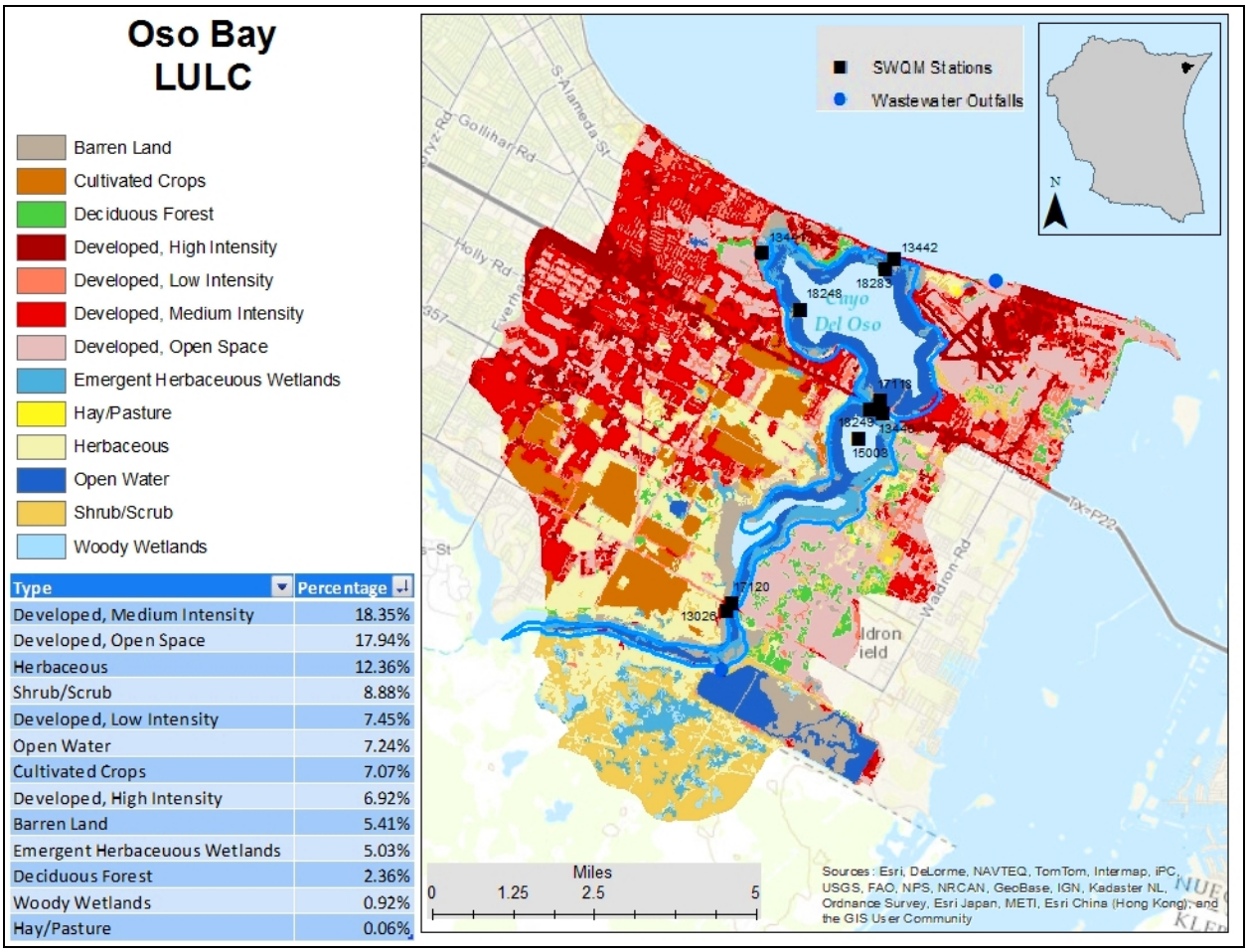
| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 26 | <0.06 | 0.34 | 0.1 | 1 | 1 |

### Fish Consumption Use

The harbor has no concerns for bioaccumulation of toxics in water for fish consumption use.

# OSO BAY WATERSHED– SEGMENT 2485

The 2,194 acre segment is in Nueces County and is divided into three AUs.




| Type | Percentage |
|---|---|
| Developed, Medium Intensity | 18.35% |
| Developed, Open Space | 17.94% |
| Herbaceous | 12.36% |
| Shrub/Scrub | 8.88% |
| Developed, Low Intensity | 7.45% |
| Open Water | 7.24% |
| Cultivated Crops | 7.07% |
| Developed, High Intensity | 6.92% |
| Barren Land | 5.41% |
| Emergent Herbaceuous Wetlands | 5.03% |
| Deciduous Forest | 2.36% |
| Woody Wetlands | 0.92% |
| Hay/Pasture | 0.06% |

| | |
|---|---|
| **Drainage area** | 29,661 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Corpus Christi |
| **Counties** | Nueces |
| **EcoRegions** | Laguna Madre Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 33” - 35”; Low: 64° F - 66° F; High: 79°F - 80° F |
| **Water Body Uses** | Aquatic Life, General, Recreation, Oyster Waters |
| **Permitted WWTFs** | WQ0001490-000 – AEP Texas Central Barney M. Davis Plant: 540,000,000 gpd<br>WQ0003646-000 – Texas A&M University System La Coss Facility Corpus Christi: 900,000 gpd<br>WQ0010401-004 – City of Corpus Christi Oso Facility: 16,200,000 gpd |

## Special Studies

Oso Bay was the subject of a TMDL and DO study as described in the Bays and Estuaries write up on Page 141.

## Water Quality Analysis

**AU_01** is from the upper bay from Holly Road to Cimarron Blvd. **AU_02** is the middle bay from SH 358 to Holly Road. **AU_03** is lower bay from Ocean Drive to SH 358.

The analysis for AU_01 is based on data from **Station 17120**, located at the Yorktown bridge in Corpus Christi, from 2003 – 2005. There is insufficient data for trend analysis. There are currently no active monitoring sites in this AU.


Station 13440

Except for 24-Hr DO, the analysis for AU_02 is based on data from **Station 13440**, located at east side of SH 358 in Corpus Christi. Trend analysis was conducted on data from January 2000 through September 2011. NRA is responsible for routine quarterly monitoring at this site. Data from **Station 17119**, located at the railroad bridge near Holly Road in Corpus Christi, was used for the 24-Hr DO analysis.

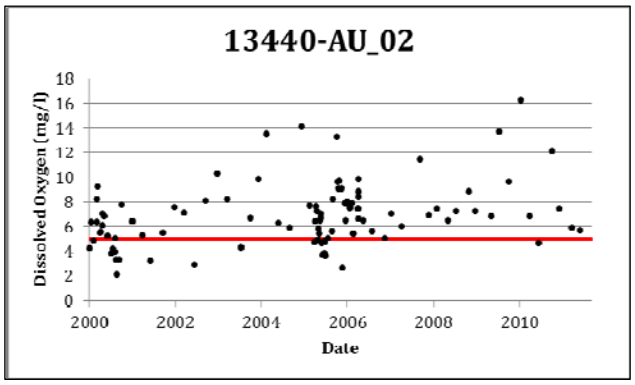
The analysis for AU_03 is based on data from **Station 13442**, located at the east crossing of Ocean Drive in Corpus Christi. Routine monitoring at this site ended in 2006, so there is insufficient data for trend analysis. There are currently no active monitoring sites in this AU.

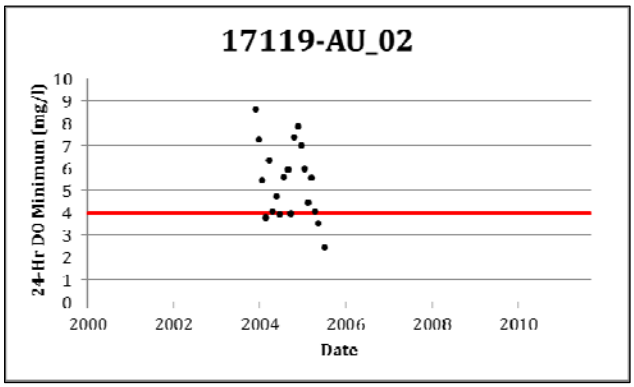
There is a **low DO screening level concern** and **a 24-Hr DO minimum impairment** for AU_02. There is a **chlorophyll-a concern** for the entire segment and a **total phosphorus concern** for AU_02 and AU_03.

The watershed for the bay is almost entirely within the Corpus Christi city limits. It includes the Corpus Christi Naval Air Station and receives water from the Laguna Madre (Segment 2491) via discharge from the Barney Davis Power Plant. There is a large area of wetland on the southern end of the watershed. The northwest area of the bay, known as the Blind Oso, receives the discharge of the City of Corpus Christi Oso WWTF.

### Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 4.0 mg/l | FS | 16 | 5.3 | 10.4 | 6.7 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 4.0 mg/l | FS | 20 | 3.6 | 8.4 | 5.8 | 1 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 5.1 | 9.6 | 6.9 | NA | 0 |
| AU-02 | Minimum 4.0 mg/l | FS | **62** | **2.6** | **16.2** | **7.0** | **4** | **10** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 4.0 mg/l | **NS** | **20** | **2.4** | **8.6** | **5.5** | **5** | **NA** |
| | 24-Hr Average 5.0 mg/l | FS | | 4.9 | 9.3 | 7.1 | NA | 2 |
| AU-03 | Minimum 4.0 mg/l | FS | 50 | 4.6 | 11.9 | 7.1 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 4.0 mg/l | FS | 19 | 4.2 | 9.1 | 6.0 | 0 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 6.0 | 10.3 | 7.6 | NA | 0 |




The *Water Quality and Biological Characterization of Oso Creek & Oso Bay, Corpus Christi, Texas* report, a result of the TMDL studies, states: "Regarding depressed DO conditions; clearly, the shallow nature of this bay system plays alarge part in the naturally occurring fluctuations of this important aquatic life parameter. Analysis of the data shows wide diurnal fluctuations that are common and expected in such a shallow, warm water, highly saline system typical of South Texas. While the exceptional habitat designation for Oso Bay may be justified, it is clear that the natural hydrodynamics of this system, coupled with the nutrient loadings from the Oso Bay WWTF, play a critical part in DO levels occurring in this bay system."

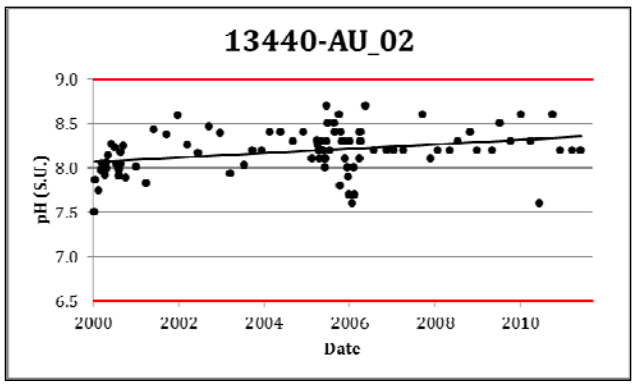
## Recreation Use

| Enterococcus | | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|---|
| AU-02 | Geomean | FS | 62 | <1 | 1,400 | 14,48 | 7 | 12 |
| AU-03 | 35 cfu/100 ml | FS | 34 | <1 | 11,550 | 18.15 | 2 | 9 |

## General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU-01 | 35 °C | FS | 16 | 11.3 | 32.3 | 24.3 | 0 |
| AU-02 | | FS | 62 | 8.3 | 34.7 | 26.6 | 0 |
| AU-03 | | FS | 50 | 9.2 | 32.2 | 27.6 | 0 |

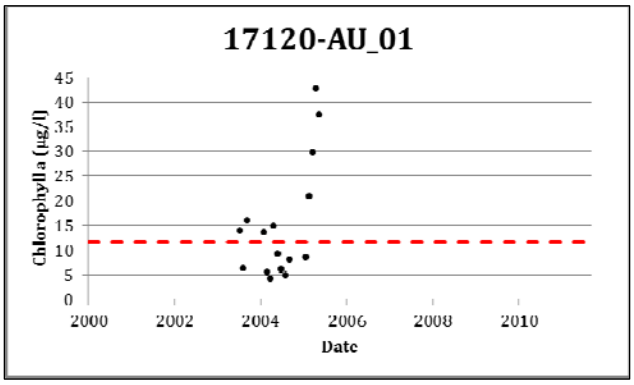
| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 16 | 7.8 | 8.5 | 8.0 | 0 | 0 |
| AU-02 | | FS | 62 | 7.6 | 8.7 | 8.2 | 0 | 0 |
| AU-03 | | FS | 50 | 7.7 | 8.6 | 8.1 | 0 | 0 |

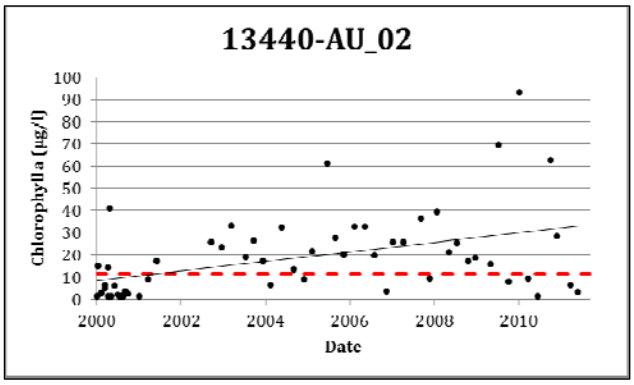


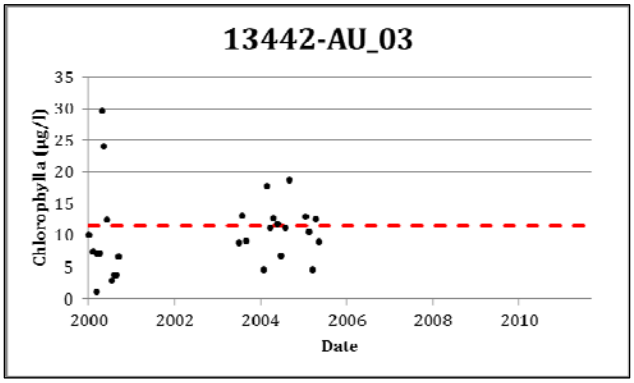

Statistical analysis indicates that there is an increasing trend in pH values in AU_02 with a **t-stat of 3.33** and a **p-value of 0.00.** There is no obvious reason for this trend. However, the values are well within the pH range and not a concern at this time.

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.1 mg/l | NC | 16 | <0.02 | 0.14 | 0.03 | 3 | 2 |
| AU-02 | | NC | 28 | <0.02 | 0.285 | 0.02 | 15 | 2 |
| AU-03 | | NC | 14 | <0.02 | 0.12 | 0.02 | 7 | 1 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 11.6 µg/l | **CS** | **16** | **4.2** | **42.7** | **11.4** | **0** | **8** |
| AU-02 | | **CS** | **28** | **<2** | **92.9** | **20.7** | **1** | **21** |
| AU-03 | | **CS** | **12** | **4.5** | **18.7** | **11.5** | **0** | **6** |



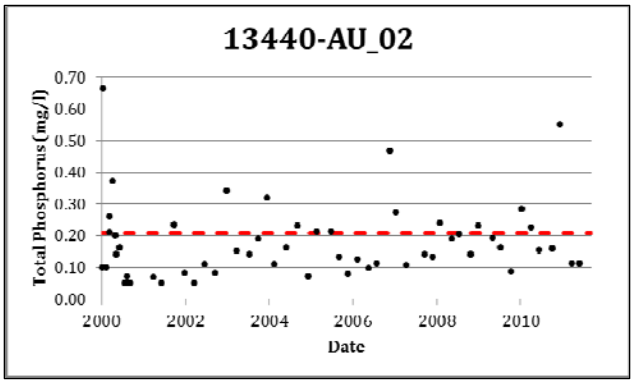



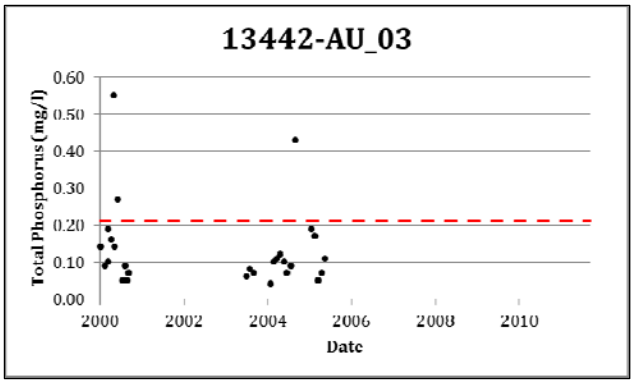




In addition to concerns in all three AUs, statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values in AU_02 with a **t-stat of 3.54** and a **p-value of 0.00.** The high chlorophyll-*a* values are most likely related to the shallow nature of the bay and DO fluctuations.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.17 mg/l | NC | 16 | <0.04 | 0.91 | 0.04 | 9 | 3 |
| AU-02 | | NC | 28 | <0.02 | 6.3 | 0.02 | 24 | 2 |
| AU-03 | | NC | 13 | <0.02 | 0.19 | 0.02 | 9 | 1 |

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.21 mg/l | NC | 16 | <0.06 | 0.7 | 0.14 | 2 | 4 |
| AU-02 | | **CS** | **28** | **0.071** | **0.466** | **0.161** | **0** | **10** |
| AU-03 | | **CS** | **13** | **0.04** | **0.43** | **0.1** | **0** | **1** |

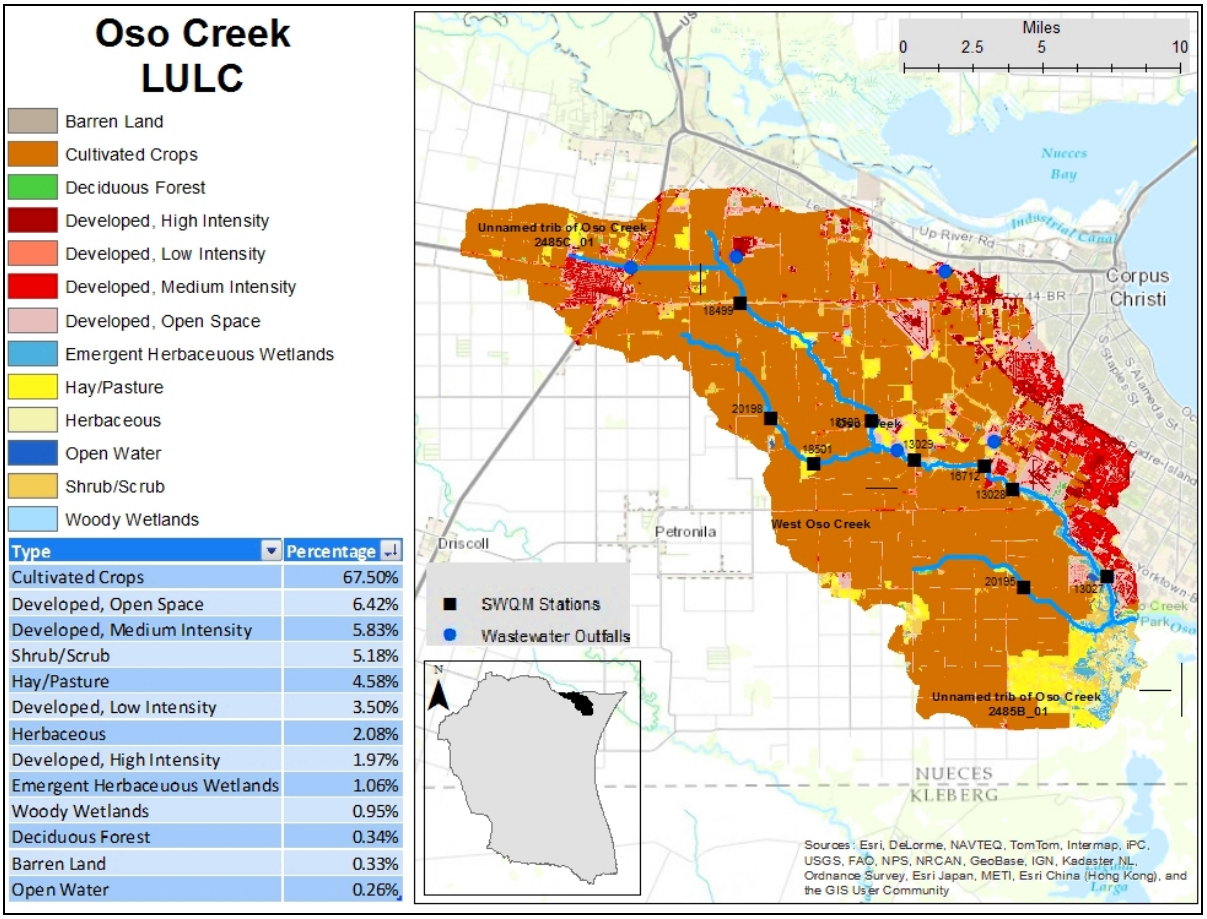



The phosphorus levels in AU_02 could be related to the WWTF discharges. In this instance, the data analysis for AU_03 does not support the 2012 IR finding of a concern for total phosphorus in this AU. However, data from multiple stations were used for the official assessment, which resulted in the concern.

# OSO CREEK WATERSHED– SEGMENT 2485A

The 30 mile segment is within Nueces County and extends from the Oso Bay confluence to a point 4.8 km upstream of SH 44 and is a single AU.




| Type | Percentage |
|---|---|
| Cultivated Crops | 67.50% |
| Developed, Open Space | 6.42% |
| Developed, Medium Intensity | 5.83% |
| Shrub/Scrub | 5.18% |
| Hay/Pasture | 4.58% |
| Developed, Low Intensity | 3.50% |
| Herbaceous | 2.08% |
| Developed, High Intensity | 1.97% |
| Emergent Herbaceuous Wetlands | 1.06% |
| Woody Wetlands | 0.95% |
| Deciduous Forest | 0.34% |
| Barren Land | 0.33% |
| Open Water | 0.26% |

| | |
|---|---|
| **Drainage area** | 118,380 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Corpus Christi, Robstown |
| **Counties** | Nueces |
| **EcoRegions** | Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 31” - 33”; Low: 61° F - 64° F; High: 79°F - 81° F |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0002075-000 – Equistar Chemicals LP – Corpus Christi Plant: storm water<br>WQ0004752-000 – Mineral Processing & Marketing, Inc.: 15,700 gpd via evaporation<br>WQ0004900-000 – United Casing, Inc.: storm water<br>WQ0010261-001 – City of Robstown: 3,000,000 gpd via unnamed ditch<br>WQ0010401-003 – City of Corpus Christi – Greenwood Plant: 16,000,000 gpd via La Volla Creek<br>WQ0011134-001 – Corpus Christi Peoples Baptist Church: 20,000 gpd directly to Oso Creek.<br>WQ0014228-001 – MPB Properties, L.L.C and Corpus Christi People’s Baptist Church: 60,000 gpd |

## Special Studies

Oso Creek was the subject of a TMDL study as described in the Bays and Estuaries write up on Page 141.

## Water Quality Analysis

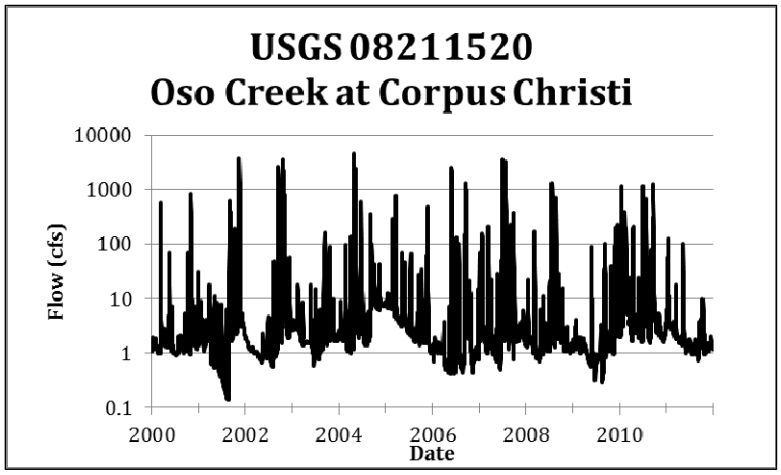
Analysis for AU_02 is based on data from **Station 13028**, located at SH 286 in Corpus Christi. Trend analysis was conducted on data from January 2000 through September 2011. NRA is responsible for routine quarterly monitoring at this site.


There are **low DO screening level, chlorophyll-a, nitrate,** and **total phosphorus concerns** and **a bacteria impairment** for the segment.

The watershed is predominately croplands, but also includes Robstown and a portion of the City of Corpus Christi. The creek is effluent dominant with discharge from Robstown and the City of Corpus Christi Greenwood WWTF.

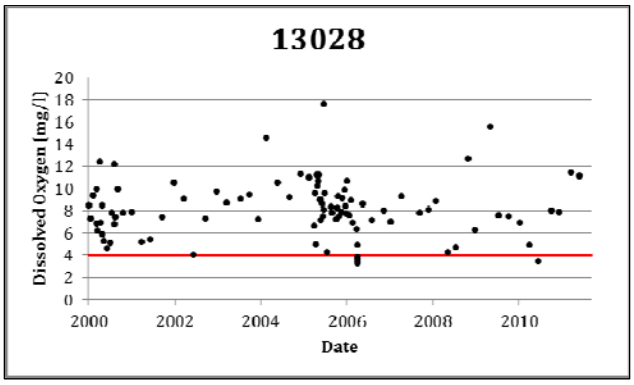
The USGS flow gauge at Oso Creek at Corpus Christi is located at the same location as Station 13029 at FM 763 which is upstream of Station 13028. The annual mean flows are:

2000 – 11.6 cfs
2001 – 29.5 cfs
2002 – 59.2 cfs
2003 – 6.1 cfs
2004 – 45.1 cfs
2005 – 13.2 cfs
2006 – 31.2 cfs
2007 – 78.1 cfs
2008 – 18.2 cfs
2009 – 6.8 cfs
2010 – 45.1 cfs
2011 – 3.7 cfs




## Aquatic Life Use Assessment

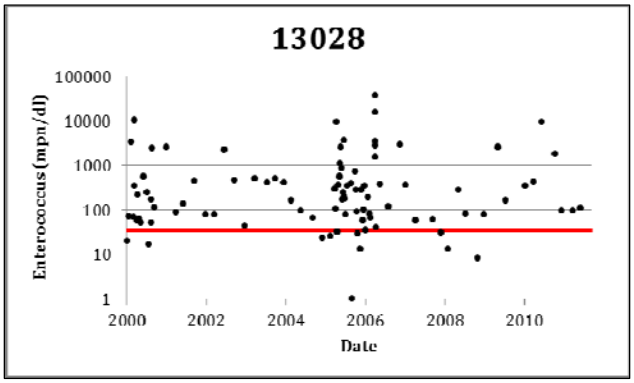
| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | **62** | **3.3** | **17.6** | **8.0** | **0** | **5** |
| Screening Level 4.0 mg/l | **CS** | | | | | | |




The low DO concern is based on data collected for the TMDL in 2005 – 2006 at several other locations along the creek. Station 13028 is located towards the downstream end of the segment where low DO does not seem to be an issue.

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | NS | 61 | 1 | 38,500 | 228.74 | 0 | 41 |

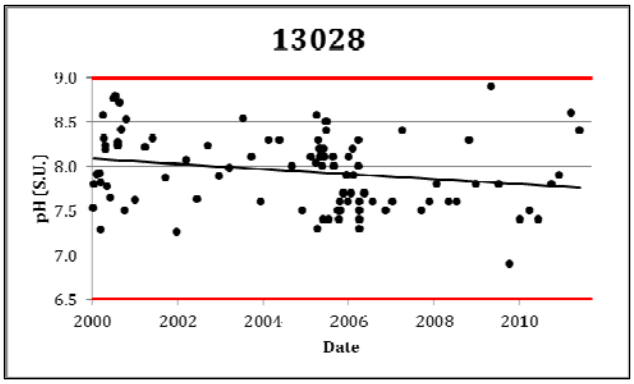



The creek is effluent dominated and would be intermittent or ephemeral if not for the wastewater discharges. Another bacteria source, and probably the major source, is from wildlife. After rains, the fields around the creek are often covered with birds.

## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | NA | 62 | 12.3 | 33.9 | 26.5 | 0 |

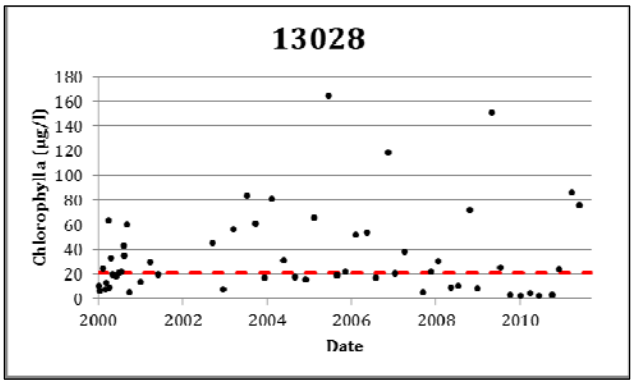
| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | NA | 62 | 6.9 | 9.1 | 7.8 | 0 | 1 |




Statistical analysis indicates that there is a decreasing trend in pH values with a **t-stat of -2.05** and a **p-value of 0.04.** There is no obvious reason for this trend. However, the values are within the pH range and not a concern at this time.

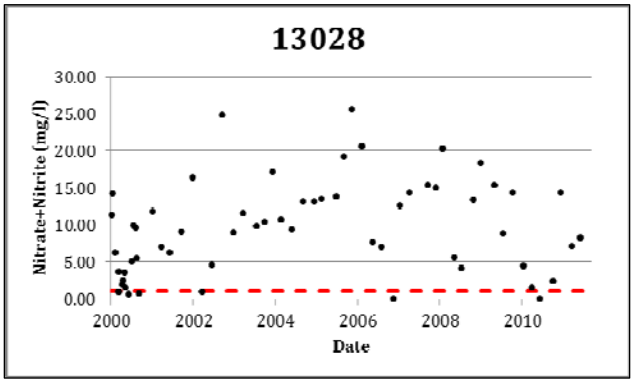
| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 28 | <0.02 | 2.47 | 0.062 | 8 | 2 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >21 |
|---|---|---|---|---|---|---|---|
| 21 µg/l | CS | 28 | <2 | 164 | 20.8 | 2 | 14 |



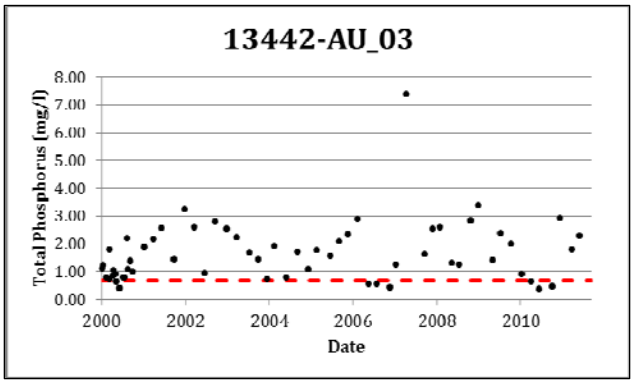

The high chlorophyll-a values are most likely related to the high nitrate levels and the occurrence of algal blooms.

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | CS | 28 | <0.02 | 25.6 | 13.25 | 1 | 26 |




The source of the high nitrate levels are possibly related to WWTF discharges and agricultural runoff.

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | CS | 28 | 0.363 | 7.37 | 1.585 | 0 | 23 |




The source of the high nitrate levels are possibly related to WWTF discharges and agricultural runoff.

# UNNAMED TRIBUTARY TO OSO CREEK– SEGMENT 2485B

The 8 mile segment is within Nueces County and extends from the Oso Creek confluence to a point 5.2 km west of SH 286 and is a single AU. The location is included in the map for Oso Creek, Segment 2485A.

| | |
|---|---|
| **Water Body Uses** | General |
| **Permitted WWTFs** | None |

## Special Studies

The Unnamed Tributary was included in the Oso Bay / Oso Creek TMDL as described in the Bays and Estuaries write up on Page 141.

## Water Quality Analysis

The analysis is based on data from **Station 20195**, located at FM 2444 south of Corpus Christi. The data were collected for the Oso Creek TMDL in 2006 – 2008, so there is insufficient data for trend analysis. There are no active monitoring sites on this segment.

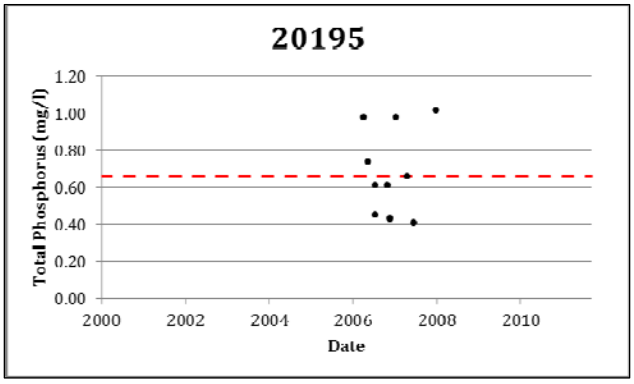
## General Use

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | NA | 10 | 6.5 | 8.2 | 6.9 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 10 | <0.02 | 0.17 | 0.02 | 3 | 0 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | NC | 10 | <0.06 | 1.37 | 0.235 | 1 | 1 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66/l | **CS** | **10** | **0.41** | **1.02** | **0.635** | **0** | **4** |




The source of the high nitrate levels are possibly related to agricultural runoff.

# WEST OSO CREEK – SEGMENT 2485D

The 9 mile segment is within Nueces County and extends from the Oso Creek confluence to a point 0.5 km west of FM 1694 and is a single AU. The location is included in the map for Oso Creek, Segment 2485A.

| | |
|---|---|
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | None |

## Special Studies

West Oso Creek was included in the Oso Bay / Oso Creek TMDL as described in the Bays and Estuaries write up on Page 141.

## Water Quality Analysis

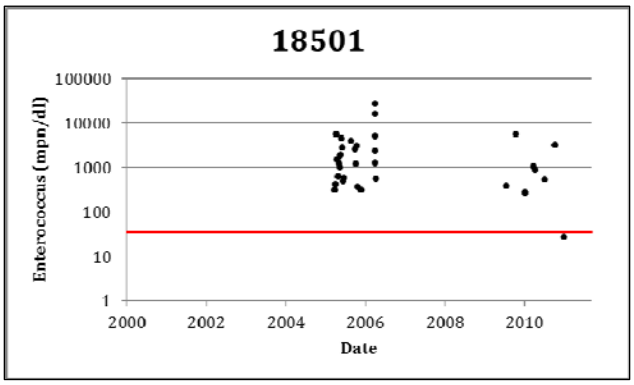
The analysis is based on data from **Station 18501**, located at FM 665, (water temperature, DO, pH, and Enterococcus) and **Station 20198**, located at Nueces CR 30, (ammonia, nitrates, and total phosphorus). The data were collected for the Oso Creek TMDL in 2006 – 2008, so there is insufficient data for trend analysis. TAMUCC is currently conducting routine monitoring at Station 18501.

## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | NA | 28 | 1.7 | 12.4 | 4.0 | 4 | 13 |
| Screening Level 4.0 mg/l | NA | | | | | | |

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | NA | 31 | 270 | 26,500 | 1408.35 | 0 | 33 |




The 2012 IR does not list Enterococcus as an impairment due to the very limited time period over which the data were collected. The source is possibly related to the abundance of wildlife after rain events and the subsequent runoff.

## General Use

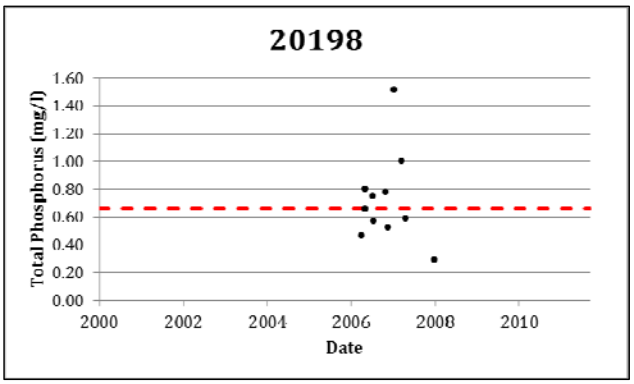
| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | NA | 31 | 8.5 | 32.0 | 25.3 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | NA | 31 | 7.3 | 8.4 | 7.8 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 11 | <0.02 | 0.39 | 0.04 | 2 | 0 |

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | NC | 11 | 0.22 | 3.26 | 0.71 | 0 | 3 |

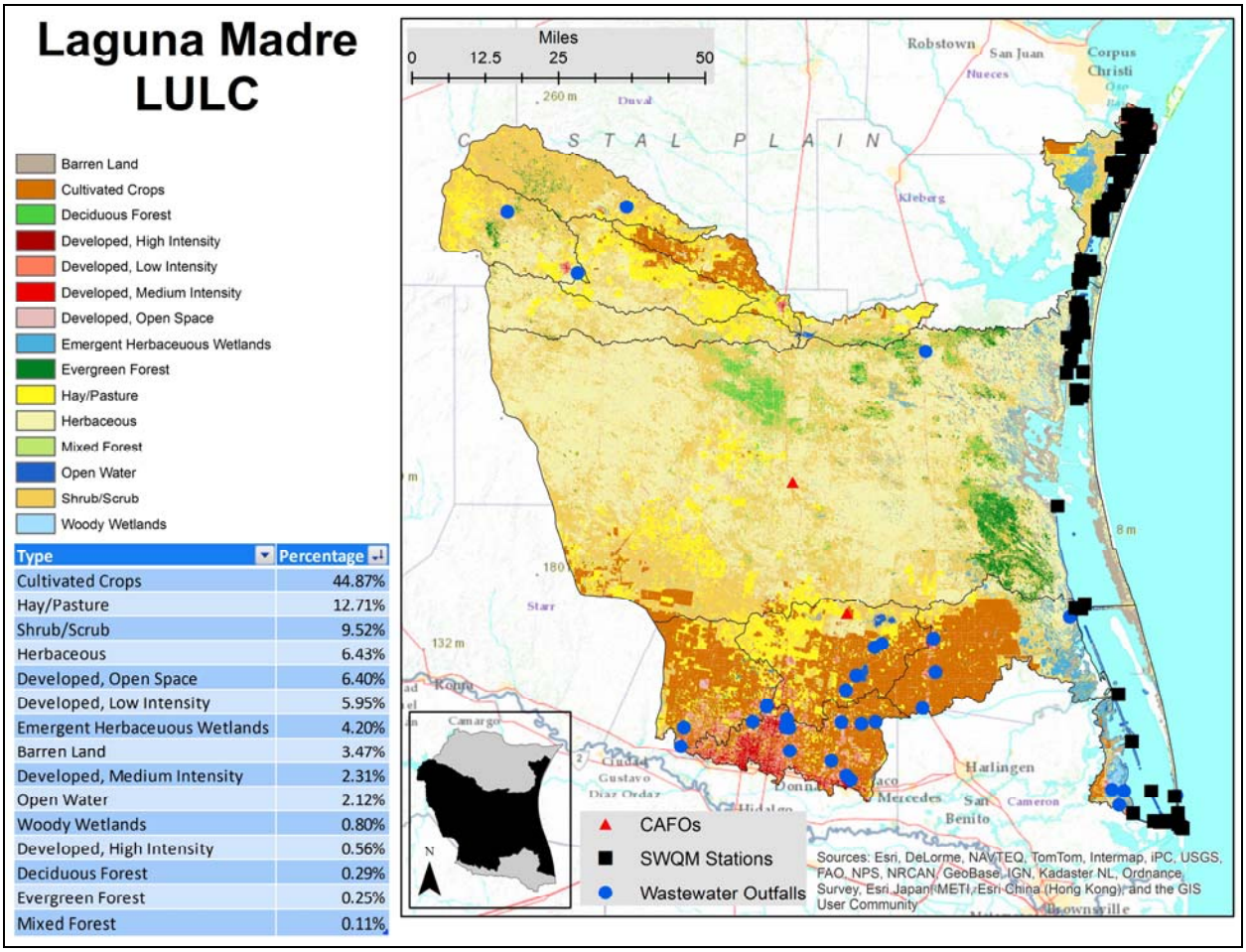
| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | NC | 11 | 0.29 | 1.52 | 0.66 | 0 | 3 |




The source of the high nitrate levels are possibly related to agricultural runoff.

# LAGUNA MADRE WATERSHED– SEGMENT 2491

The 89,511 acre segment extends from its confluence with Corpus Christi Bay in Nueces County the Port Isabel Causeway in Cameron County and is divided into three AUs.




| Type | Percentage |
|---|---|
| Cultivated Crops | 44.87% |
| Hay/Pasture | 12.71% |
| Shrub/Scrub | 9.52% |
| Herbaceous | 6.43% |
| Developed, Open Space | 6.40% |
| Developed, Low Intensity | 5.95% |
| Emergent Herbaceuous Wetlands | 4.20% |
| Barren Land | 3.47% |
| Developed, Medium Intensity | 2.31% |
| Open Water | 2.12% |
| Woody Wetlands | 0.80% |
| Developed, High Intensity | 0.56% |
| Deciduous Forest | 0.29% |
| Evergreen Forest | 0.25% |
| Mixed Forest | 0.11% |

| | |
|---|---|
| **Drainage area** | 4,222,224 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Alton, Corpus Christi, Donna, Edcouch, Edinburg, Elsa, Falfurrias, La Villa, Lyford, McAllen, Mercedes, Palmhurst, Raymondville, San Perlita, Weslaco |
| **Counties** | Brooks, Cameron, Duval, Hidalgo, Jim Hogg, Jim Wells, Kenedy, Kleberg, Nueces, Starr, Webb, Willacy |
| **EcoRegions** | Coastal Sand Plain, Laguna Madre Barrier Islands and Coastal Marshes, Lower Rio Grande Valley, Southern Subhumid Gulf Coastal Prairies |
| **Climate Annual Averages** | Rain: 21” - 35”; Low: 58° F - 66° F; High: 79°F - 84° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters, Recreational Beaches |

| | |
|---|---|
| **Permitted WWTFs** | WQ0001752-000 – Rio Grande Valley Sugar Growers: 289,000 gpd via North Floodway Pilot Channel<br>WQ0002525-000 – Azteca Milling: 300,000 gpd via irrigation<br>WQ0002803-000 – Value Frozen Foods: 6.9 acre feet/acre/year via irrigation<br>WQ0003946-000 – Harlingen Shrimp Farms, LTD: 8,000,000 gpd via tidal ditch<br>WQ0004040-000 – Calpine Construction Finance: 1,110,000 gpd via North Floodway Pilot Channel<br>WQ0004054-000 – Loma Alta Trust (Loma Alta Aquaculture): 8,200,000 gpd via Hidalgo County Drainage Ditch<br>WQ0004138-000 – Calpine Hidalgo Energy Center: 920,000 gpd via North Floodway Pilot Channel<br>WQ0004480-000 – North Alamo WSC: 1,000,000 gpd via East Main Drain<br>WQ0004758-000 – P.E.N. Joint Tenants and North Cameron Regional WSC: 2,000,000 gpd: via North Floodway<br>WQ0004782-000 – North Alamo WSC: 2,000,000 gpd via Donna Drain<br>WQ0004789-000 – North Alamo WSC: 2,000,000 gpd via Donna<br>WQ0010330-001 – City of Santa Rosa: 390,000 gpd via North Floodway<br>WQ0010365-001 – City of Raymondville: 1,500,000 gpd via Delta Irrigation Ditch<br>WQ0010401-008 – City of Corpus Christi Laguna Madre: 3,000,000 gpd via pipeline<br>WQ0010401-009 – City of Corpus Christi Whitecap: 2,500,000 gpd<br>WQ0010503-002 – City of Edinburg: 5,900,000 gpd via North Floodway<br>WQ0010619-001 – City of Weslaco: 250,000 gpd via North Floodway<br>WQ0010619-003 – City of Weslaco: 3,000,000 gpd via North Floodway<br>WQ0010633-004 – City of McAllen: 15,000,000 gpd via North Floodway<br>WQ0010682-003 – Willacy Co. Navigation District: 221,000 gpd via Four Mile Slough<br>WQ0010757-001 – Laguna Madre Water District Isla Blanca Plant: 2,600,000 gpd via irrigation<br>WQ0010799-001 – Jim Hogg County WCID No. 2 (Hebbronville Plant): 796,000 gpd: via drainage ditch<br>WQ0010973-001 – County of Hidalgo Delta Lake Park: 5,000 gpd via Willacy WCID Ditch No.<br>WQ0011210-001 – City of Lyford: 270,000 gpd via North Floodway<br>WQ0011510-002 – City of Elsa: 800,000 gpd via via North Floodway<br>WQ0012321-001 – U.S. Department of Homeland Security Immigration and Customs Enforcement: 160,000 gpd via Cameron County WCID No. 11 Drainage Ditch<br>WQ0012854-001 – Hidalgo County MUD: 500,000 gpd<br>WQ0013344-002 – US Department of the Interior: 25,000 gpd via wetland<br>WQ0013742-001 – Sebastian MUD: 225,000 gpd via North Floodway<br>WQ0013747-001 – North Alamo WSC: 100,000 gpd via drainage ditches<br>WQ0013747-002 – North Alamo WSC: 210,000 gpd via surface irrigation<br>WQ0013747-003 – North Alamo WSC: 122,000 gpd via surface irrigation<br>WQ0013747-004 – North Alamo WSC: 300,000 gpd via drainage<br>WQ0013772-001 – Laguna Madre Water District Andy Bowie Park Plant: 1,500,000 gpd via wetland<br>WQ0014069-001 – Laguna Madre Water District Laguna WWTP: 650,000 gpd via City of Port Isabel Reservoir<br>WQ0014076-001 – City of San Perlita: 100,000 gpd via evaporation and percolation<br>WQ0014398-002 – Edinburg Consolidated ISD & City of Edinburg – 12,000 gpd via subsurface drip irrigation system<br>WQ0014698-001 – TxDOT: 13,000 gpd via drainage ditches<br>WQ0014781-002 –City of La Villa: 399,000 gpd via North Floodway<br>WQ0014810-001 –City of Edcouch: 3100,000 gpd via North Floodway Pilot Channel<br>WQ0014919-001 – City of Edcouch: 310,000 gpd via North Floodway Pilot Channel |

## Special Studies

The Laguna Madre was the subject of a DO study as described in the Bays and Estuaries write up on Page 141.

## Water Quality Analysis

**AU_01** is the upper portion of the bay north of the Arroyo Colorado confluence. **AU_02** is the area adjacent to the Arroyo Colorado confluence. **AU_03** is lower portion of the bay south of the Arroyo Colorado confluence.

Analysis for AU_01 is based on data from **Station 13445**, located in the ICWW at Bird Island Basin. Trend analysis was conducted on data from February 2000 through December 2011. TCEQ is responsible for routine quarterly monitoring at this site.

Analysis for AU_02 is based on data from **Station 13447**, located in the intersection of ICWW and the Arroyo Colorado. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

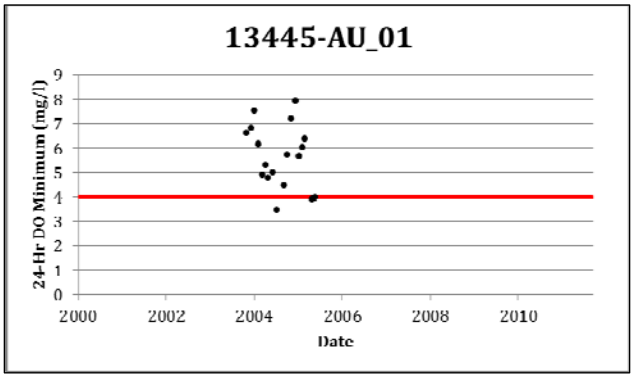
Analysis for AU_03 is based on data from **Station 13446**, located in the ICWW at CM 129. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

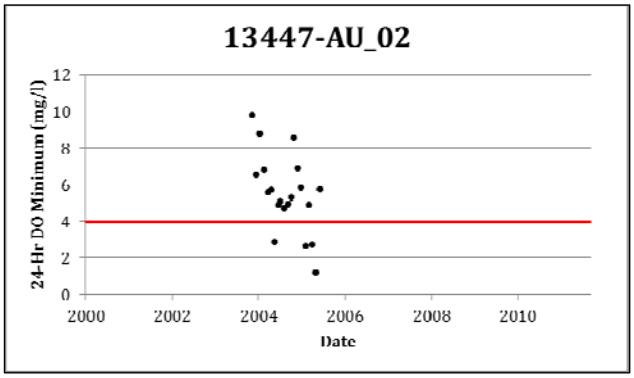
There are **24-Hr DO minimum impairments** for AU-01 and AU_02 and a **low DO screening level concern** in AU_03. There is a **bacteria impairment** for AU_02. There are **chlorophyll-*a* concerns** for AU-01 and AU_02 and a **nitrate concern** for AU_02.

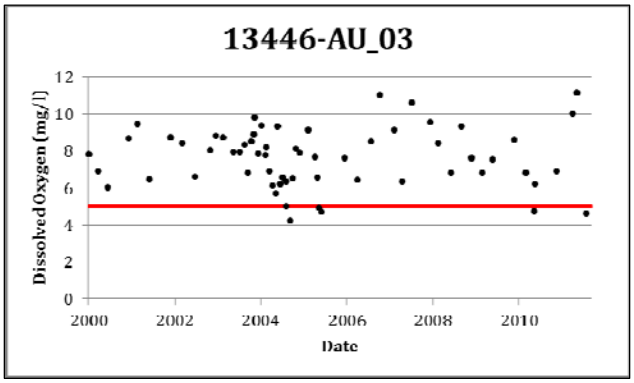
The eastern shore of this segment is Padre Island, a large portion of which is within the Padre Island National Seashore. The watershed for the Upper Laguna is the Flour Bluff and the Island areas of Corpus Christi. The watershed for the middle area runs along the King Ranch many miles inland. Brush is the primary land cover in this area. The southern area is dominated by the Valley croplands and population centers. It is influenced by its proximity to the confluences of the North Floodway and the Arroyo Colorado (Segment 2201).

## Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Minimum 4.0 mg/l | FS | 42 | 4.9 | 10.2 | 7.2 | 0 | 2 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 4.0 mg/l | **NS** | **18** | **3.5** | **7.9** | **5,7** | **3** | **NA** |
| | 24-Hr Average 5.0 mg/l | FS | | 5.8 | 9.1 | 7.2 | NA | 0 |
| AU-02 | Minimum 4.0 mg/l | FS | 40 | 1.1 | 14.1 | 7.7 | 2 | 3 |
| | Screening Level 5.0 mg/l | NC | | | | | | |
| | 24-Hr Minimum 4.0 mg/l | **NS** | **20** | **1.2** | **9.8** | **5.4** | **4** | **NA** |
| | 24-Hr Average 5.0 mg/l | FS | | 4.4 | 11.9 | 7.1 | NA | 1 |
| AU-03 | Minimum 4.0 mg/l | FS | **41** | **4.2** | **11.0** | **7.6** | **0** | **4** |
| | Screening Level 5.0 mg/l | **CS** | | | | | | |
| | 24-Hr Minimum 4.0 mg/l | FS | 19 | 3.7 | 7.8 | 5.4 | 1 | NA |
| | 24-Hr Average 5.0 mg/l | FS | | 5.5 | 9.2 | 7.2 | NA | 0 |



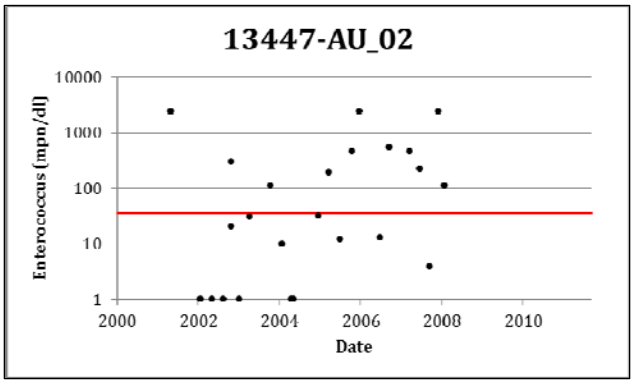

Additional 24-Hr data from several other monitoring sites were combined with the data for Station 13445, which resulted in the NS designation for 24-Hr DO minimum in AU_01.

Additional DO data from several other monitoring sites were combined with the data for Station 13446, which resulted in the CS designation for DO screening level in AU_03.

The *Oso Bay and Laguna Madre Total Maximum Daily Load Project – Phase III and IV Data Report* states: "High emphasis remains on the fact that the relatively shallow, warm water, high salinity bays, typical of South Texas, exert a strong influence on DO, and that collectively all these factors produce water quality conditions that often lead to wide diurnal fluctuations and depressed DO levels. However, these depressed DO levels are often common and routinely expected in such shallow (**physical**), warm water, highly saline (**chemical**) systems and are not necessarily indicative of "impaired" water quality as the biota (**biological**) of the systems are well adapted to dramatically changing conditions."

## Recreation Use

| Enterococcus | | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | Geomean 35 cfu/100 ml | FS | 24 | <10 | 1,600 | 15.70 | 19 | 2 |
| AU-02 | | **NS** | **15** | **<1** | **>2,400** | **61.18** | **3** | **8** |
| AU-03 | | FS | 17 | <1 | 317 | 18.88 | 3 | 3 |




Sampling for Enterococcus ended in 2008 in AU_02 and AU_03 by TCEQ Region15 due to complications meeting the the National Environmental Laboratory Accreditation Conference (NELAC) certification and holding time requirements. The Arroyo Colorado, which flows into the Laguna Madre in this AU, is possibly a primary source of high bacteria levels. Abundant wildlife is another likely source.

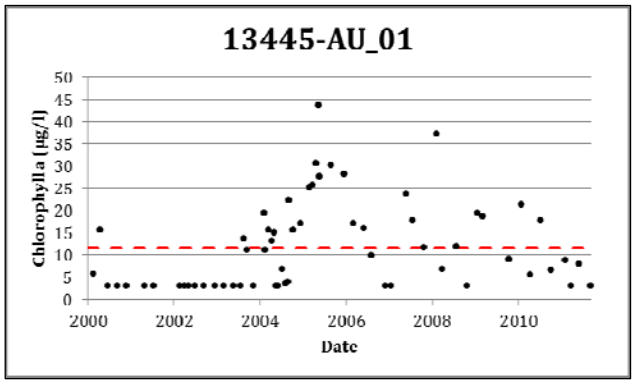
## General Use

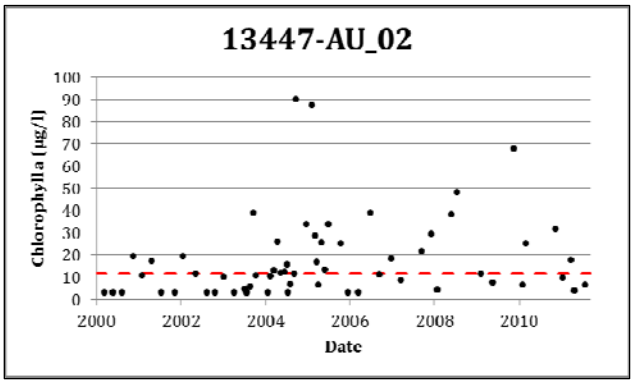
| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU-01 | 35 °C | FS | 42 | 13.3 | 31.6 | 26.8 | 0 |
| AU-02 | | FS | 42 | 10.8 | 31.4 | 26.2 | 0 |
| AU-03 | | FS | 44 | 12.6 | 30.6 | 24.1 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 6.5 – 9.0 su | FS | 41 | 7.8 | 8.5 | 8.2 | 0 | 0 |
| AU-02 | | FS | 42 | 7.7 | 8.7 | 8.2 | 0 | 0 |
| AU-03 | | FS | 44 | 7.6 | 8.6 | 8.0 | 0 | 0 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.1 mg/l | NC | 37 | <0.02 | 0.06 | 0.05 | 32 | 0 |
| AU-02 | | NC | 38 | <0.02 | 0.2 | 0.04 | 17 | 7 |
| AU-03 | | NC | 39 | <0.02 | 0.05 | 0.02 | 35 | 0 |

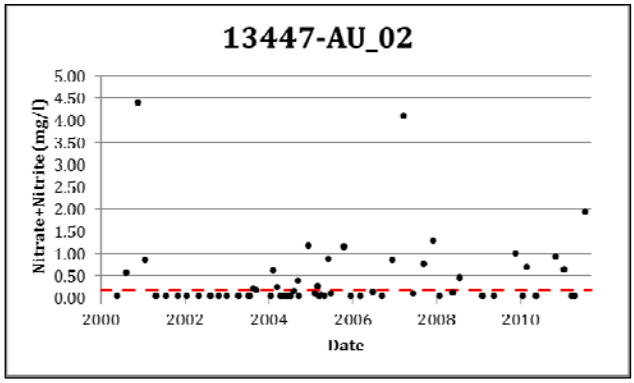
| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 11.6 µg/l | **CS** | **38** | **<3** | **43.8** | **15.8** | **5** | **25** |
| AU-02 | | **CS** | **36** | **<3** | **89.9** | **14.45** | **4** | **22** |
| AU-03 | | NC | 37 | <3 | 16.4 | 3 | 26 | 2 |




The high chlorophyll-*a* levels may be associated with high nitrates, again possibly a result of proximity to the Arroyo Colorado confluence.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.17 mg/l | NC | 39 | <0.02 | 1.25 | 0.04 | 38 | 1 |
| AU-02 | | **CS** | **38** | **<0.04** | **4.09** | **0.095** | **17** | **14** |
| AU-03 | | NC | 39 | <0.04 | 0.07 | 0.04 | 36 | 0 |




The high nitrate levels may be associated to the proximity of the Arroyo Colorado confluence. There are also a number of WWTFs that discharge to the Laguna Madre via the North Floodway.

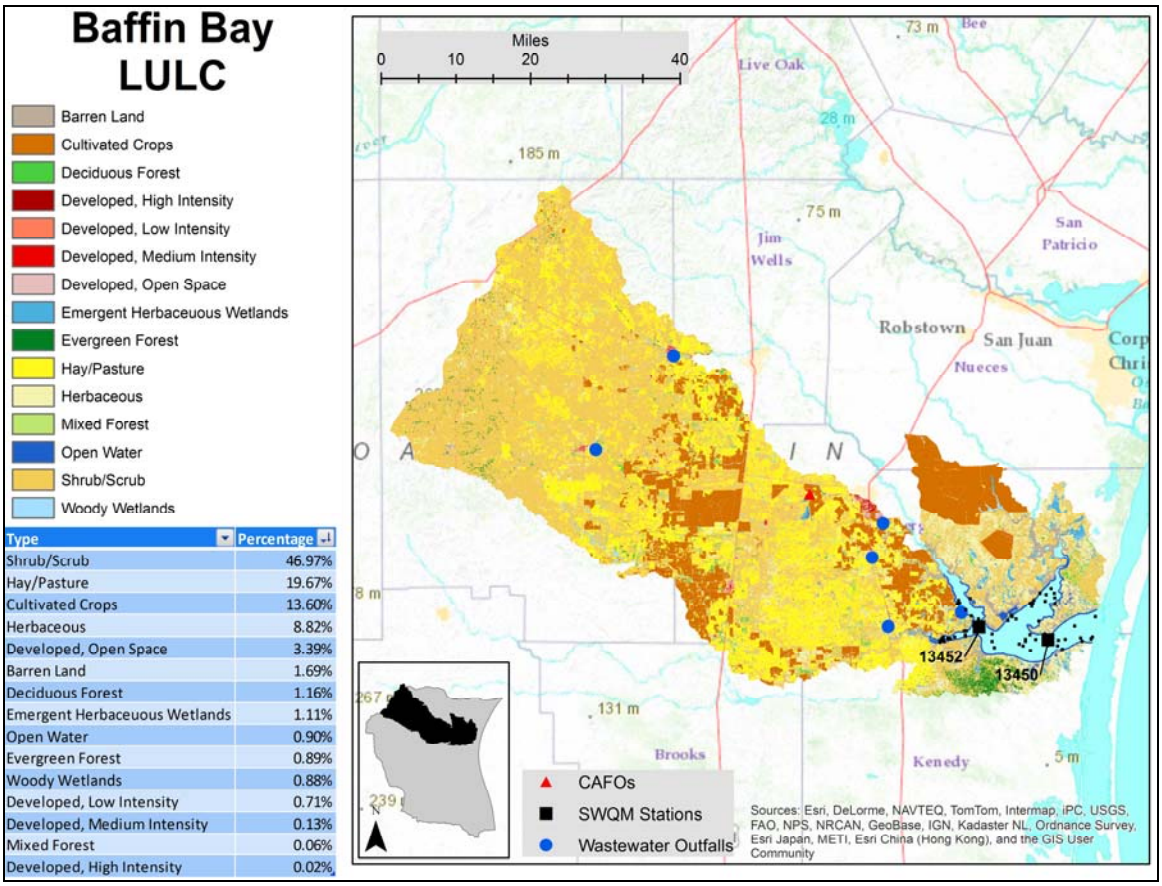
| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|---|
| AU-01 | 0.21 mg/l | NC | 37 | <0.02 | 0.24 | 0.06 | 18 | 1 |
| AU-02 | | NC | 37 | <0.05 | 0.5 | 0.12 | 3 | 8 |
| AU-03 | | NC | 37 | <0.03 | 0.19 | 0.05 | 27 | 0 |

**Oyster Waters Use** DSHS has listed the area adjacent to the Arroyo Colorado confluences as non-supporting for oyster waters use. The lower portion of the by south of the Port Mansfield channel is fully supporting.

**Recreational Beaches** The Upper Laguna Madre and Laguna Shores are fully supporting for contact recreation.

## BAFFIN BAY / ALAZAN BAY / CAYO DEL GRULLO / LAGUNA SALADA WATERSHED– SEGMENT 2492

The 65,025 acre segment is in Kenedy and Kleberg Counties and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 46.97% |
| Hay/Pasture | 19.67% |
| Cultivated Crops | 13.60% |
| Herbaceous | 8.82% |
| Developed, Open Space | 3.39% |
| Barren Land | 1.69% |
| Deciduous Forest | 1.16% |
| Emergent Herbaceuous Wetlands | 1.11% |
| Open Water | 0.90% |
| Evergreen Forest | 0.89% |
| Woody Wetlands | 0.88% |
| Developed, Low Intensity | 0.71% |
| Developed, Medium Intensity | 0.13% |
| Mixed Forest | 0.06% |
| Developed, High Intensity | 0.02% |

| | |
|---|---|
| **Drainage area** | 1,376,310 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Benavides, Kingsville, Premont, San Diego, |
| **Counties** | Brooks, Duval, Jim Wells, Kleberg, Kenedy, Nueces |
| **EcoRegions** | Coastal Sand Plain, Laguna Madre Barrier Islands and Coastal Marshes, Southern Subhumid Gulf Coastal Prairies, Texas-Tamaulipan Thornscrub |
| **Climate Annual Averages** | Rain: 25” - 33”; Low: 58° F - 65° F; High: 79°F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters, Fish Consumption, Recreational Beaches |
| **Permitted WWTFs** | WQ0004761-000 – El Paso Merchant Energy-Petroleum Company: 7,200 gpd via evaporation<br>WQ0010067-002 – Duval County Conservation and Reclamation District: 40,000 gpd via Los Olmos Creek<br>WQ0010084-001 – Utility Board of Falfurias: 460,000 gpd via surface irrigation<br>WQ0010253-001 – City of Premont: 350,000 gpd via surface irrigation<br>WQ0011515-001 – Riviera ISD: 16,000 gpd via surface irrigation<br>WQ0013361-001 – Sarita Sewer Service and WSC: 44,000 gpd via evaporation<br>WQ0013374-001 – Kleberg County Kaufer Hubert Memorial Park: 33,000 gpd via Cayo Del Grullo.<br>WQ0013374-002 – Riviera WCID: 60,000 gpd via Los Olmos Creek<br>WQ0013374-003 – County of Kleberg Ricardo WWTP: 48,500 gpd via Jaboncillos Creek<br>WQ0014808-001 – King Ranch Inc.: 25,500 gpd via evaporation |

## Special Studies

The Baffin Bay Group, comprised of area stakeholders and researchers, has formed to address concerns about the health of the bay, as described in the Bays and Estuaries write up on Page 141.

## Water Quality Analysis

The analysis is based on data from **Station 13450**, located mid-bay at CM 14. Trend analysis was conducted on data from February 2000 through December 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There is a **chlorophyll-*a* concern** for the bay.

The watershed of the bay extends many miles inland and is a mixture of brush pasture, and croplands. A portion of the City of Kingsville is within the watershed, but its WWTFs discharge to San Fernando Creek (Segment 2492A)

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 28 | 5.0 | 9.3 | 7.2 | 0 | 0 |
| Screening Level 4.0 mg/l | NC | | | | | | |

The bay is fully supporting / has no concerns for toxic substances in water for aquatic life use.

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 24 | <10 | 200 | 21.07 | 11 | 3 |

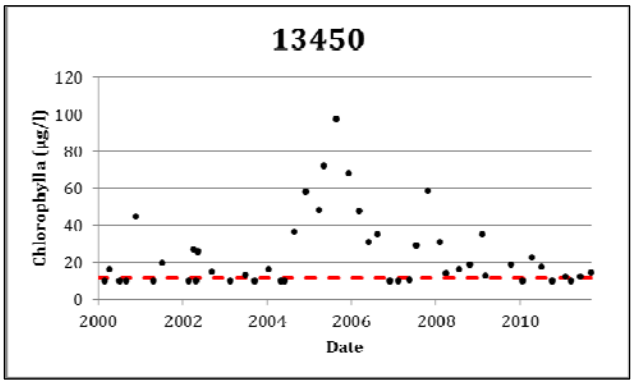
### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 28 | 14.0 | 31.2 | 26.4 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 27 | 7.8 | 8.4 | 8.2 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 26 | <0.05 | 0.27 | 0.05 | 25 | 1 |

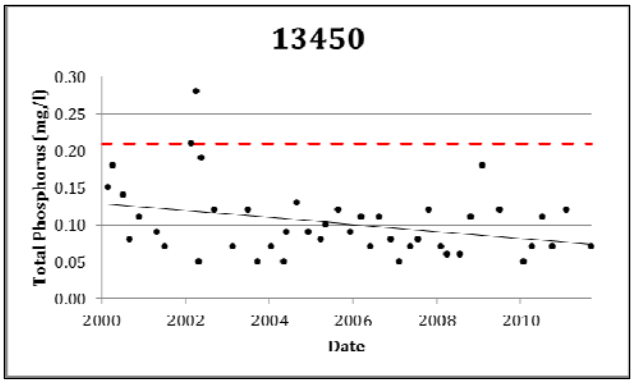
| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | **CS** | **27** | **5.3** | **97.5** | **22.8** | **5** | **21** |




Both San Fernando Creek and Petronila Creek, which flow into Baffin Bay via Cayo Del Grullo, and Alazan Bay, respectively, have high levels of chlorophyll-*a*. This, combined with limited circulation within the bay, may be contributing to these high levels.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 28 | <0.04 | 1.25 | 0.04 | 27 | 1 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 26 | <0.05 | 0.18 | 0.085 | 5 | 0 |




Statistical analysis indicates that there is a decreasing trend in total phosphorous values with a **t-stat of -2.22** and a **p-value of 0.03.** This trend may be due to increasing droughts and therefore less runoff from agricultural fields.

### Fish Consumption Use

The bay is fully supporting / has no concerns for bioaccumulation of toxics in water for fish consumption use.

### Oyster Waters Use

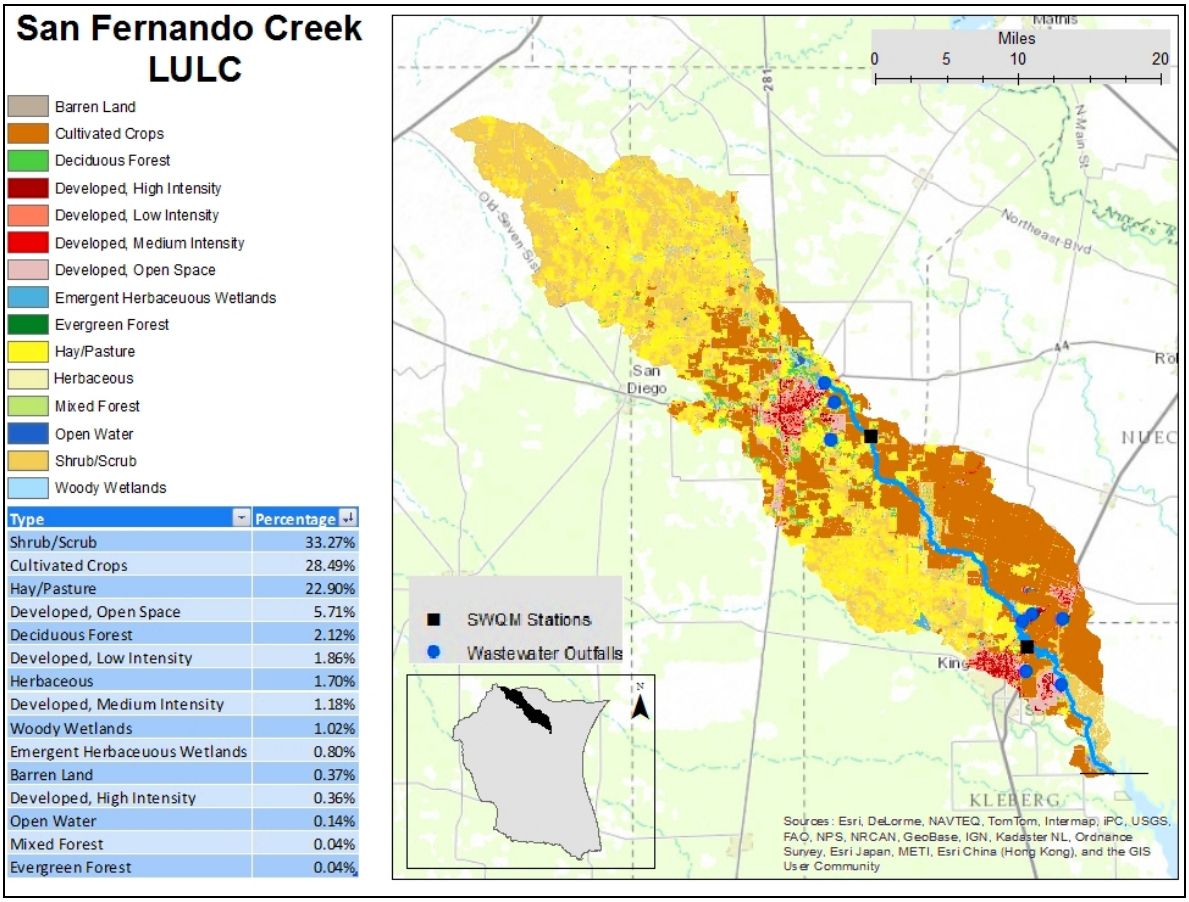
DSHS has listed the entire water body north of the boundary with the Lower Laguna Madre as fully supporting for oyster waters use.

### Recreational Beaches

For, Cayo del Grullo Bay, Kaufer-Hubert #1, Kaufer-Hubert #2, Kaufer-Hubert #3, and Riviera Beach Pier are fully supporting for contact recreation.

## SAN FERNANDO CREEK WATERSHED– SEGMENT 2492A

The 46 mile segment extends from the Cayo Del Gruillo confluence in Kleberg County to the Lake Alice Dam in Jim Wells County and is a single AU.




| Type | Percentage |
|---|---|
| Shrub/Scrub | 33.27% |
| Cultivated Crops | 28.49% |
| Hay/Pasture | 22.90% |
| Developed, Open Space | 5.71% |
| Deciduous Forest | 2.12% |
| Developed, Low Intensity | 1.86% |
| Herbaceous | 1.70% |
| Developed, Medium Intensity | 1.18% |
| Woody Wetlands | 1.02% |
| Emergent Herbaceuous Wetlands | 0.80% |
| Barren Land | 0.37% |
| Developed, High Intensity | 0.36% |
| Open Water | 0.14% |
| Mixed Forest | 0.04% |
| Evergreen Forest | 0.04% |

| | |
|---|---|
| **Drainage area** | 288,572 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Alice, Bishop, Kingsville |
| **Counties** | Duval, Kleberg, Jim Wells, Nueces |
| **EcoRegions** | Southern Subhumid Gulf Coastal Prairies, Texas-Tamaulipan Thornscrub |
| **Climate Annual Averages** | Rain: 25" - 29"; Low: 58° F - 61° F; High: 82°F - 83° F |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0000579-000 – Ticona Polymers, Inc.: storm water<br>WQ0004589-000 – Coil Tubing Services: 1,000 gpd via drainage ditch<br>WQ0004819-000 – SNBL USA Ltd.: 35,000 gpd via evaporation<br>WQ0010067-001 – Duval County Conservation and Reclamation District: 250,000 gpd via Santa Gertrudis Creek<br>WQ0010270-001 – San Diego MUD: 750,000 gpd via San Diego Creek<br>WQ0010427-001 – City of Bishop: 320,000 gpd via Carreta Creek<br>WQ0010536-002 – City of Alice: 2,600,000 gpd via Lattas Creek<br>WQ0010536-004 – City of Alice: 2,020,000 gpd and irrigation<br>WQ0010696-001 – City of Kingsville – Plant 1: 3,000,000 gpd via Tranquitas Creek<br>WQ0010696-004 – City of Kingsville: 1,000,000 gpd via Santa Gertrudis Creek and irrigation<br>WQ0012035-001 – US Department of the Navy (Kingsville NAS: 400,000 gpd |

## Water Quality Analysis

The analysis is based on data from **Station 13033**, located at US 77 in Kingsville. Trend analysis was conducted on data from March 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

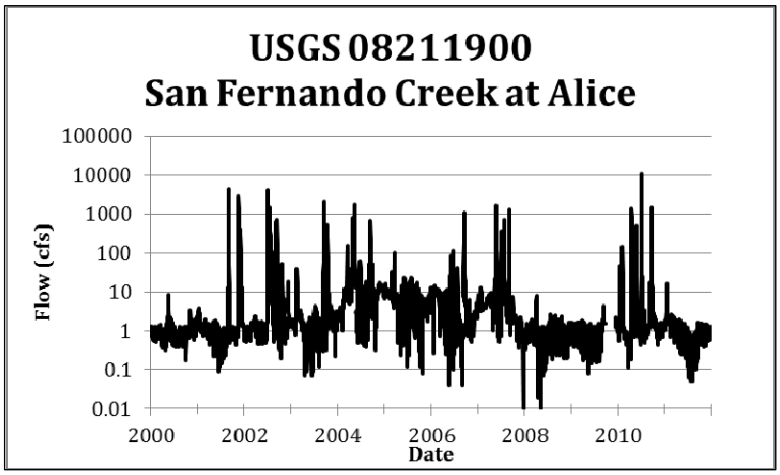

There is a **bacteria impairment** and **chlorophyll-a, nitrate,** and **total phosphorus concerns** for the segment.

The creek is currently classified with its segment number being with 24, which indicates bays and estuaries. NRA plans to seek funding to connect a study to determine the inland extent of the tidal influence. This could possibly lead to splitting the segment into tidal and non-tidal segment.s.

The eastern portion of the watershed is primarily croplands, while the north and west portions are a mixture of brush, pasture, and croplands. The City of Alice and a large portion of the City of Kingsville are within the watershed.

The USGS flow gauge at San Fernando Creek at Alice is located at the same location as SH 44 in Alice about 10 miles upstream of Station 13033. The annual mean flows are:

2000 – 1.0 cfs 2006 – 12.2 cfs
2001 – 69.0 cfs 2007 – 24.2 cfs
2002 – 59.1 cfs 2008 – 18.2 cfs
2003 – 17.6 cfs 2009 – 1.1 cfs
2004 – 25.7 cfs 2010 – 62.4 cfs
2005 – 8.3 cfs 2011 – 1.2 cfs

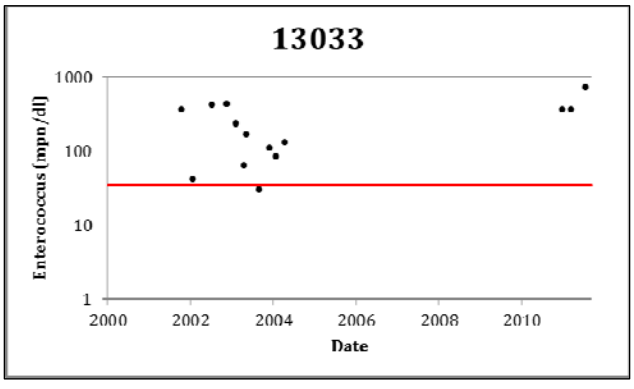



### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 28 | 5.7 | 17.7 | 9.6 | 0 | 0 |
| Screening Level 4.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | **NS** | **3** | **85** | **130** | **106.07** | **0** | **2** |

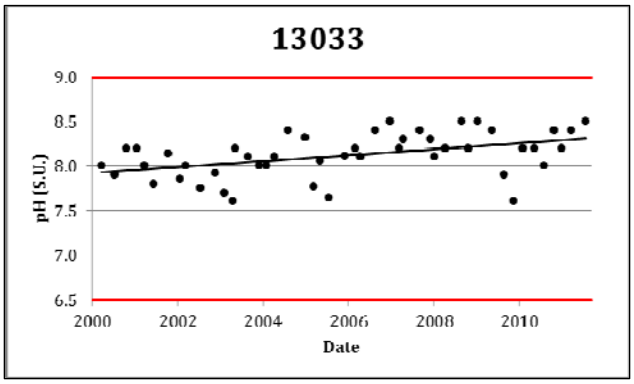



There are a number of WWTFs that discharge into this creek. Livestock and wildlife contributions are also possible contributors to the bacteria impairment.

### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | NA | 28 | 13.0 | 33.9 | 22.8 | 0 |

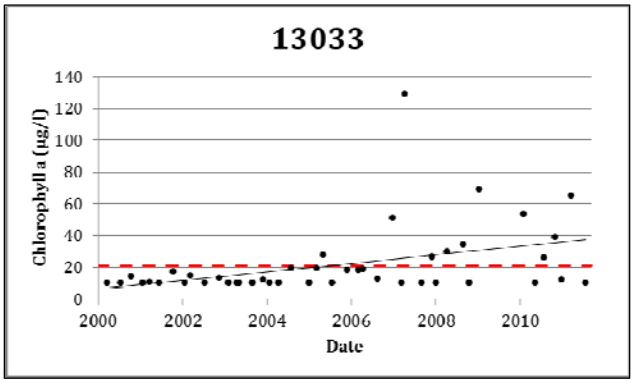
| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | NA | 28 | 7.6 | 8.5 | 8.2 | 0 | 0 |




Statistical analysis indicates that there is an increasing trend in pH values with a **t-stat of 3.36** and a **p-value of 0.00.** There is no obvious reason for this trend. However, the values are within the pH range and not a concern at this time.

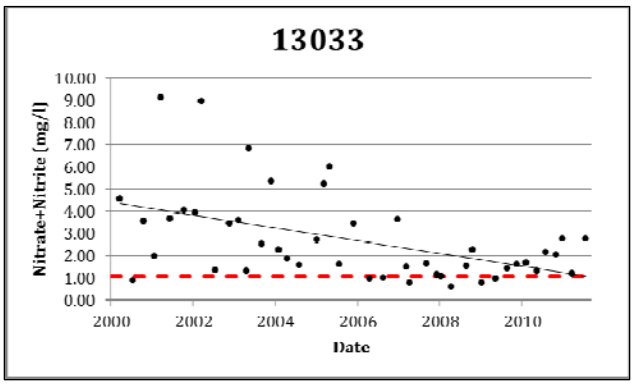
| Ammonia | Status | # samples | Min | Max | Median | ND | >0.46 |
|---|---|---|---|---|---|---|---|
| 0.46 mg/l | NC | 26 | <0.02 | 1.29 | 0.065 | 6 | 1 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >21 |
|---|---|---|---|---|---|---|---|
| 21 µg/l | **CS** | **25** | **<10** | **129** | **18** | **9** | **9** |



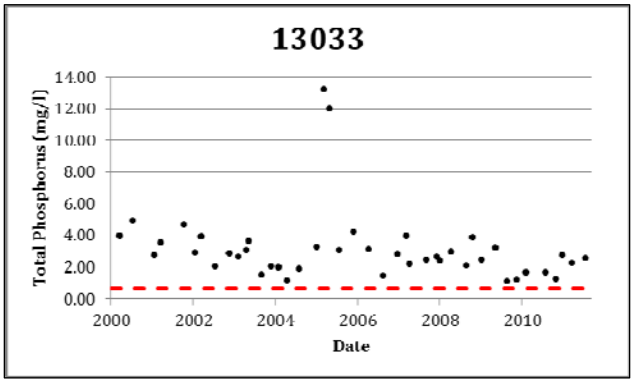

Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with a **t-stat of 2.80** and a **p-value of 0.01.** This trend may be the increasing droughts and therefore less rain to dilute the WWTFs discharges.

| Nitrates | Status | # samples | Min | Max | Median | ND | >1.1 |
|---|---|---|---|---|---|---|---|
| 1.1 mg/l | **CS** | **27** | **0.59** | **5.99** | **1.59** | **0** | **20** |




Statistical analysis indicates that there is a decreasing trend in nitrate values with a **t-stat of -3.69** and a **p-value of 0.00.** This trend may be the increasing droughts and therefore less agricultural runoff.

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.66 |
|---|---|---|---|---|---|---|---|
| 0.66 mg/l | **CS** | **26** | **1.09** | **13.2** | **2.46** | **0** | **26** |

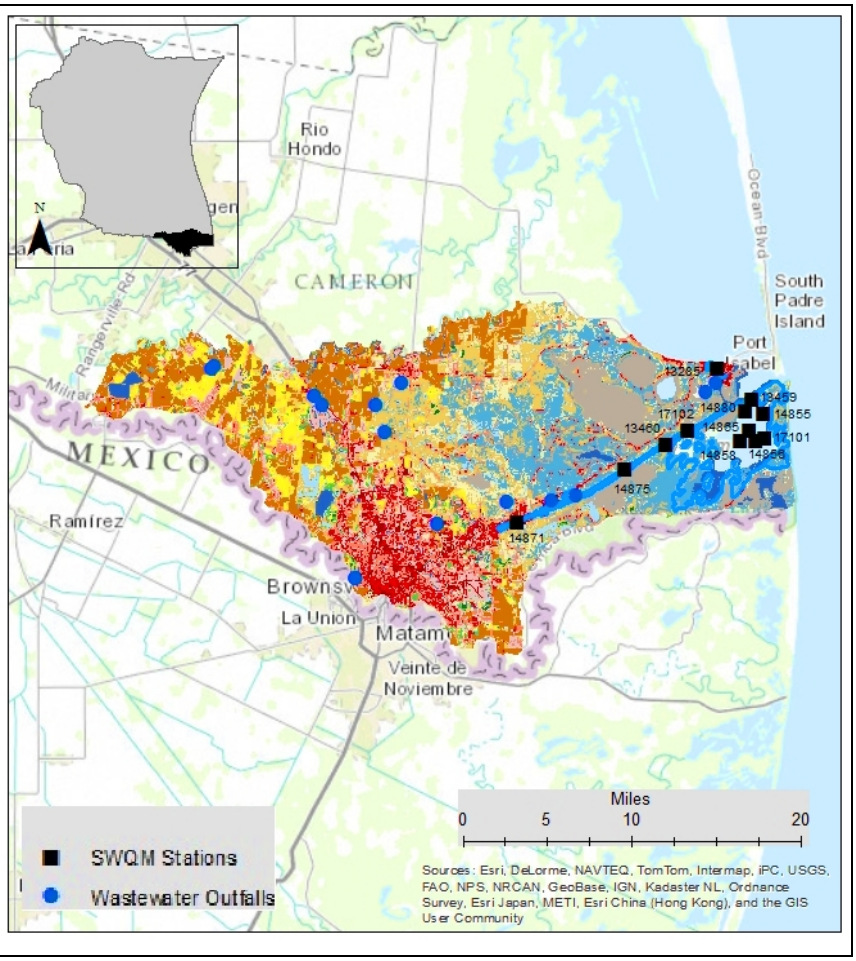



The source of the phosphorus is possibly related to the WWTF discharges and some agricultural runoff.

# SOUTH BAY WATERSHED– SEGMENT 2493

The 13,397 acre segment is in Cameron County and is a single AU.

**Brownsville Ship Channel, South Bay, and Port Isabel Fishing Harbor LULC**




- Barren Land
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands

| Type | Percentage |
|---|---|
| Shrub/Scrub | 16.67% |
| Emergent Herbaceuous Wetlands | 14.35% |
| Cultivated Crops | 14.16% |
| Barren Land | 12.39% |
| Developed, Low Intensity | 8.36% |
| Herbaceuous | 7.43% |
| Developed, Open Space | 5.98% |
| Developed, Medium Intensity | 5.79% |
| Hay/Pasture | 5.24% |
| Open Water | 4.19% |
| Woody Wetlands | 2.38% |
| Deciduous Forest | 1.48% |
| Developed, High Intensity | 1.29% |
| Evergreen Forest | 0.25% |
| Mixed Forest | 0.04% |

| | |
|---|---|
| **Drainage area** | Included with Brownsville Ship Channel drainage area |
| **Aquifers** | None |
| **Cities** | None |
| **Counties** | Cameron |
| **EcoRegions** | Laguna Madre Barrier Islands and Coastal Marshes |
| **Climate Annual Averages** | Rain: 29"; Low: 66° F - 67° F; High: 79° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Oyster Waters |
| **Permitted WWTFs** | None |

## Water Quality Analysis

The analysis is based on data from **Station 13459**, located near CM 17 and Clark Island. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

All water quality standards are being met in this segment. The watershed for the bay is nearly entirely wetlands. The bay itself is a pocket of a largely undisturbed natural area.

### Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 23 | 4.9 | 11.5 | 7.4 | 0 | 0 |
| Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | FS | 15 | <1 | 110 | 28.44 | 1 | 1 |

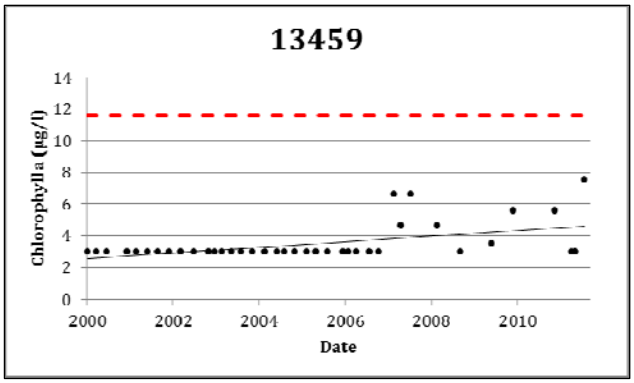
### General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 25 | 14.8 | 30.8 | 26.1 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 25 | 7.8 | 8.3 | 8.1 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 24 | <0.05 | 0.14 | 0.05 | 22 | 1 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 20 | <3 | 6.63 | 3 | 14 | 0 |




Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with a **t-stat of 3.60** and a **p-value of 0.0.** The sudden increase in values in 2007 coincides with a change in method used for analysis. This newer method provides for more reliable results at lower concentrations. The non-detects for the trend analysis were converted from <10 µg/l to<3 µg/l for consistency. Therefore, a real trend may not even exist.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 23 | <0.04 | 0.12 | 0.04 | 21 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 21 | <0.05 | 0.08 | 0.05 | 18 | 0 |

### Oyster Waters Use

DSHS has listed the bay as fully supporting for oyster waters use.

# BROWNSVILLE SHIP CHANNEL WATERSHED– SEGMENT 2494

The 1,717 acre segment is in Cameron County and is a single AU. The location is included in the map for South Bay, Segment 2493.

| | |
|---|---|
| **Drainage area** | 225,554 acres |
| **Major Aquifers** | Gulf Coast |
| **Cities** | Laguna Vista, Port Isabel |
| **Counties** | Cameron |
| **EcoRegions** | Laguna Madre Barrier Islands and Coastal Marshes, Lower Rio Grande Alluvial Floodplain |
| **Climate Annual Averages** | Rain: 25" - 31"; Low: 63° F - 67° F; High: 79°F - 84° F |
| **Water Body Uses** | Aquatic Life, Recreation, General |
| **Permitted WWTFs** | WQ0002597-000 – Brownsville Navigation District: 100,000 gpd via evaporation<br>WQ0002817-000 – Brownsville Navigation District Fishing Harbor: 250,000 gpd<br>WQ0003936-000 – Valley MUD No. 2: 500,000 gpd via San Martin Lake<br>WQ0004126-000 – Texas Pack, Inc: 150,000 gpd via irrigation<br>WQ0004466-000 – Lone Star Hatchery, Inc.: 500,000 gpd via Port Isabel Channel<br>WQ0004541-000 – Southmost Regional Water Authority and Brownsville Public Utilities Board: 4,000,000 gpd via San Martin Lake<br>WQ0005005-000 – Tenaska Brownsville Partners: storm water<br>WQ0010332-001 – Brownsville Navigation District Northside Plant: 98,000 gpd via drainage ditch<br>WQ0010350-001 – Laguna Madre Water District Port Isabel Plant: 1,100,000 gpd via Vadia Ancha and monofill sludge on permittee property<br>WQ0010397-005 – Brownsville Public Utilities N. Robindale Plant: 14,500,000 gpd via San Martin Lake<br>WQ0010590-002 – City of Los Fresnos: 1,000,000 gpd via San Martin Lake<br>WQ0011348-001 – Valley MUD No. 2: 400,000 gpd via San Martin Lake<br>WQ0013817-001 – Olmito WSC (Olmito Plant): 750,000 gpd via San Martin Lake<br>WQ0014355-001 – Brownsville Navigation District: 100,000 gpd via San Martin Lake |

## Water Quality Analysis

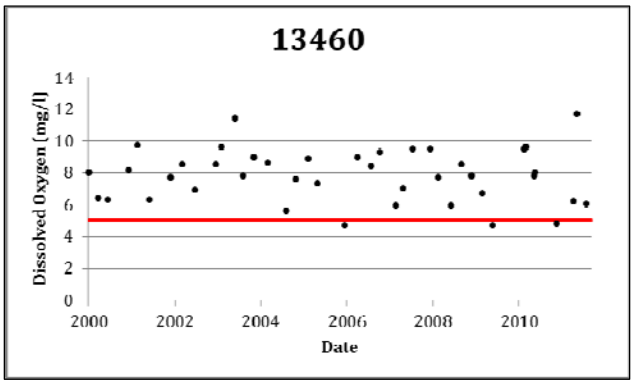
The analysis is based on data from **Station 13460**, located near CM 35. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There is a **low DO screening level concern** and **bacteria impairment** for the segment.

The City of Brownsville dominates the western end of the watershed. The areas immediately adjacent to the channel are mostly wetlands.

## Aquatic Life Use Assessment

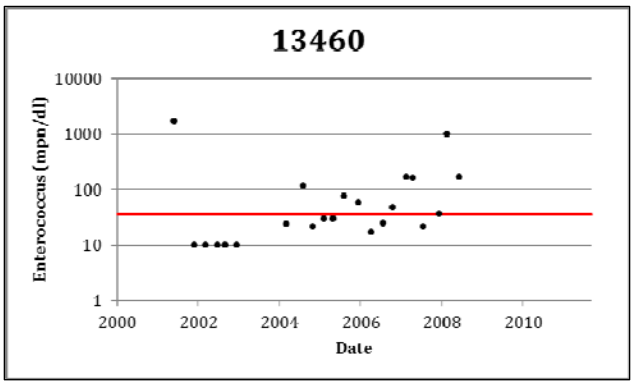
| DO | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|
| Minimum 4.0 mg/l | FS | 24 | 4.7 | 9.6 | 7.9 | 0 | 2 |
| Screening Level 5.0 mg/l | CS | | | | | | |




The 2012 IR used DO data from three additional monitoring sites. Those data, combined with the data for Station 13460, resulted in the CS designation for DO screening level. The physical nature of the ship channel and the limited circulation may contribute to low DO values.

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | NS | 16 | 17 | 1,000 | 58.21 | 0 | 5 |




Sampling for Enterococcus ended in 2008 by TCEQ Region15 due to complications meeting the NELAC certification and holding time requirements. The numerous WWTFs that discharge into the ship channel may contribute to the elevated bacteria levels.

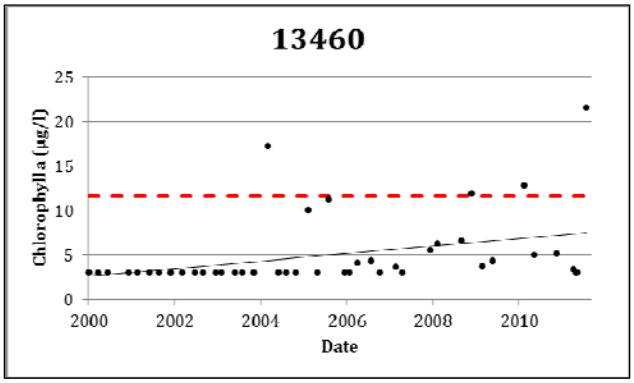
## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | FS | 26 | 16.7 | 30.6 | 26.7 | 0 |

| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | FS | 26 | 7.4 | 8.4 | 8.1 | 0 | 0 |

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 25 | <0.05 | 0.14 | 0.05 | 23 | 1 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 23 | <3 | 17.2 | 4.12 | 9 | 3 |




Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with a **t-stat of 2.40** and a **p-value of 0.02.** The sudden increase in values in 2006 coincides with a change in method used for analysis. This newer method provides for more reliable results at lower concentrations. The non-detects for the trend analysis were converted from <10 µg/l to<3 µg/l for consistency. Therefore, a real trend may not even exist.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 25 | <0.04 | 0.08 | 0.04 | 21 | 0 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 25 | <0.05 | 0.14 | 0.05 | 23 | 0 |

# PORT ISABEL FISHING HARBOR – SEGMENT 2494A

The 94 acre segment is in Cameron County and is a single AU. The location is included in the map for South Bay, Segment 2493.

| | |
|---|---|
| **Drainage area** | Included with Brownsville Ship Channel drainage area |
| **Aquifers** | None |
| **Cities** | Port Isabel |
| **Counties** | Cameron |
| **EcoRegions** | Laguna Madre Barrier Islands and Coastal Marshes |
| **Climate Annual Averages** | Rain: 29"; Low: 67° F; High: 79° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption |
| **Permitted WWTFs** | None |

## Water Quality Analysis

The analysis is based on data from **Station 13285**, located at SH 100. Trend analysis was conducted on data from March 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

There is a **bacteria impairment** for the harbor.

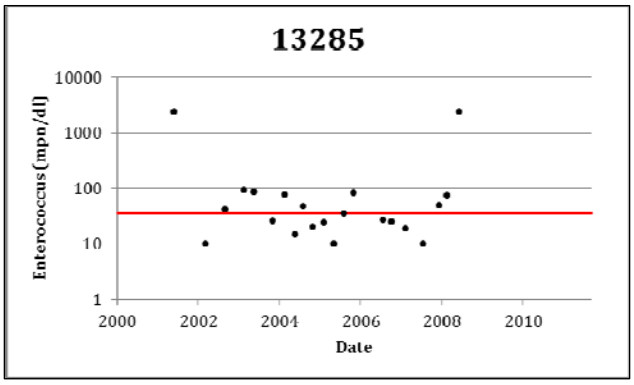
The watershed for the harbor is entirely urbanized and entirely within the City of Port Isabel.

## Aquatic Life Use Assessment

| DO | Status | # samples | Min | Max | Median | <3 | <4 |
|---|---|---|---|---|---|---|---|
| Minimum 3.0 mg/l | FS | 24 | 4.0 | 9.9 | 7.4 | 0 | 0 |
| Screening Level 4.0 mg/l | NC | | | | | | |

## Recreation Use

| Enterococcus | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|
| Geomean 35 cfu/100 ml | **NS** | **16** | **<10** | **>2,400** | **38.35** | **2** | **1** |

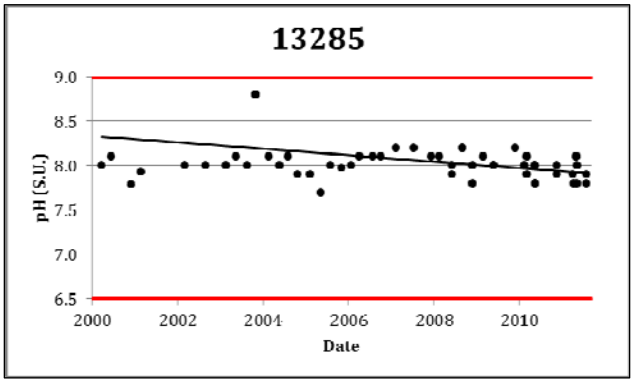



Sampling for Enterococcus ended in 2008 by TCEQ Region15 due to complications meeting the NELAC certification and holding time requirements. Given that the calculated geomean is very close to the standard, additional sampling is needed to determine is the impairment actually exists.

## General Use

| Water Temperature | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|
| 35 °C | NA | 26 | 14.6 | 31.5 | 26.4 | 0 |

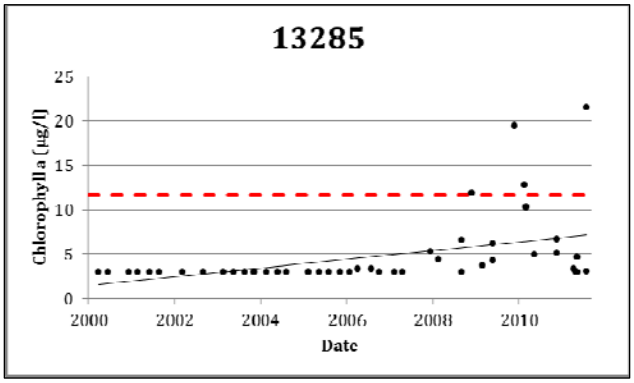
| pH | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|
| 6.5 – 9.0 su | NA | 26 | 7.7 | 8.8 | 8.0 | 0 | 0 |




Statistical analysis indicates that there is a decreasing trend in pH values with a **t-stat of -2.24** and a **p-value of 0.03.** There is no obvious reason for the trend. The values are well within the criteria, and not a concern at this time.

| Ammonia | Status | # samples | Min | Max | Median | ND | >0.1 |
|---|---|---|---|---|---|---|---|
| 0.1 mg/l | NC | 23 | <0.05 | 0.12 | 0.05 | 19 | 1 |

| Chlorophyll-*a* | Status | # samples | Min | Max | Median | ND | >11.6 |
|---|---|---|---|---|---|---|---|
| 11.6 µg/l | NC | 20 | <3 | 19.5 | 3 | 13 | 1 |



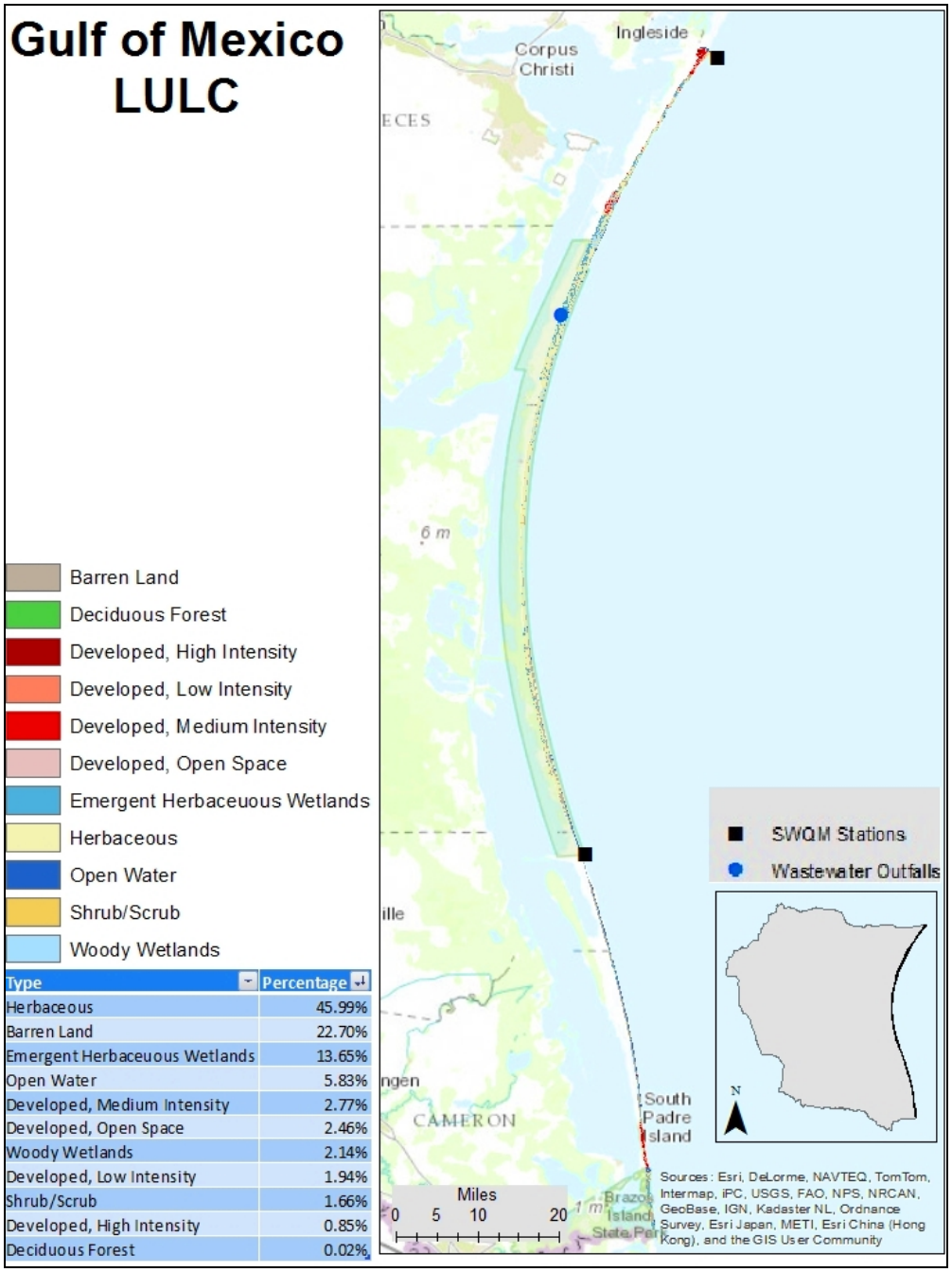

Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with a **t-stat of 2.18** and a **p-value of 0.03.** The sudden increase in values in 2006 coincides with a change in method used for analysis. This newer method provides for more reliable results at lower concentrations. The non-detects for the trend analysis were converted from <10 µg/l to<3 µg/l for consistency. Therefore, a real trend may not even exist.

| Nitrates | Status | # samples | Min | Max | Median | ND | >0.17 |
|---|---|---|---|---|---|---|---|
| 0.17 mg/l | NC | 23 | <0.04 | 0.18 | 0.04 | 22 | 1 |

| Total Phosphorus | Status | # samples | Min | Max | Median | ND | >0.21 |
|---|---|---|---|---|---|---|---|
| 0.21 mg/l | NC | 21 | <0.05 | 0.08 | 0.05 | 20 | 0 |

# GULF OF MEXICO – SEGMENT 2501

The area of the Gulf of Mexico that NRA includes in its reporting extends approximately 150 miles from Port Aransas to Port Isabel.




| Type | Percentage |
|---|---|
| Herbaceous | 45.99% |
| Barren Land | 22.70% |
| Emergent Herbaceuous Wetlands | 13.65% |
| Open Water | 5.83% |
| Developed, Medium Intensity | 2.77% |
| Developed, Open Space | 2.46% |
| Woody Wetlands | 2.14% |
| Developed, Low Intensity | 1.94% |
| Shrub/Scrub | 1.66% |
| Developed, High Intensity | 0.85% |
| Deciduous Forest | 0.02% |

| | |
|---|---|
| **Cities** | Port Aransas, South Padre Island |
| **Counties** | Cameron, Aransas. Kenedy, Kleberg, Nueces, Willacy |
| **EcoRegions** | Laguna Madre Barrier Islands and Coastal Marshes, Mid-Coast Barrier Islands and Coastal Marshes |
| **Climate Annual Averages** | Rain: 29” - 35”; Low: 65° F - 67° F; High: 77°F - 79° F |
| **Water Body Uses** | Aquatic Life, Recreation, General, Fish Consumption |
| **Permitted WWTFs** | None |

## Water Quality Analysis

**AU_06** is the Port Aransas area. **AU_07** is the area between Port Aransas and Port Mansfield. **AU_08** is the Port Mansfield area. **AU_09** is the area between Port Mansfield and Port Isabel.

The analysis for AU_06 is based on data from **Station 13468**, located off Port Aransas near marker R-7. Trend analysis was conducted on data from January 2000 through November 2011. TCEQ is responsible for routine quarterly monitoring at this site.

Except for fish consumption use, AU_07, AU_08, and AU_09 were not assessed in 2012.

There is a **mercury in edible fish tissue impairment** for the entire gulf.

### Aquatic Life Use Assessment

| DO | | Status | # samples | Min | Max | Median | <4 | <5 |
|---|---|---|---|---|---|---|---|---|
| AU-06 | Minimum 4.0 mg/l | FS | 28 | 5.5 | 9.6 | 7.0 | 0 | 0 |
| | Screening Level 5.0 mg/l | NC | | | | | | |

### Recreation Use

| Enterococcus | | Status | # samples | Min | Max | Geomean | ND | >89 |
|---|---|---|---|---|---|---|---|---|
| AU-06 | Geomean 35 cfu/100 ml | FS | 22 | <1 | 190 | 3.39 | 11 | 1 |

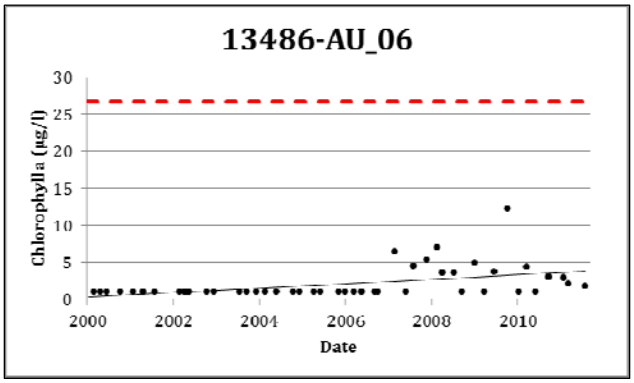
### General Use

| Water Temperature | | Status | # samples | Min | Max | Median | >35 |
|---|---|---|---|---|---|---|---|
| AU-06 | 35 °C | FS | 28 | 10.1 | 31.3 | 24.8 | 0 |

| pH | | Status | # samples | Min | Max | Median | <6.5 | >9.0 |
|---|---|---|---|---|---|---|---|---|
| AU-06 | 6.5 – 9.0 su | FS | 27 | 7.2 | 8.3 | 8.1 | 0 | 0 |

| Ammonia | | Status | # samples | Min | Max | Median | ND | >0.11 |
|---|---|---|---|---|---|---|---|---|
| AU-06 | 0.11 mg/l | NC | 28 | <0.02 | 0.2 | 0.05 | 24 | 2 |

| Chlorophyll-*a* | | Status | # samples | Min | Max | Median | ND | >26.7 |
|---|---|---|---|---|---|---|---|---|
| AU-06 | 26.7 µg/l | NC | 28 | <1 | 12.2 | 1 | 18 | 0 |




Statistical analysis indicates that there is an increasing trend in chlorophyll-*a* values with a **t-stat of 3.54** and a **p-value of 0.00.** The sudden increase in values in 2006 coincides with a change in method used for analysis. This newer method provides for more reliable results at lower concentrations. The non-detects for the trend analysis were converted from <10 µg/l to<3 µg/l for consistency. Therefore, a real trend may not even exist.

| Nitrates | | Status | # samples | Min | Max | Median | ND | >0.37 |
|---|---|---|---|---|---|---|---|---|
| AU-06 | 0.37 mg/l | NC | 27 | <0.04 | 1.25 | 0.04 | 26 | 1 |

| Total Phosphorus | | Status | # samples | Min | Max | Median | ND | >0.69 |
|---|---|---|---|---|---|---|---|---|
| AU-06 | 0.69 mg/l | NC | 28 | <0.04 | 0.12 | 0.06 | 20 | 0 |

**Fish Consumption Use** The entire segment is non-supporting for mercury in edible fish tissue.

# Summaries and Recommendations

CRP utilizes a watershed management approach to identify and evaluate water quality issues, establish priorities for corrective action, and work to implement those actions. Below is a brief narrative of the water quality conditions assessed in the report for each of the three major basins and the bays.

## Summaries

### Water Quality in the San Antonio – Nueces Coastal Basin

The primary issue in the basin is bacteria with respect to contact recreation. The control actions of the TMDL that is being developed for the tidal sections of these rivers, in addition to Copano Bay (Page 8), are addressing this issue. There are also some concerns for low DO and nutrients, which may indirectly be addressed through implementation of the control actions.

### Water Quality in Nueces River Basin

The upper reaches of this basin, in general, have fewer water quality issues than the middle and lower reaches. Three of the upper reach segments, Upper Sabinal River, Upper Nueces River, and Seco Creek, meet all water quality standards. Low DO, bacteria, and nutrients are the primary concerns and impairments in the lower reaches. The Atascosa River TMDL and RUAA (Page 26), the Leona River RUAA (Page 27), the Lower Sabinal River TMDL (Page 27), and the Upper Frio River TMDL (Page 28) are all studies that were designed to address water quality concerns after they had been identified on the 303 (d) List. The Lower Nueces River WPP (Page 26) and the Upper Nueces River and Upper Frio River Arundo Removal
(Page 28) projects were initiated as proactive attempts to protect the water quality.

### Water Quality in the Nueces – Rio Grande Coastal Basin

The issues within this basin differ greatly between the northern and southern areas. The primary issues in the northern area are being addressed by the Petronila Creek TMDL for chloride, sulfate, and TDS (Page 111). The southern area is dominated by the Arroyo Colorado and has numerous quality issues which are being addressed by the Arroyo Colorado TMDL and WPP.

Total phosphorus is the primary concern for Oso Creek and San Fernando Creek. These creeks are included in the bays and estuaries watershed summaries because of their segment numbers beginning with “24.”

### Water Quality in the Bays and Estuaries

Bacteria in oyster waters, chlorophyll-*a,* and bacteria at recreational beaches are the primary issues within the coastal bays. Other issues include low DO and nutrients. The Oso Bay and Oso Creek TMDL (Page 141) is addressing the bacteria issues in those segments. The Oso Bay and Laguna Madre TMDL (Page 141) is addressing the DO issues in those segments. Two of the 13 bays, Mesquite Bay and South Bay, meet all water quality standards.

Each ship channel and harbor has different issues: metals in Conn Brown Harbor; ammonia and nitrates in the Corpus Christi Ship Channel, and bacteria in the Brownsville Ship Channel and Port Isabel Fishing Harbor.

## Recommendations

The CRP partner agencies provide a large percentage of the data that are used by TCEQ for assessment purposes. Dedicated funds for CRP should be reinstated in order to maintain the current level of monitoring and to provide additional monitoring to support the TCEQ, WPPs, RUAAs, TMDLs, and I-Plans. Collaborating and coordinating with all entities that conduct studies that include water quality monitoring reduces duplication of effort and increases the amount of information that can be collected and shared.

Funding opportunities for proactive projects to protect water quality before a segment is listed on the 303 (d) List have been on the rise. This is a change in the right direction, and hopefully these opportunities will continue.

NRA will continue to provide as much support to all water quality monitoring and protection efforts as possible as resources allow. Specifically, NRA plans to:

- Continue to conduct routine CRP monitoring.
- Complete the Lower Nueces River WPP by September 2015 (TSSWCB funded).
- Conduct an RUAA on San Miguel Creek beginning FY 2014 (TSSWCB funded).
- Continue the widespread education and outreach activities (Numerous funding sources).
- Continue to battle the *Arundo donax* invasion in the upper Nueces Basin (Numerous funding sources).
- Find funding to conduct a study to identify the tidal boundary in San Fernando Creek.
- Conduct a special study to investigate recent increases TDS, sulfate, chloride on the Atascosa River, the Nueces River, the Frio River, and San Miguel Creek, possibly related to oil and gas activity. This project is an approved Supplemental Environmental Programs project and will be initiated when sufficient funds are received. The water samples will also be analyzed for arsenic, barium and strontium.
- Continue to serve as stakeholders on all water quality related projects within our areas of jurisdiction and responsibility.

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