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Texas Clean Rivers Program, Senate Bill 818 (SB 818), known as the Texas Clean Rivers Act, was enacted in 1991 by the 72nd Legislature to ensure the comprehensive regional assessment of water quality in each watershed and river basin of the State. This program was administered by the Texas Water Commission, now known as the Texas Commission on Environmental Quality (TCEQ) and at the time was very different from any other monitoring program in Texas.

The Clean Rivers Program (CRP) created a partnership with river authorities, local and special area agencies to create a network of monitoring stations that reported data to the TCEQ. Partnering with other agencies created an atmosphere of cooperation, and built bonds and communication between the agencies. Another aspect of the CRP was the early use of stakeholders to guide the program. Currently, the San Antonio River Authority (SARA) uses an Environmental Advisory Committee (EAC) made up of stakeholders from various geographical areas within the basin who represent a variety of professional interests. This group meets quarterly, and is routinely contacted through email. The EAC provides input to the CRP and a variety of other SARA projects and programs that have an environmental component.

Perhaps the most unique aspect of the CRP is the attention to quality assurance. Early on, the CRP provided quality control and data management training to its partners as part of its program. By 1996, all work performed under a TCEQ contract involving the acquisition, generation and collection of environmental data was conducted in accordance with a TCEQ-approved Quality Assurance Project Plan (QAPP). Current QAPP’s must meet all applicable TCEQ and Environmental Protection Agency (EPA) requirements. The EPA describes a QAPP as a formal document that comprehensively details the required quality assurance and quality control (QA/QC) and other technical activities must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria (EPA, 2001). The QAPP must provide a project-specific “blueprint” for obtaining the type and quality of environmental data needed for a TCEQ regulatory decisions and assessments. The QAPP should identify:

- The technical and quality objectives;
- The sampling and analytical methods and acceptable criteria to meet the projects objective;
- Any measurement(s) or information describing environmental processes, sampling locations and frequencies, conditions, and ecological conditions;
- All technical and quality aspects of a project, including planning, implementation, and assessment;
- How QA/QC is applied to assure that the results obtained are of the type and quality needed and expected.

The CRP and its SARA-funded companion monitoring program, SARA Stream Monitoring, together with the TCEQ monitoring efforts, are the primary programs for the collection of water quality data in the San Antonio River Basin. Data generated from these programs are used in State assessments and compliance decisions. Therefore, these programs operate under a TCEQ-approved CRP QAPP.
Coordination and Cooperation with Other Basin Entities

With the high expense associated with collecting water quality data and limited funding, the importance of leveraging funds and maximizing regional efforts while minimizing duplicative efforts is paramount. To remain adaptable to economic and environmental changes, each year SARA conducts a coordinated monitoring meeting (CMM) with the TCEQ and other basin monitoring partners. During the meeting, resources are coordinated at the watershed level. This level of coordination provides monitoring that is spatially and temporally sufficient to identify water quality issues and changes in the San Antonio River Basin.

The Draft 2014 TCEQ Integrated Report provides information on the states’ surface waters, including concerns for public health, fitness for use by aquatic species, and specific pollutants and their sources. It is composed of several documents including the 303(d) List of Impaired Water Bodies, a list of water bodies evaluated, added and removed from previous 303(d) lists and several other reports. The Draft 2014 Integrated Report can be found on the TCEQ website located at https://www.tceq.texas.gov/waterquality/assessment.

During SARA’s annual CMM, normally held in mid-spring, information from the TCEQ Integrated Report, CRP partners, and the EAC is used to select stations and parameters that enhance the overall water quality monitoring coverage of the San Antonio River Basin. Water monitoring decisions made during the CMM are directed towards:

- Completing data sets where limited data indicates that a water quality criterion shows a standard is not supported;
- Concerns for water bodies that are near nonattainment;
- Waters with known water quality concerns;
- Specific priority for water bodies that have no known water quality problems or without current water quality data.
For the TCEQ 2015 monitoring year, the San Antonio River Basin will be monitored by SARA, TCEQ and the Guadalupe-Blanco River Authority. The Bandera County River Authority and Groundwater District (BCRAGD), a sub-participant under SARA’s CRP QAPP, will collect routine water quality samples in the Upper Medina River Watershed, Segment 1905. The 2015 Coordinated Monitoring Schedule (CMS) for the San Antonio River Basin is located at https://cms.lcra.org/.

Texas Surface Water Quality Standards

The Texas Surface Water Quality Standards (Title 30, Chapter 307 of the Texas Administrative Code) describes the chemical, physical, and biological conditions to be attained in the surface waters of Texas. The standards are periodically revised to adjust designated uses criteria of individual water bodies, to incorporate new scientific data on the effects of specific chemicals and pollutants, and to address new provisions in the Texas Water Code, federal regulations and EPA guidance. At the February 12, 2014 TCEQ Commission Agenda meeting, the Commissioners adopted revisions to the Texas Surface Water Quality Standards (TSWQS). The adopted standards revisions were published in the Texas Register on February 28, 2014 with an effective date of March 6, 2014.

The 2014 TSWQS revisions include a new category of contact recreation, primary contact recreation 2, with a bacteria criterion of 206 colony forming units per 100 milliliters. This category cannot be assumed for any water body and can only be applied based on the results of a recreational use-attainability analysis. Other standard revisions address changes in site-specific designated uses criteria for classified and unclassified segments. The 2014 TSWQS have been submitted to EPA for review and approval. During the EPA’s review of the 2014 TSWQS, the 2010 TSWQS will continue to be used in assessing surface water quality data in the San Antonio River Basin (TCEQ website). The 2010 and 2014 TSWQS can be found on the TCEQ’s website located at http://www.tceq.state.tx.us/waterquality/standards/eq_swqs.html.

Assessment of the Basin: How is water quality measured?

The TCEQ Integrated Report is generated every two years in even-number years and satisfies the requirements of Federal Clean Water Act Sections 305(b) and 303(d). In producing the Integrated Report, the TCEQ utilizes historical water quality data to assess and identify water bodies that do not meet designated use criteria and standards as identified in the TSWQS. If the water quality data indicates that a designated use(s) is not supported, the segment will be identified as “impaired” and included in the Integrated Report’s 303(d) List of Impaired Waters. If the data indicates good water quality, the water body is identified as “fully supporting” its designated uses. A “concern” may be identified if a limited amount of data indicates elevated levels of pollutants or if a screening level is exceeded.

In the TSWQS, the TCEQ has assigned five categories of designated uses for all classified waterbodies in Texas: aquatic life, contact recreation, fish consumption, public water supply, and general use. Each waterbody in the San Antonio River Basin is evaluated against its designated aquatic life use, contact recreation standard and general use. Fish consumption use and public water supply use are assessed to specific waterbodies.

Aquatic Life Use: Each classified segment in the TSWQS is assigned an aquatic life use (ALU), based on physical, chemical, and biological characteristics of the water body. The five aquatic life use (ALU) categories are exceptional, high, intermediate, limited, or minimal (no significant) aquatic life use.

Support of the ALU is based on assessment of dissolved oxygen criteria, toxic substances in water criteria, ambient water and sediment toxicity test results, and indices for habitat, benthic macroinvertebrate and fish community, provided that the minimum number of samples are available. Each set of criteria is generally evaluated independently of the others, and impairment of the ALU results when any of the individual criteria are not attained.

For freshwater streams not classified in the TSWQS, the ALU and criteria are presumed based on the stream flow type. Stream flow type; perennial, intermittent with pools, or intermittent; is established from flow data associated with samples, information provided by local monitoring staff, previous assessments, or recent receiving water assessments.

Recreation Use: Recreation Use categories and criteria are assigned to all water bodies. Two organisms are routinely analyzed in water samples collected to determine support of the recreation use: Escherichia coli (E. coli) in freshwater, and Enterococci in tidal water bodies and certain inland water bodies. E. coli is used to assess recreation use attainment in the San Antonio River Basin.
General Use: Water quality criteria for several constituents are established in the TSWQS to safeguard general water quality, rather than for protection of one specific use. Water temperature, pH, chloride, sulfate, total dissolved solids (TDS), and chlorophyll are the parameters protecting aquatic life, recreation, public water supply, and other beneficial uses of water resources. For the purpose of assessment, the criteria protecting these multiple uses are evaluated for attainment of a construct entitled, “general use.”

Specific criteria for each of the other parameters are assigned to every classified segment in the TSWQS based on physical, chemical, and biological characteristics. Water temperature, pH, chloride, sulfate, TDS, and chlorophyll a criteria developed for classified segments do not apply to unclassified water bodies.

Concerns for general uses are identified with screening levels for nutrients and chlorophyll a for both classified and unclassified water bodies with the exception of some classified reservoirs identified in the TSWQS for which chlorophyll a site specific criteria were developed. Although other concerns are reported for general use, attainment of the general use for unclassified water bodies is not assessed and therefore not reported.

Fish Consumption Use: Fish consumption use attainment and concerns are evaluated with three assessment methods:

- Advisories, Closures, and Risk Assessments
- Human Health Criteria for Bioaccumulation and Fish Consumption Use
- Human Health Fish Tissue Criteria Concerns

For a full assessment of use attainment for fish consumption and a determination of fully supporting, a Texas Department of State Health Services (DHS) risk assessment or advisory is required. Risk assessments are costly and conducted only on water bodies where the assessment has indicated a risk from consumption. Additional information may be found on the DHS website located at http://www.dshs.state.tx.us/seafood/survey.shtm#advisory.

Public Water Supply Use: Public water supply use (PS) is evaluated for surface water bodies that are designated in the TSWQS for public water supply use. Human health criteria from the TSWQS are used to determine whether the segment is supporting public water supply use. The human health criteria are based, in part, on the primary maximum contaminant levels adopted in the Texas Administrative Code (30 TAC §290). Segments designated for aquifer protection (AP) are capable of recharging the Edwards Aquifer. The principal purpose of this use designation is to protect the quality of water infiltrating into and recharging the aquifer and applies to designated portions that are on the recharge zone, transition zone, or contributing zone as defined in the TSWQS.

Additional information on designated uses for all classified waterbodies in Texas can be found in the Draft 2012 Guidance for Assessing and Reporting Surface Water Quality in Texas at the TCEQ website located at http://www.tceq.state.tx.us/assets/public/waterquality/swqm/assess/12twqi/2012_guidance.pdf

Every five years, SARA publishes a Basin Summary Report as required by the CRP. This report, last conducted in 2013, provides a detailed review of parameters analyzed, designated uses and associated water quality concerns and impairments in the San Antonio River Basin. The SARA CRP Basin Summary and annual Basin Highlight Reports are located on the SARA website located at http://www.sara-tx.org/public_resources/library.php?id=6.

Surface Water Quality Measurements

A major CRP monitoring objective is to provide the TCEQ sufficient data to support the assessment of surface water quality, water quality standards and wastewater permits. With this in mind, monitoring decisions are made considering the monitoring types, parameters analyzed, and the minimum number of samples needed to assess waterbodies in the San Antonio River Basin.

Under the SARA CRP, there are two types of sampling events conducted throughout the Basin.

Routine Sampling (RT) events are scheduled in advance without intentionally trying to target any certain environmental conditions. Samples are collected regardless of the conditions encountered that day. Parameters collected and analyzed for RT sampling events include:

- Bacteria and Conventional Chemical Parameters
  - E. coli
  - Chloride
• Sulfate
• Total Kjeldahl nitrogen (TKN)
• Total suspended solids (TSS)
• Ammonia nitrogen
• Nitrite-nitrogen
• Nitrate-nitrogen
• Total phosphorus
• Chlorophyll-a
• Temperature
• pH

• Conductivity
• Dissolved oxygen
• Secchi depth
• Flow

Biased Season (BS) sampling events are scheduled for a certain time of year and are meant to capture the conditions characteristic of that time of year. Keeping safety in mind, BS samples are collected regardless of the flow condition encountered that day. Parameters collected and analyzed for BS sampling events include biological (fish and benthic), habitat, 24 hour dissolved oxygen and flow measurements.
Basin Highlights Report

The purpose of 2015 CRP Watershed Characterization Reports is to review activities within the Medina River, Leon Creek and Medio Creek watersheds. Characterizations such as segment descriptions, hydrology, land uses, maps, and ongoing projects, are reviewed. Potential sources of impairments and concerns based on the Draft 2014 Texas Integrated Report are identified and recommendations to improve water quality are suggested.

The TCEQ and CRP partners, including SARA, use this report and others submitted throughout the State to develop and prioritize programs that will protect the water quality of healthy waterbodies and improve the quality of impaired waterbodies. The Report Cycle table identifies reports currently planned for the SARA Clean Rivers Program over the next several years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Report Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>CRP Basin Summary Report</td>
</tr>
<tr>
<td>2014</td>
<td>CRP Update Report</td>
</tr>
<tr>
<td>2015</td>
<td>CRP Watershed Characterization for Medina River, Leon Creek &amp; Medio Creek</td>
</tr>
<tr>
<td>2016</td>
<td>CRP Basin Highlight Report</td>
</tr>
<tr>
<td>2017</td>
<td>CRP Watershed Characterization for Upper San Antonio River, Salado Creek &amp; Upper Cibolo Creek</td>
</tr>
</tbody>
</table>

For the purposes of this characterization report, use support is reported at both the segment and assessment unit subarea level.

A classified segment is a water body or portion of a water body that is individually defined in the TSWQS. A segment is intended to have relatively homogeneous chemical, physical, and hydrological characteristics. A segment provides a basic unit for assigning site-specific standards and for applying water quality management programs of the TCEQ. Classified segments may include streams, rivers, bays, estuaries, wetlands, lakes, or reservoirs. Classified segments are protected by site-specific criteria as stated in the TSWQS. The classified segments are assigned four-digit numbers. The first two digits correspond to the major basin in which they are located. The last two digits distinguish individual segments within the particular basin. For example, Segment 1905 is in basin 19 (San Antonio River Basin) and 05 represents the Medina River above Medina Lake from a point immediately upstream of the confluence of Red Bluff Creek in Bandera County to the confluence of the North Prong Medina River and the West Prong Medina River in Bandera County.

Because of the great extent of waters in the state, not all bodies of water are classified in the standards. For example, when managing a classified segment of the Medina River above Medina Lake, it may be necessary to examine water quality in the tributaries that flow into that segment. Some of these tributaries may not be part of the classified segment system. When that happens, for management purposes, the tributary is assigned a unique tracking number that is referred to as an unclassified segment. This unclassified tributary will be designated with the number of the classified segment in whose watershed it is located, along with a letter. Example 1905A North Prong Medina River is a tributary of the Medina River above Medina Lake. Unclassified segments are small and often intermittent water bodies, typically not assigned specific water quality standards.

Unclassified segments are generally assessed on the flow and the criteria for the classified segment into which they flow, but in some cases may be assigned specific water quality standards.

Each segment is further broken down into smaller subareas called assessment units (AU). Each assessment subarea is known as an AU, which is defined as the smallest geographic area of use support reported in the assessment. Each AU within a segment is assigned a number such as 1905_01. A segment may consist of more than one AU, 1905_01, 1905_02, and so on. Support of criteria and designated uses are examined for each AU. To address water quality regulatory activity such as permitting, standards development, and remediation, use support information applies to the AU level. The 303(d) List is reported at the AU level for each water body.
**SEGMENT DESCRIPTION**

Segment 1903 extends upstream from its confluence with the San Antonio River in southeast Bexar County to the Medina Diversion Dam in Medina County. The segment is approximately 80 miles long and has a drainage area of 376 square miles. See Table 1903-1 for the stations and number of proposed sampling events to be collected in the TCEQ 2015 fiscal year.

The upper end of this segment flows through portions of the Edwards Plateau. Due to the lack of deep organic soils, vegetation is limited along the stream within the upper reaches of this segment. Major tributaries to the Lower Medina River include Leon Creek, Geronimo Creek, and Medio Creek. Other major contributors to the Medina River include the effluent discharge from Dos Rios Water Recycling Center, Leon Creek and Medio Creek Water Recycling Center Treatment Facility. The upper reach of this segment is characterized by excellent water clarity, moderate to swift velocity, gravel and limestone substrates, high steep limestone banks and alternating run, glide, riffle and pooled habitats. The lower reach of this segment is influenced by alluvial formations of the Gulf Coastal Plains and the stream habitats alternate between runs and glides. This portion of the Medina River is characteristically deeper and more turbid.

**HYDROLOGIC CHARACTERISTICS**

According to the United States Geological Survey website located at http://waterdata.usgs.gov/tx/nwis/current/?type=flow, accessed on Jan 26, 2015, the 75 year median annual average flow at USGS gage – 08181500, Medina River at San Antonio, TX, is 112 cubic feet per second (cfs), and a flow range of 3.6 (1957) to 1220 (1992) cfs. The USGS 08180700 gage station, Medina River at Macdona, TX, has a 32 year median annual average flow is 56 cubic feet per second (cfs), and a flow range of 4.1 (1914) to 899 (1992) cfs. In general, post-rainfall flows generally return to normal within a week depending on the magnitude of the stormwater event. Over the last several years, flow in this Segment has been affect by drought conditions, especially in the summer months, with slightly higher ambient flows in the winter months. Some erosion is evident in the upper part of the Segment, especially southwest of the City of San Antonio.

**IMPAIRMENT/AREA OF INTEREST DESCRIPTION**

Segment 1903 is located in the Southern Texas Plains and Texas Blackland Prairies Ecoregions and is identified in the Draft 2014 TCEQ Integrated Report as being a freshwater perennial stream with a high aquatic life use designation. Segment 1903 is for use as a public water supply except from the confluence of the San Antonio River in Bexar County upstream to a point 2.5 Kilometers (1.5 miles) upstream of the confluence of Leon Creek. Aquifer protection use applies to this segment because it contributes to recharge of the Edwards Aquifer. Like all segments in the San Antonio River Basin, TCEQ has designated this section for primary contact recreation. Primary contact activities are presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. Impairments and concerns in Segment 1903 include:

Assessment Unit 1903_01: Concerns for nutrients have been identified.

Assessment Unit 1903_02: This AU was first identified as impaired for recreational use in the 2010 Texas Water Quality Inventory and 303(d) List. According to the Draft TCEQ 2014 IR, the geometric mean for E. coli in assessment unit 1903_02 is 142.10 colony forming units, exceeding the criterion of 126 colony forming units. The bacteria impairment is currently listed as 5c, indicating that additional data and information will be collected and/or evaluated for one or more parameters before a management strategy is selected. Concerns for nutrients have also been identified.

Assessment Unit 1903_03: Concerns for nutrients have been identified.

Assessment Unit 1903_04: Concerns for nutrients have been identified.

Assessment Unit 1903_05: No impairments or concerns have been identified.

See Table 1903-2 for Site-Specific Uses and Criteria for Segment 1903. Details of the impairments and concerns for the Medina River below the Medina Diversion Lake Watershed, as identified in the Draft TCEQ 2014 Integrated Assessment, can be seen in Table 1903-3.


**LAND USE/LAND COVER**

The Lower Medina River Watershed is made up of a mixture of land uses and cover. The upper portion of the watershed is characterized by large forest and moderate agriculture areas with lower development. The middle portion is a mixture of forest, agriculture and pasture lands, with light to medium urban development southwest of the City of San Antonio. The Leon and Medio Creeks contribute flow to the lower portion of the watershed. This area has high pasture lands and agricultural areas with varying levels of development south of the City of San Antonio. Although Figure 1903-01 includes the Medio Creek Watershed, the Medio Creek land use information is not include in Lower Medina River Watershed characterization statistics.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority’s GIS Department, and includes National Land Cover Database (NLCD) 2011 data created by the Multi-Resolution Land Characteristics (MRLC) Consortium located at http://www.mrlc.gov/nlcd2011.php, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data. See Figure 1903-1 for more detail.

According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data, there are 7 permitted and one pending permitted discharges in Segment 1903. See Table 1903-4 for details.

**POSSIBLE CAUSES OF IMPAIRMENT OR INTEREST**

Drought conditions, municipal discharges, improperly maintained septic systems, stormwater runoff from agricultural lands, livestock and wildlife waste may be contributing to the bacterial impairment and nutrient concerns in the Lower Medina River.

**POTENTIAL STAKEHOLDERS**

- City of Somerset
- City of La Coste
- City of Castroville
- Landowners
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Bexar-Medina-Atascosa Counties Water Improvement District No. 1 (BMA)
- San Antonio Water System

**RECOMMENDATIONS FOR IMPROVING WATER QUALITY**

Until a TMDL is initiated, SARA and the TCEQ should continue routine monitoring and provide quality assured data to TCEQ for assessment. SARA should also work with partners to implement and monitor BMPs identified in the San Antonio River Authority Medina River Holistic Watershed Master Plan.

**SPECIAL PROJECTS**

- SARA Medina River Watershed Master Plan, 2011-2014: SARA and its consultant, Malcolm Pirnie/ARCADIS-US, together with stakeholders, the City of San Antonio, Bexar County and other partners are developing a high-level, long-range master plan for the Medina River Watershed, including portions of Medio Creek. The Master Plan will address potential water quality and flooding issues in a “holistic” or integrated manner, with planning emphasis on sustainable, non-structural solutions. This includes green infrastructure, low impact development programs, stormwater best management practices, and protection of riparian corridors through voluntary measures. Examples of these measures include conservation easements as well as development of parks and open spaces. In addition to sustainable solutions, traditional approaches such as complete streets and sustainable sites will be considered when alternatives are being evaluated.

- The acquisition of the 85 acres of property on the Medina River in southwest Bexar County known as the Catfish Farm will become the River Authority’s first Medina River Paddling Trail access for the public. This access point opens approximately 12 miles of paddling opportunities and creates additional park area for public recreation. In the fiscal year 2014/15 budget the Catfish property will receive site improvements to allow it to be opened for limited public use. This includes upgrading the road, developing and installing signage, adding fencing to exclude the public from catfish tanks or
demolishing tanks, and adding picnic amenities and paddling access.

- The San Antonio River Authority is conducting monitoring focused on identifying potential sources of bacterial contamination. These sampling efforts should continue.

**MAJOR WATERSHED EVENTS**

SARA conducts fish, habitat and 24-hour dissolved oxygen (DO) assessments in Segment 1903_04 at Station 14200, Medina River at County Road 484. The Draft 2014 Integrated Report indicates this station is fully supporting the high aquatic life use designation, with a fish Index of Biotic Integrity (IBI) scores of 43.50, a Habitat Quality Index (HQI) score of 20.0, and no exceedances of 24-hour dissolved oxygen average and minimum criterion. However, changes in land use, ambient low flows and wastewater discharge coupled with the extended drought conditions are factors that are directly affecting water quality and the biological communities in the Medina River below Medina Diversion Lake, as well as the entire Medina River Watershed. As a result of drought conditions, no biological monitoring was conducted at Station 14200 in 2014. As the majority of this segment is above the effluent contributions from Dos Rios Water Recycling Center, Leon Creek and Medio Creek Water Recycling Center Treatment Facilities, it is highly susceptible to extreme low flows during drought conditions; see Figure 1903-4 and 1903-5.

**IMAGES**

See Figure 1903-2 to 1903-5 for pictures of this segment.

**TABLES AND FIGURES**

<table>
<thead>
<tr>
<th>Seg_AU</th>
<th>TCEQ Segment AU Description</th>
<th>Stations in the Seg_AU</th>
<th>Station Short Description</th>
<th>Collection Entity</th>
<th>Monitoring Type</th>
<th>24 Hour DO</th>
<th>Habitat</th>
<th>Nekton</th>
<th>Conventional</th>
<th>Bacteria</th>
<th>Field</th>
<th>Flow</th>
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<tbody>
<tr>
<td>1903_01</td>
<td>Lower 5 miles of segment</td>
<td>12811</td>
<td>MEDINA RIVER AT FM 19937</td>
<td>TCEQ</td>
<td>RT</td>
<td>4</td>
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<td>1903_01</td>
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<td>16584</td>
<td>DOS RIOS WWTP DISCHARGE</td>
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<td>From 5 miles upstream of San Antonio River to 1.5 miles upstream of Leon Creek</td>
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<td>RT</td>
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<td>1903_03</td>
<td>From 1.5 miles upstream of Leon Creek to confluence with Live Oak Slough</td>
<td>12814</td>
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<td>SARA</td>
<td>RT</td>
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<td>1903_04</td>
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### Table 1903-4: Municipal & Industrial Wastewater Outfalls in Segment 1903 – Medina River Below Medina Diversion Lake

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<th>Wastewater Outfall</th>
<th>Permittee</th>
<th>Status</th>
<th>Type</th>
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<td>Dos Rios Water Recycling Center</td>
<td>San Antonio Water System</td>
<td>Current Permit</td>
<td>Wastewater</td>
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<td>Mitchell Lake</td>
<td>San Antonio Water System</td>
<td>Current Permit</td>
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<td>City of Somerset WWTP</td>
<td>City of Somerset</td>
<td>Current Permit</td>
<td>Domestic</td>
</tr>
<tr>
<td>ACCD First Response Academy WWTP</td>
<td>San Antonio River Authority</td>
<td>Current Permit</td>
<td>Domestic</td>
</tr>
<tr>
<td>City of La Coste WWTP</td>
<td>City of La Coste</td>
<td>Current Permit</td>
<td>Domestic</td>
</tr>
<tr>
<td>City of Castroville WWTF</td>
<td>City of Castroville</td>
<td>Current Permit</td>
<td>Domestic</td>
</tr>
<tr>
<td>Flowmatic Systems, Inc.</td>
<td>Flowmatic Systems, Inc.</td>
<td>Current Permit</td>
<td>Wastewater</td>
</tr>
<tr>
<td>Forest Glen Utility Company</td>
<td>Forest Glen Utility Company</td>
<td>Pending Permit</td>
<td>Domestic</td>
</tr>
</tbody>
</table>

**Domestic:** Less than 1 MGD domestic sewage; **Wastewater:** Greater than or equal to 1 MGD domestic sewage or process water including water treatment plant discharge
Figure 1903-1 Land Cover Map for Segment 1903
Figure 1903-2: Station 14200 - Medina River at County Road 484, August 2009

Figure 1903-3: Station 14200 - Medina River at County Road 484, March 2014
Figure 1903-4: Station 12814 – Medina River at Applewhite Road, located below the Medio Creek confluence

Figure 1903-5: Station 12813 – Medina River at Cassin Crossing, located below the Leon Creek confluence
SEGMENT DESCRIPTION

Segment 1909, in Medina County, extends from Medina Diversion Dam to Medina Lake Dam and reaches the normal pool elevation of 926.5 feet (impounds Medina River). See Table 1909-1 for the stations and number of proposed sampling events to be collected in the TCEQ 2015 fiscal year.

The USGS identifies the upper member of the Glen Rose Limestone underlying Medina Lake and the intervening stream channel from the outflow of Medina Lake to the midpoint of Medina Diversion Lake, where the Diversion Lake fault intersects Diversion Lake. A thin sequence of strata consisting primarily of the basal nodular and dolomitic members of the Kainer Formation of the Edwards Group, is present in the southern part of the area. Where Medina Dam, Medina Lake, and Diversion Lake come in contact with the Edwards limestone outcrop, a large amounts of water enters the Edwards Aquifer, either directly or indirectly through the Trinity Aquifer (USGS, 2004). The lake is owned and managed by the Bexar-Medina-Atascosa Counties Water Improvement District No. 1. While Medina Lake has numerous parks and public access areas, Medina Diversion Lake is surrounded by private property, and access to the lake is limited.

HYDROLOGIC CHARACTERISTICS

The Medina Diversion Lake is maintained by release of water from the Medina Lake Dam and is mainly used for water supply and recreational activities. As a result of the drought, the Medina Lake Dam gates have been closed and the level of the Medina Diversion Lake has dropped.

IMPAIRMENT/AREA OF INTEREST DESCRIPTION

Segment 1909 is located in Edwards Plateau Ecoregion and is identified in as being a 500 acres reservoir with a high aquatic life use designation. Aquifer protection use applies to this segment because it contributes to recharge of the Edwards Aquifer. Like all segments in the San Antonio River Basin, TCEQ has designated this section for primary contact recreation. Primary contact activities are presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. According to the Draft TCEQ 2014 Integrated Assessment, there are no impairments or concerns in this segment. See Table 1909-2 for Site-Specific Uses and Criteria for Segment 1909.

LAND USE/LAND COVER

The Medina Diversion Lake Watershed is predominantly forested areas with sparse areas of open and medium intensity development.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority’s GIS Department, and includes National Land Cover Database (NLCD) 2011 data created by the Multi-Resolution Land Characteristics (MRLC) Consortium located at http://www.mrlc.gov/nlcd2011.php, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data. See Figure 1909-01 for more detail.

According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data, there are no permitted discharges in Segment 1909.

POSSIBLE CAUSES OF IMPAIRMENT OR INTEREST

According to the Draft TCEQ 2014 Integrated Assessment, Medina Diversion Lake is meeting all TSWQS and screening criterion.

 POTENTIAL STAKEHOLDERS

- Local Municipalities
- Landowners
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
• US Fish and Wildlife Service
• Bexar-Medina-Atascosa Counties Water Improvement District No. 1 (BMA)
• San Antonio Water System

RECOMMENDATIONS FOR IMPROVING WATER QUALITY

The TCEQ field efforts should continue routine monitoring and provide quality assured data for TCEQ assessments. SARA should also work with partners to implement and monitor BMPs identified in the San Antonio River Authority Medina River Holistic Watershed Master Plan.

SPECIAL PROJECTS

SARA Medina River Watershed Master Plan, 2011-2014: SARA and its consultant, Malcolm Pirnie/ARCADIS-US, together with stakeholders, the City of San Antonio, Bexar County and other partners are developing a high-level, long-range master plan for the Medina River Watershed, including portions of Medio Creek. The Master Plan will address potential water quality and flooding issues in a “holistic” or integrated manner, with planning emphasis on sustainable, non-structural solutions. This includes green infrastructure, low impact development programs, stormwater best management practices, and protection of riparian corridors through voluntary measures. Examples of these measures include conservation easements as well as development of parks and open spaces. In addition to sustainable solutions, traditional approaches such as complete streets and sustainable sites will be considered when alternatives are being evaluated.

MAJOR WATERSHED EVENTS

The TCEQ sampling efforts in the watershed should continue. Extended drought conditions are directly affecting the water quality in the Medina Diversion Lake, as well as the entire Medina River Watershed.

IMAGES

See Figure 1909-2 and 1909-3 for pictures of this segment.

TABLES AND FIGURES

### Table 1909-1: 2015 Coordinated Monitoring Schedule for Segment 1909 - Medina Diversion Lake

<table>
<thead>
<tr>
<th>Seg AU</th>
<th>TCEQ Segment AU Description</th>
<th>Stations in the Seg AU</th>
<th>Station Short Description</th>
<th>Collection Method</th>
<th>Monitoring Type</th>
<th>24 Hour DO</th>
<th>Habitat</th>
<th>Nekton</th>
<th>Conventional Bacteria</th>
<th>Field</th>
<th>Flow</th>
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</thead>
<tbody>
<tr>
<td>1909_01</td>
<td>Entire segment</td>
<td>11407</td>
<td>MEDINA DIVERSION</td>
<td></td>
<td>TCEQ</td>
<td></td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
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</tbody>
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### Table 1909-2: Site-Specific Uses and Criteria for Segment 1909 - Medina Diversion Lake

<table>
<thead>
<tr>
<th>Segment</th>
<th>Segment Description</th>
<th>Recreation</th>
<th>Aquatic life use</th>
<th>Domestic Water Supply</th>
<th>Chloride (mg/L)</th>
<th>Sulfate (mg/L)</th>
<th>Dissolved Oxygen Grab (mg/L)</th>
<th>Dissolved Oxygen Grab Average (mg/L)</th>
<th>Dissolved Oxygen Grab Maximum (mg/L)</th>
<th>pH Range (pH)</th>
<th>Temperature (°C)</th>
<th>Nitrate Nitrogen (mg/L)</th>
<th>Ortho-Phosphorus (mg/L)</th>
<th>Total Phosphate (mg/L)</th>
<th>Total Phosphorus (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>Medina Diversion</td>
<td>PCR</td>
<td>High</td>
<td>High</td>
<td>50</td>
<td>75</td>
<td>400</td>
<td>5.0</td>
<td>3.0</td>
<td>50</td>
<td>3.0</td>
<td>6.5-9.0</td>
<td>12.2</td>
<td>0.05</td>
<td>0.20</td>
</tr>
</tbody>
</table>

1 Temperature was converted from °F to °C. The criteria for temperature are listed as maximum values at any site within the segment.
2 The indicator bacteria for freshwater is E. coli.
3 The aquifer protection use applies to areas in the contributing, recharge and transition zones of the Edwards Aquifer.
Figure 1909-1 Land Cover Map for Segment 1909
Figure 1909-2: Medina Diversion Lake

Figure 1909-3: Medina Diversion Dam
SEGMENT DESCRIPTION

The TCEQ describes Medina Lake, Segment 1904 as extending from Medina Lake Dam in Medina County to a point immediately upstream of the confluence of Red Bluff Creek in Bandera County, up to the normal pool elevation of 1072 feet (impounds Medina River). See Table 1904-1 for the stations and number of proposed sampling events to be collected in the TCEQ 2015 fiscal year.

The USGS identifies the upper member of the Glen Rose Limestone underlying Medina Lake and the intervening stream channel from the outflow of Medina Lake to the midpoint of Medina Diversion Lake, where the Diversion Lake fault intersects Diversion Lake. A thin sequence of strata consisting primarily of the basal nodular and dolomitic members of the Kainer Formation of the Edwards Group, is present in the southern part of the area. Where Medina Dam, Medina Lake, and Diversion Lake come in contact with the Edwards limestone outcrop, a large amounts of water enters the Edwards Aquifer, either directly or indirectly through the Trinity Aquifer (USGS, 2004).

Medina Lake is located in the Texas Hill Country where soils are generally shallow and underlain by limestone. The limestone rock has been eroded to create the steep hills in this region. The hills are dominated by Ashe juniper, Texas red oak and stunted live oak trees, and sparse grasses. Rainfall on the Edwards Plateau drains rapidly into creeks, causing flash floods within the region and downstream. The rapid flow often causes scouring of aquatic habitat within the region. Ranching is common, with this area becoming more populated with small hobby ranches.

HYDROLOGIC CHARACTERISTICS

Medina Lake is owned and managed by the Bexar-Medina-Atascosa Counties Water Improvement District No. 1. Medina Lake and was completed in 1913 with the primary purpose of supplying irrigation water for agricultural use. At the time of this report, Medina Lake has been severely affected by drought conditions and is at 3.2% of full capacity and -89.72 feet below reservoir and conservation storage level of 254,823 acre feet. In 1997 the Medina Lake reservoir storage was 295,400 acre feet and in 2015 is 8,893 acre feet. Medina Lake receives flow from the Upper Medina River which is also experiencing drought conditions.

IMPAIRMENT/AREA OF INTEREST DESCRIPTION

Segment 1904 is located in Edwards Plateau Ecoregion and is identified as being a 5575 acres reservoir with a high aquatic life use designation. It is also designated for use as a public water supply. Aquifer protection use applies to this segment because it contributes to recharge of the Edwards Aquifer. Like all segments in the San Antonio River Basin, TCEQ has designated this section for primary contact recreation. Primary contact activities are presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. According to the Draft TCEQ 2014 Integrated Assessment, there are no impairments or concerns in this segment. See Table 1904-2 for Site-Specific Uses and Criteria for Segment 1904.

LAND USE/LAND COVER

The area around the Medina Lake Watershed is composed of a mixture of land uses and cover. The majority of the watershed is evergreen and deciduous forests, shrub and herbaceous areas. Open and varying levels of development are located throughout the watershed, but mainly around the northern portions of the Lake. Medina Lake occupies 8.59% of the watershed.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority's GIS Department, and includes National Land Cover Database (NLCD) 2011 data created by the Multi-Resolution Land Characteristics (MRLC) Consortium located at http://www.mrlc.gov/nlcd2011.php, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data. See Figure 1904-1 for more details.

According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data, there is one permitted discharge in Segment 1904. See Table 1904-3 for details.
POSSIBLE CAUSES OF IMPAIRMENT OR INTEREST

According to the Draft TCEQ 2014 Integrated Assessment, Medina Lake is meeting all TSWQS and screening criteria.

POTENTIAL STAKEHOLDERS

- Local Municipalities
- Landowners
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Bexar-Medina-Atascosa Counties Water Improvement District No. 1 (BMA)
- San Antonio Water System

RECOMMENDATIONS FOR IMPROVING WATER QUALITY

As a result of unsafe conditions in accessing the sample site on the Media Lake Dam, the TCEQ has halted sampling collections. Once environmental condition improve, the TCEQ field efforts should continue routine monitoring and provide quality assured data for TCEQ assessment, see the Major Watershed Event Section for details. SARA should also work with partners to implement and monitor BMPs identified in the San Antonio River Authority Medina River Holistic Watershed Master Plan.

SPECIAL PROJECTS

- SARA Medina River Watershed Master Plan, 2011-2014: SARA and its consultant, Malcolm Pirnie/ARCADIS-US, together with stakeholders, the City of San Antonio, Bexar County and other partners are developing a high-level, long-range master plan for the Medina River Watershed, including portions of Medio Creek. The Master Plan will address potential water quality and flooding issues in a “holistic” or integrated manner, with planning emphasis on sustainable, non-structural solutions. This includes green infrastructure, low impact development programs, stormwater best management practices, and protection of riparian corridors through voluntary measures. Examples of these measures include conservation easements as well as development of parks and open spaces. In addition to sustainable solutions, traditional approaches such as complete streets and sustainable sites will be considered when alternatives are being evaluated.

- SARA Medina Dam Rehabilitation Project, 2010-2011: As a result of historic July 4-6, 2002 rainfall and flooding events throughout the Medina River Watershed, especially in Bandera, Medina and Bexar Counties, several dam inspections were conducted. These State and Consultant Dam Inspections Reports indicated that the Medina Lake Dam did not meet the probable maximum flood event or criteria for stability. In response to these to these reports, the Medina Lake Dam Rehabilitation Project was initiated in 2010. The $10 million dollar project was managed by SARA and provided management and construction administration services to Bexar-Medina-Atascosa Counties Water Control & Improvement District No.1 (BMA) and Bexar County for the Medina Dam improvements. The improvements included the addition of 30 anchors to the dam’s existing abutments. The improvements also included the addition of a concrete apron downstream of the emergency spillway and was completed in late 2011.

MAJOR WATERSHED EVENTS

Changes in land use, ambient low flow, and water withdraws coupled with the extended drought conditions are several factors affecting Medina Lake water levels. According to the Texas Water Development Board (TWDB) Water Data for Texas website located at http://waterdatafortexas.org/reservoirs/basin/san-antonio, as of this report, Medina Lake was at 3.2% of full capacity. Although the Draft TCEQ 2014 Integrated Report identifies Segment 1904 as meeting all TSWQS and screening criteria, the TCEQ has suspended 2015 sampling events due to unsafe sampling conditions. This will affect the amount of water quality data needed for future TCEQ Integrated Reports. The TCEQ has indicated they will resume monitoring once environmental conditions improve.

IMAGES

See Figure 1904-2 to 1904-6 for pictures of this segment.
Table 1904-3: Municipal & Industrial Wastewater Outfalls Segment 1904 - Medina Lake

<table>
<thead>
<tr>
<th>aquatic_Utilities, Inc.</th>
<th>Aquatic Utilities, Inc.</th>
<th>Current Permit</th>
<th>Domestic</th>
</tr>
</thead>
</table>

Domestic: Less than 1 MGD domestic sewage
Medina Lake (Segment 1904)  
2011 NLCD Land Cover

Legend

- Medina River Watershed
- Evergreen Forest 46.95%
- Herbaceous 10.19%
- Open Water 8.59%
- Shrub/Scrub 21.64%
- Woody Wetlands 0.01%
- Developed, High Intensity 0.02%
- Developed, Medium Intensity 0.19%
- Developed, Low Intensity 0.91%
- Developed, Open Space 6.71%
- Deciduous Forest 4.74%
- Developed, Low Intensity 0.91%
- Developed, Open Space 6.71%
- Developed, Medium Intensity 0.19%
- Developed, High Intensity 0.02%

Figure 1904-1 Land Cover Map for Segment 1904
Figure 1904-4: Medina Lake, April 2013

Figure 1904-5: Medina Lake sinkhole recharge feature, normally underwater, August 2013, picture courtesy of BCRAGD
Figure 1904-6: Medina Lake, Bandera County Park, September 2014; 3.8% capacity
SEGMENT DESCRIPTION
Segment 1905 extends from a point immediately upstream of the confluence of Red Bluff Creek in Bandera County to the confluence of the North Prong Medina River and West Prong Medina River in Bandera County. See Table 1905-1 for the stations and number of proposed sampling events to be collected in the TCEQ 2015 fiscal year. The North Prong Medina River, Segment 1905A, is the only unclassified segment of the Upper Medina River assessed in the Draft 2014 TCEQ Integrated Report.

This portion of the Medina River is rural and lies entirely within the Edwards Plateau. The immediate banks of the Upper Medina River vary from low, gently sloping, gravel-covered banks sparsely covered with native vegetation to high, steep, solid layers of limestone formations. This segment is characterized by alternating riffle, glides and pooled habitats with wide, gentle curves and bends. Substrates consist of limestone bedrock covered with gravel and boulders. Large cypress tree trunks are commonly seen lying within the stream bottom. The riparian corridor varies in width and consists of willows, cypress, pecan, and oaks. Native grasses and forbs are common along the stream.

HYDROLOGIC CHARACTERISTICS
According to the United States Geological Survey website located at http://waterdata.usgs.gov/tx/nwis/current/?type=flow, accessed on Jan 26, 2015, USGS gage – 08178880, Medina River at Bandera, TX, has a flow range from 14 (2009) to 710 (1992) cubic feet per second (cfs) and a median 31 annual year average flow of 54 cfs. As a result of thin top soil layers, large areas of exposed bedrock and small riparian corridor, this area is more susceptible to rapid runoff and scouring. This Segment is located in the Texas Hill Country, which is also known as “flash flood alley”. In general, post-rainfall flows generally return to normal within a week depending on the magnitude of the stormwater event.

IMPAIRMENT/AREA OF INTEREST DESCRIPTION
Segment 1905 is located in Edwards Plateau Ecoregion and is identified in the Draft 2014 TCEQ Integrated Report as being a freshwater perennial stream with an exceptional aquatic life use designation. Exceptional is the highest aquatic life use given by the state. This segment is also designated for use as a public water supply. Like all segments in the San Antonio River Basin, this segment is designated for primary contact recreation. Primary contact activities are presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. Impairments and concerns in Segment 1905 include:

Assessment Unit 1905_01: Existing data indicates that the fish community is not supporting the exceptional aquatic life use designation, a habitat concern has also been identified.

Assessment Unit 1905_02: A concern for fish community has been identified.

Assessment Unit 1905A: No impairments or concerns in this segment

See Table 1905-2 for Site-Specific Uses and Criteria for Segment 1903. Details of the Impairment and Concerns for the Medina River above Medina Lake Watershed, as identified in the Draft TCEQ 2014 Integrated Assessment, can be seen in Table 1905-3.

LAND USE/LAND COVER
The Upper Medina River Watershed is predominantly Evergreen Forest and Shrub cover with varying levels of development and agricultural activities.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority’s GIS Department, and includes National Land Cover Database (NLCD) 2011 data created by the Multi-Resolution Land Characteristics (MRLC) Consortium located at http://www.mrlc.gov/nlcd2011.php, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data. See Figure 1905-01 for more details.

According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data, there is one permitted discharge in Segment 1905. See Table 1905-4 for details.
POSSIBLE CAUSES OF IMPAIRMENT OR INTEREST

The Upper Medina River is characterized by well to poorly defined stream bends. Stream banks of the Upper Medina River vary from low-lying, gently sloping banks to high, steep, solid limestone formations. Many of the low-lying banks consist of gravel sparsely covered with native grasses and wildflowers. The dominant substrate type throughout the Upper Medina River is gravel. A critical component of habitat quality is substrate stability. The fish community and habitat impairments are believed to be the result of site-related limitations experienced during heavy rainfall, such as scouring down to bedrock. Although SARA and BCRAGD will continue to conduct biological monitoring in Segment 1905, biological efforts in 1905A have ceased. This will affect the amount of water quality data needed for future TCEQ Integrated Reports. As with all segments in the San Antonio River Basin, the extended drought conditions are another factor affecting the biological communities in the Upper Media River Watershed.

POTENTIAL STAKEHOLDERS

- Local Municipalities
- Landowners
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Bexar-Medina-Atascosa Counties Water Improvement District No. 1 (BMA)
- Lake Medina Conservation Society (LAMCOS)
- Bandera Canyonlands Alliance
- County Fire Marshall
- San Antonio Water System

RECOMMENDATIONS FOR IMPROVING WATER QUALITY

SARA and the BCRAGD should continue monitoring and provide quality assured data to TCEQ for assessment. SARA believes the impaired fish community and habitat concerns in the Upper Medina River Watershed are the result of site-specific related limitations and not the result of a pollutant(s). As a result, SARA is suggesting a TCEQ Aquatic Life Use Attainability Analyses be initiated to determine the appropriate ALU classification for the segment.

SARA and BCRAGD should continue routine monitoring and provide quality assured data to TCEQ for assessment. SARA should work with partners to implement and monitor BMPs identified in the San Antonio River Authority Medina River Holistic Watershed Master Plan.

SPECIAL PROJECTS

SARA Medina River Watershed Master Plan, 2011-2014: SARA and its consultant, Malcolm Pirnie/ARCADIS-US, together with stakeholders, the City of San Antonio, Bexar County and other partners are developing a high-level, long-range master plan for the Medina River Watershed, including portions of Medio Creek. The Master Plan will address potential water quality and flooding issues in a “holistic” or integrated manner, with planning emphasis on sustainable, non-structural solutions. This includes green infrastructure, low impact development programs, stormwater best management practices, and protection of riparian corridors through voluntary measures. Examples of these measures include conservation easements as well as development of parks and open spaces. In addition to sustainable solutions, traditional approaches such as complete streets and sustainable sites will be considered when alternatives are being evaluated.

MAJOR WATERSHED EVENTS

Due to lack of flow, SARA ceased biological collections in 2014 for Segment 1905A_01 at station 18447, North Prong of the Medina River at SH16. The Draft 2014 Integrated Report indicates this Segment 1905A is fully supporting the high aquatic life use designation, with a fish Index of Biotic Integrity (IBI) scores of 50.40, a Macrobenthic Community IBI score of 33.9, and a Habitat Quality Index (HQI) score of 21.8, and no exceedances of 24-hour dissolved oxygen average and minimum criterion. Changes in land use, ambient low flows coupled with the extended drought conditions are possible factors affecting water quality and the biological communities in the Medina River above Medina Lake, as well as the entire Medina River Watershed.
In response to the fish and habitat impairments and concerns in Segment 1905, TCEQ, BCRAGD and SARA will be conducting field reconnaissance of the Segment 1905 in early 2015 to determine if an Aquatic Life Use Attainability Analyses is needed to evaluate the appropriate Aquatic Life Use classification for the segment.

**IMAGES**

See Figure 1905-2 to 1905-4 for pictures of this segment.

**TABLES AND FIGURES**

**Table 1905-1: 2015 Coordinated Monitoring Schedule for Segment 1905 - Medina River above Medina Lake**

<table>
<thead>
<tr>
<th>Seg_AU</th>
<th>TCEQ Segment AU Description</th>
<th>Stations in the Seg_AU</th>
<th>Station Short Description</th>
<th>Collection Entity</th>
<th>Monitoring Type</th>
<th>24 Hour DO</th>
<th>Habitat</th>
<th>Nickton</th>
<th>Conventional</th>
<th>Bacteria</th>
<th>Field</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905_01</td>
<td>From lower end of segment to RR 470, upstream of Bandera</td>
<td>12830</td>
<td>MEDINA RIVER AT OLD ENGLISH CROSSING</td>
<td>BA/SARA</td>
<td>BS/RT</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>1905_02</td>
<td>Remainder of segment</td>
<td>21125</td>
<td>MEDINA RIVER AT MOFFITT PARK</td>
<td>BA</td>
<td>RT</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1905A_01</td>
<td>From the confluence with Segment 1905 (Medina River) up to the confluence with Shephard Creek</td>
<td>11447</td>
<td>NORTH PRONG MEDINA RIVER UPSTREAM OF SHEPHERD CREEK</td>
<td>BA</td>
<td>RT</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1905A_02</td>
<td></td>
<td>21126</td>
<td>NORTH PRONG MEDINA RIVER AT FM 2107</td>
<td>BA</td>
<td>RT</td>
<td>4</td>
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<td>4</td>
<td>4</td>
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</table>

**Table 1905-2: Site-Specific Uses and Criteria for Segment 1905 - Medina River above Medina Lake**

<table>
<thead>
<tr>
<th>Segment</th>
<th>Segment Description</th>
<th>Recreations</th>
<th>Legitimate Use</th>
<th>Ultimate Use</th>
<th>Fishable (mg/l)</th>
<th>Total Dissolved Solids (mg/l)</th>
<th>Blaschke Oxygen (mg/l)</th>
<th>Blaschke DO (mg/l)</th>
<th>Phosphorus (mg/l)</th>
<th>Nitrogen (mg/l)</th>
<th>pH Range (G1)</th>
<th>Temperature (°C)</th>
<th>Nutrients Screening Levels</th>
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</thead>
<tbody>
<tr>
<td>1905</td>
<td>Medina River Above Medina Lake</td>
<td>RV, EC</td>
<td>Excellent</td>
<td>PS</td>
<td>50</td>
<td>150</td>
<td>400</td>
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<td>150</td>
<td>6.0</td>
<td>6.0</td>
<td>6.5-8.0</td>
<td>11.1</td>
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</tbody>
</table>

1. Temperature was converted from °F to °C, the criteria for temperature are listed as maximum values at any site within the segment.
2. The indicator bacteria for freshwater is E. coli.
3. The critical low-flow for Segment 1905 is calculated according to §307.8(a)(2)(B) of the TSWQS.
### Table 1905-3: Draft 2014 Texas Integrated Report: Assessment Results for Segment 1905 - Medina River Above Medina Lake

<table>
<thead>
<tr>
<th>Sag_AU</th>
<th>Designated Use</th>
<th>Method</th>
<th>Parameter Description</th>
<th>Criteria</th>
<th># of Samples Assessed</th>
<th>Mean # of Samples Exceeding Criteria</th>
<th>Meas of Samples Exceeding Criteria</th>
<th>Data Set Qualifier</th>
<th>Level of Support</th>
<th>Impairment Category</th>
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</thead>
<tbody>
<tr>
<td>1905.01</td>
<td>Aquatic Life</td>
<td>Fish Community</td>
<td>Fish Community</td>
<td>52.00</td>
<td>6</td>
<td>48.6</td>
<td>AD</td>
<td>NS</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1905.02</td>
<td>Aquatic Life</td>
<td>Habitat</td>
<td>Habitat</td>
<td>26.00</td>
<td>6</td>
<td>18.8</td>
<td>AD</td>
<td>CS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dataset Qualifier Codes**
- AD = Adequate Data (10 or more samples)
- *=Impairment level was carried forward from a previous assessment due to inadequate data for this method in 2012 assessment period

**Level of Support**
- CS = Screening level concern
- NS = Not Supporting
- CN = Us Concern

**Impairment Category**
- * indicating additional data and information will be collected and/or evaluated for one or more parameters before a management strategy is selected. Concerns for nutrients have also been identified.

### Table 1905-4: Municipal & Industrial Wastewater Outfalls Segment 1905 - Medina River above Medina Lake

<table>
<thead>
<tr>
<th>Wastewater Outfall</th>
<th>Permittee</th>
<th>Status</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Bandera WWTP</td>
<td>City of Bandera</td>
<td>Current Permit</td>
<td>Domestic</td>
</tr>
</tbody>
</table>
Upper Medina River Watershed (Segment 1905) 2011 NLCD Land Cover

Legend
- Medina River Watershed

Land Cover
- Barren Land 0.09%
- Cultivated Crops 0.26%
- Deciduous Forest 5.14%
- Developed, High Intensity 0.02%
- Developed, Low Intensity 0.24%
- Developed, Medium Intensity 0.08%
- Developed, Open Space 3.23%
- Evergreen Forest 40.39%
- Hay/Pasture 0.25%
- Herbaceous 12.05%
- Mixed Forest 0.01%
- Open Water 0.16%
- Shrub/Scrub 38.04%
- Woody Wetlands 0.036%

Figure 1905-1 Land Cover Map for Segment 1905
Figure 1905-2: Station 21125 – Medina River at Moffett Park

Figure 1905-3: Station 21126 – North Prong Medina River at FM 2107
Figure 1905-4: Station 18447 – North Prong Medina River Upstream of SH16
SEGMENT DESCRIPTION

Lower Leon Creek Segment 1906 extends from the confluence with the Medina River in Bexar County to a point 100 meters (110 yards) upstream of State Highway 16 northwest of San Antonio in Bexar County. The approximate drainage area of the Lower Leon Creek is 228 square miles and it has a total continuous length of 32 miles. Segment 1906A, Helotes Creek, is an unclassified water body in the Leon Creek Watershed. For the Draft 2014 TCEQ Integrate Report there was inadequate data to assess 1906A for any use criteria. See Table 1906-1 for the stations and proposed number of sampling events to be collected in the TCEQ 2015 fiscal year.

Flow in the upper two-thirds of this segment pass through heavily urbanized portions of west and southwest San Antonio in Bexar County, including the main portion of Kelly USA, formerly Kelly Air Force Base. The lower one-third continues to flow in a general southwest direction through rural farm and ranch land. The portion of this segment between State Highway 16 to Highway 151 lies within the Edwards Recharge Zone and is dry except during times of heavy precipitation. The Balcones Escarpment bisects Bexar County from the west to northeast; bottom substrates along portions of Leon Creek that cross the Edwards Recharge formation consist of boulders, cobble, gravel and flat limestone bedrock scarred by cracks and fissures. Where alluvial substrates have accumulated, sycamores, willows and oak trees have established themselves. Below Highway 151, a noticeable change in habitat features occurs. Creek channels become narrow and deep and the surrounding geology is dominated by alluvial soils. Riparian vegetation becomes dense and dominated by stands of native hardwood trees, grasses, forbs, and shrubs. Complete canopies overshadow the creek in many areas within the lower reaches of this segment.

HYDROLOGIC CHARACTERISTICS

According to the United States Geological Survey website located at http://waterdata.usgs.gov/tx/nwis/current/?type=flow, accessed on Jan 26, 2015, the 29 year median annual average flow at USGS gage – 08181480, Leon Creek at IH 35, TX, is 31 cubic feet per second (cfs), and a flow range of 2.9 (2009) to 610 (1992) cfs.

As this Segment receives stormwater runoff for the Upper Leon Creek, which extends into the Texas Hill country, flow in Lower Leon Creek can take several weeks to return to normal depending on the magnitude of the stormwater event. Hilly terrain and low-permeability clay soils make this segment susceptible to rapid runoff and scouring.

IMPAIRMENT/AREA OF INTEREST DESCRIPTION

Segment 1906 is located in Texas Blackland Prairies Ecoregion and is identified in the Draft TCEQ 2014 Integrated Assessment as being a freshwater perennial stream with a high aquatic life use designation. For Segment 1906, the public supply designation does not apply from the confluence of the Medina River in Bexar County upstream to a point 4.8 Kilometers (3 miles) upstream. Like all segments in the San Antonio River Basin, this segment is designated for primary contact recreation. Primary contact activities are presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. Impairments and concerns in Segment 1906 include:

Assessment Unit 1906_01 and 1906_02: No impairments or concerns have been identified.

Assessment Unit 1906_03 through 1906_06: The Draft TCEQ 2014 Integrated Assessment identifies assessment units 1906_03 through 1906_06 as impaired for fish consumption.

Assessment Unit 1906_04: This AU was first identified in the 1999 Texas Water Quality Inventory and 303(d) List as impaired based on grab dissolved oxygen minimum concentrations lower than the standard established to assure optimum conditions for aquatic life. The Draft TCEQ 2014 Integrated Assessment identifies the dissolved oxygen impairment as 5a, indicating that a Total Maximum Daily Load (TMDL) is underway, scheduled, or will be scheduled for one or more parameters.

Assessment Unit 1906_05: Concerns for dissolved oxygen 24 hour average have been identified.

Assessment Unit 1906_06: Concerns for silver screening levels in sediment have been identified. Concerns for chlorophyll-a has also been detected.
See Table 1906-2 for Site-Specific Uses and Criteria for Segment 1906. Details of the impairments and concerns for the Lower Leon Creek Watershed, as identified in the Draft TCEQ 2014 Integrated Assessment, can be seen in Table 1906-3.

**LAND USE/LAND COVER**

The Lower Leon Creek Watershed lies entirely within Bexar County and is characterized by a mixture of land uses and cover. The upper portion of the watershed is characterized by large forest, moderate agriculture areas, with low to high areas of development along Interstate 410 and State Highway 151. The middle portion drains the heavily urbanized portions of west and southwest San Antonio, including Kelly USA, formerly Kelly Air Force Base. The lower portion, below Interstate 35, has higher levels of agricultural activities with varying levels of development. The watershed includes the municipalities of San Antonio, Cross Mountain, Helotes, and Leon Valley.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority’s GIS Department, and includes National Land Cover Database (NLCD) 2011 data created by the Multi-Resolution Land Characteristics (MRLC) Consortium located at http://www.mrlc.gov/nlcd2011.php, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data. See Figure 1906-01 for more details.

According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data, there are four permitted discharges in Segment 1906. See Table 1906-4 for details.

**POSSIBLE CAUSES OF IMPAIRMENT OR INTEREST**

Fish consumption bans and the metals in sediment concerns in the Lower Leon Creek are currently being studied. The Draft TCEQ 2014 Integrated Assessment identifies the Lower Leon Creek as a freshwater perennial stream. However, the 24-hour dissolved oxygen (DO) data collected as part of the 2008 TMDL verification study indicated that a site-specific standards change may be appropriate. Monitoring data for the study indicated that the creek meets neither the 24-hour DO average criterion (5.0 mg/L), nor the minimum criterion (3.0 mg/L) that are presumed for perennial streams. As a result, the TCEQ has initiated a Use Attainability Analysis to evaluate the appropriate aquatic life use and DO criterion for Lower Leon Creek. Existing depressed DO levels in the Lower Leon Creek may also be attributed to ambient low flow conditions exacerbated by drought conditions that have persisted throughout the San Antonio River Basin and the Draft TCEQ 2014 Integrated Assessment period.

**POTENTIAL STAKEHOLDERS**

- Bexar County
- City of San Antonio
- City of Leon Spring
- City of Helotes
- Texas Department of Transportation
- Bexar Regional Watershed Management (BRWM) partnership
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Landowners
- Texas Department State Health Service
- San Antonio Water System

**RECOMMENDATIONS FOR IMPROVING WATER QUALITY**

SARA and the TCEQ should continue routine monitoring and provide quality assured data to TCEQ for assessment and continue to work on the Lower Leon Creek Use Attainability Analysis to evaluate the appropriate aquatic life use and DO criterion for Lower Leon Creek. SARA and the USGS should continue to support projects designed to identify the source(s) of PCBs impairments and metal concerns. Low Impact Development should also be encouraged to reduce stormwater impact to water quality.
SPECIAL PROJECTS

Lower Leon Creek Depressed DO Verification Project, September 2010: The TCEQ contracted with SARA to verify depressed DO and develop information necessary to support TCEQ's DO Total Maximum Daily Load (TMDL) efforts on Lower Leon Creek, Segment 1906. The final report describes the 24-hour DO data from December 1, 2001 through August 31, 2010. The report can be viewed at SARA's website located at http://www.sara-tx.org/public_resources/library.php#enviro_monitoring.

USGS Occurrence, Distribution, and Concentrations of Selected Contaminants in Streambed- and Suspended-Sediment Samples Collected in Bexar County, Texas, 2007–09 study. The study sampled bed sediment and large volume suspended solids in in several segments in the San Antonio River Basin, including Segment 1906 Lower Leon Creek. Analyses included major and trace elements (including Mercury) and organic compounds including: DDT, Chlordane, Polychlorinated biphenyls (PCBs), and Polycyclic aromatic hydrocarbons (PAHs). The final USGS report is located at http://pubs.usgs.gov/fs/2011/3090/FS11-3090.pdf. The project was sponsored by SARA and the San Antonio Metropolitan Health District.

USGS Sources of Contaminants of Concern to Upper Leon Creek, San Antonio, Texas study. In October 2012, SARA and USGS initiated the Study to better characterize the source for PCBs in the Leon Creek Watershed upstream from the former Kelley AFB to Interstate Highway 410. Streambed sediment and suspended sediment samples will be collected to investigate the relation between storm flow and base flow sediment concentrations. Existing and new sample sites will be studied to add to the understanding of PCB concentrations in the study area. This project is being sponsored by SARA and should be complete by the end of the 2015 fiscal year.

Lower Leon Creek Use Attainability Analysis: Lower Leon Creek, Segment 1906 was originally listed on the 1999 303(d) List of Impaired Waters for depressed dissolved oxygen (DO). The TCEQ Total Maximum Daily Load (TMDL) Team initiated a sampling project to evaluate the low DO concentrations in these water bodies, Lower Leon Creek Depressed DO Verification Project, September 2010. The 24-hour DO data collected as part of the TMDL indicated that a site-specific standards change may be appropriate.

A Use Attainability Analysis is needed to evaluate the appropriate aquatic life use and DO criterion for Lower Leon Creek. Monitoring data indicates that the creek meets neither the 24-hour DO average criterion (5.0 mg/L), nor the minimum criterion (3.0 mg/L) that are presumed for perennial streams. As part of the project, fish, benthic, habitat, 24-hour dissolved oxygen and routine chemistry will be analyzed. The project should be complete in the 2016 fiscal year.

Leon Creek Holistic Watershed Master Plan: SARA, together with stakeholders, the City of San Antonio, Bexar County and other partners, is developing a comprehensive watershed master plan for the Leon Creek Watershed in Bexar County. Given the watershed's existing density and projected growth of development, the initial phases of the project focused on evaluating flooding conditions and proposing feasible mitigation solutions. Subsequent phases will incorporate other strategies such as improving water quality, identifying appropriate low impact development techniques, identifying stream restoration and mitigation banking opportunities, and investigating sustainable solutions to keep the watershed physically, chemically and biologically healthy.

MAJOR WATERSHED EVENTS

In 2002, the Texas Department of State Health Services (TDSHS) issued fish consumption advisory ADV-26 advising people not to consume any species of fish from the Lower Leon Creek as a result of concentrations of polychlorinated biphenyl (PCBs) in the fish tissue that posed an unacceptable risk to consumers. Subsequent TDSHS fish tissue collections and analysis at stations along Lower Leon Creek resulted in a new fish consumption advisory being issued on June 29, 2010. Advisory ADV-42 expanded the geographic area beginning at the Old U.S. Highway 90 Bridge and extends downstream to the Loop 410 Bridge. The Draft TCEQ 2014 Integrated Assessment identifies assessment units 1906_03 through 1906_06 as impaired for fish consumption. Drought conditions over the last several years have impacted the up portion of this segment, especially in 1906_06. As a result, no sampling was conducted in 2014. Although the 2015 Coordinated Monitoring Schedule includes monitoring in 1906_06, drought conditions may continue to impact this assessment unit and is scheduled for 2015.

IMAGES

See Figure 1906-2 to 1906-4 for pictures of this segment.
### Table 1906-1: 2015 Coordinated Monitoring Schedule for Segment 1906 - Medina River above Medina Lake

<table>
<thead>
<tr>
<th>Seg AU</th>
<th>TCEQ Segment AU Description</th>
<th>Stations in the Seg AU</th>
<th>Station Short Description</th>
<th>Collection Entity</th>
<th>Monitoring Type</th>
<th>74 Hour DO</th>
<th>Habitat</th>
<th>Nekton</th>
<th>Metal Water</th>
<th>Metal Sediment</th>
<th>Conventional</th>
<th>Bacteria</th>
<th>Field</th>
<th>Finw</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906_01</td>
<td>Lower 3 miles of segment</td>
<td>14198</td>
<td>LION CREEK UPSTREAM FROM LION CREEK WWP UPSTREAM OF THE CONFLUENCE WITH COMANCHE CREEK</td>
<td>SARA</td>
<td>B.S.RT</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906_02</td>
<td>From 3 miles upstream lower end of segment to confluence with Indian Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906_03</td>
<td>From confluence with Indian Creek to Hwy 353</td>
<td>12198</td>
<td>LION CREEK AT IH 35 SOUTH OF SAN ANTONIO</td>
<td>TCEQ</td>
<td>RT</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906_04</td>
<td>From Hwy 353 to two miles upstream</td>
<td>12140</td>
<td>LION CREEK AT GILTY ANN ROAD IN SAN ANTONIO</td>
<td>SARA</td>
<td>B3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906_05</td>
<td>From 2 miles upstream of Hwy 353 to Hwy 90</td>
<td>12141</td>
<td>LION CREEK AT LOW WATER CROSSING AT BUZ RANCH</td>
<td>TCEQ</td>
<td>RT</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906_06</td>
<td>Remainder of segment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 1906-2: Site-Specific Uses and Criteria for Segment 1906 - Lower Leon Creek

<table>
<thead>
<tr>
<th>Segment</th>
<th>Segment Description</th>
<th>Recreation</th>
<th>Aquatic Life Use</th>
<th>Passive Water Supply</th>
<th>Chlorine (mg/L)</th>
<th>Total Dissolved Solids (mg/L)</th>
<th>Dissolved Oxygen Grab</th>
<th>Dissolved Oxygen Grab Average (mg/L)</th>
<th>Dissolved Oxygen Grab Minimum (mg/L)</th>
<th>Dissolved Oxygen Grab Maximum (mg/L)</th>
<th>Ph Range (mg/L)</th>
<th>Temperature (°C)</th>
<th>pH</th>
<th>Temperature (°C)</th>
<th>Nutrient Screening Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906_05</td>
<td>Lower Leon Creek</td>
<td>PCR</td>
<td>High</td>
<td>ps</td>
<td>1.20</td>
<td>1.20</td>
<td>700</td>
<td>5.0</td>
<td>5.0</td>
<td>3.0</td>
<td>6.5-9.0</td>
<td>35</td>
<td>1.26</td>
<td>0.33</td>
<td>1.95</td>
</tr>
</tbody>
</table>

1. Temperature was converted from °F to °C; the criteria for temperature are listed as maximum values at any site within the segment.
2. The indicator bacteria for freshwater is E. coli.
### Table 1906-4: Municipal & Industrial Wastewater Outfalls in Segment 1906 – Lower Leon Creek

<table>
<thead>
<tr>
<th>Seg_AU</th>
<th>Designated Use</th>
<th>Method</th>
<th>Parameter Description</th>
<th>Criteria</th>
<th># of Samples Assayed</th>
<th>Mean or Geometric Mean of Samples Assayed</th>
<th># of Samples Exceeding Criteria</th>
<th>Data Set Qualifier</th>
<th>Level of Support</th>
<th>Impairment Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906_03</td>
<td>Fish Consumption Use</td>
<td>DHIS Advisories, Closures, and Risk Assessments</td>
<td>Restricted and No-Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OE</td>
<td>NS*</td>
<td>5a</td>
</tr>
<tr>
<td>1906_04</td>
<td>Aquatic Life Use</td>
<td>Dissolved Oxygen grab screening level</td>
<td>Dissolved Oxygen grab</td>
<td>5.00</td>
<td>26</td>
<td>4</td>
<td>4.15</td>
<td>SM</td>
<td>CN*</td>
<td>5a</td>
</tr>
<tr>
<td></td>
<td>Aquatic Life Use</td>
<td>Dissolved Oxygen grab minimum</td>
<td>Dissolved Oxygen grab</td>
<td>3.00</td>
<td>26</td>
<td>0</td>
<td></td>
<td>AD</td>
<td>NS*</td>
<td>5a</td>
</tr>
<tr>
<td></td>
<td>Aquatic Life Use</td>
<td>Dissolved Oxygen 24hr minimum</td>
<td>Dissolved Oxygen 24hr min</td>
<td>3.00</td>
<td>10</td>
<td>2</td>
<td>2.7</td>
<td>AD</td>
<td>CN</td>
<td></td>
</tr>
<tr>
<td>1906_05</td>
<td>Aquatic Life Use</td>
<td>Dissolved Oxygen grab average</td>
<td>Dissolved Oxygen grab average</td>
<td>5.00</td>
<td>10</td>
<td>2</td>
<td>4.75</td>
<td>AD</td>
<td>CN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fish Consumption Use</td>
<td>DHIS Advisories, Closures, and Risk Assessments</td>
<td>Restricted and No-Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OE</td>
<td>NS*</td>
<td>5a</td>
</tr>
<tr>
<td>1906_06</td>
<td>Aquatic Life Use</td>
<td>Toxic Substances in sediment</td>
<td>Silver</td>
<td>2.20</td>
<td>0</td>
<td></td>
<td></td>
<td>ID</td>
<td>CS*</td>
<td></td>
</tr>
<tr>
<td>General Use</td>
<td>Nutrient Screening Levels</td>
<td>Chlorophyll-a</td>
<td>Chlorophyll-a</td>
<td>14.1</td>
<td>13</td>
<td>5</td>
<td>18.56</td>
<td>AD</td>
<td>CS</td>
<td></td>
</tr>
<tr>
<td>Fish Consumption Use</td>
<td>DHIS Advisories, Closures, and Risk Assessments</td>
<td>Restricted and No-Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OE</td>
<td>NS*</td>
<td>5a</td>
</tr>
</tbody>
</table>

### Dataset Qualifier Codes:
- AD = Adequate Data (30 or more samples)
- OE = Other information than ambient samples evaluated; generally information is provided by outside entity
- ID = Insufficient Data (less than 4 samples)
- SM = Superseded by another method

### Level of Support:
- CNH = Concen
- SM = Sampling method
- NS = Not Supporting

### Impairment Category:
- *Indicating that a Total Maximum Daily Load (TMDL) is underway, scheduled, or will be scheduled for one or more parameters.

### Table 1906-4: Municipal & Industrial Wastewater Outfalls in Segment 1906 – Lower Leon Creek

<table>
<thead>
<tr>
<th>Wastewater Outfall</th>
<th>Permittee</th>
<th>Status</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leon Creek Recycling Center</td>
<td>San Antonio Water System</td>
<td>Current Permit</td>
<td>Wastewater</td>
</tr>
<tr>
<td>Leon Creek Steam Electric Station</td>
<td>City Public Service of San Antonio</td>
<td>Current Permit</td>
<td>Wastewater</td>
</tr>
</tbody>
</table>
Figure 1906-1 Land Cover Map for Segment 1906
Figure 1906-2: Station 14198 – Leon Creek Upstream from Leon Creek WWTP; Leon Creek UAA Biological Monitoring

Figure 1906-3: Station 12840 – Leon Creek Quintana Road
Figure 1906-4: Station 12838 – Leon Creek at IH 35 South of San Antonio
SEGMENT DESCRIPTION

Segment 1907, Upper Leon Creek, extends from a point 110 yards upstream of SH-16 (Bandera Road) northwest of San Antonio in Bexar County to a point 5.6 miles upstream of Scenic Loop Road north of Helotes in Bexar County. See Table 1907-1 for the stations and number of proposed sampling events to be collected in the TCEQ 2015 fiscal year.

The upstream portion of this creek is in the Edwards Plateau Ecoregion. This area is commonly referred to as the Texas Hill Country. The soils are generally shallow and underlain by limestone. The limestone rock has been eroded to create the steep hills in this region. The hills are dominated by Ashe juniper, Texas red oak and stunted live oak trees, and sparse grasses. Rainfall on the Edwards Plateau drains rapidly into creeks, causing flash floods within the region and downstream. The rapid flow often causes scouring of aquatic habitat within the region. Ranching is common with this area becoming more populated with small hobby ranches.

The downstream portion of this segment is in the Texas Blackland Prairie. This ecoregion is dominated by deep, dark-colored rich clay soils, also known as vertisol soils, which are gently sloping to level. Vertisol soils expand and shrink with moisture, causing cracks in the soil when it is dry. The deep, rich soils make the blackland prairie ideal for row crops, but in the San Antonio River Basin, this area is dominated by urbanization. Originally a tall grassland prairie, most of the original prairie has been replaced by urbanization and agriculture. Mesquite, blackjack and post oak trees are common.

HYDROLOGIC CHARACTERISTICS

According to the United States Geological Survey website located at http://waterdata.usgs.gov/tx/nwis/current/?type=flow, accessed on Jan 26, 2015, there is limit flow data available for USGS gage – 08181435, Leon Creek at Loop 410, San Antonio, TX. As of January 27, 2015, using existing USGS flow data between October 1, 2011 and January 27, 2015, the median annual average flow at USGS gage – 08181480, Leon Creek at IH 35, TX, has been calculated to be 6.2 cubic feet per second (cfs), and a flow range of 0 to 21 cfs. This Segment is located in the Texas Hill Country, which is also known as “flash flood alley”. Soils are diverse, generally shallow and underlain by limestone. Rainfall drains rapidly causing flash floods within the region and downstream. The rapid flow often causes scouring of aquatic habitat.

IMPAIRMENT AREA OF INTEREST DESCRIPTION

Segment 1907 is located in Edwards Plateau and Texas Blackland Prairies Ecoregions and is identified in the Draft TCEQ 2014 Integrated Assessment as being a freshwater perennial stream with a high aquatic life use designation. It is also designated for use as a public water supply. Aquifer protection use applies to this segment because it contributes to recharge of the Edwards Aquifer. Like all segments in the San Antonio River Basin, TCEQ has designated this section for primary contact recreation. Primary contact activities are presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. According to the Draft TCEQ 2014 Integrated Assessment, there are no impairments or concerns in this segment. See Table 1907-2 for Site-Specific Uses and Criteria for Segment 1907.

LAND USE LAND COVER

The Upper Leon Creek Watershed is characterized by a mixture of land uses and cover. The upper portion of the watershed is generally characterized by steeper sloped reaches and larger areas of forest in the western portions. Varying levels of development occur along Interstate Highway 90 north of Interstate 410. Progressing southward, south of Interstate 410, topography becomes less steep and land uses transitions to a highly urbanized area including northern and northwestern portions of San Antonio.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority’s GIS Department, and includes National Land Cover Database (NLCD) 2011 data created by the Multi-Resolution Land Characteristics (MRLC) Consortium located at http://www.mrlc.gov/nlcd2011.php, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data. See Figure 1907-01 for more details.
According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data, there is one permitted discharge in Segment 1906. See Table 1907-3 for details.

POSSIBLE CAUSES OF IMPAIRMENT OR INTEREST

According to the Draft TCEQ 2014 Integrated Assessment, the Upper Leon Creek is meeting all TSWQS and screening criterion.

POTENTIAL STAKEHOLDERS

- Bexar County
- City of San Antonio and other municipalities
- Texas Department of Transportation
- Bexar Regional Watershed Management (BRWM) partnership
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Landowners
- San Antonio Water System

RECOMMENDATIONS FOR IMPROVING WATER QUALITY

The TCEQ should continue routine monitoring and provide quality assured data to TCEQ for assessment.

SPECIAL PROJECTS

Leon Creek Holistic Watershed Master Plan: SARA, together with stakeholders, the City of San Antonio, Bexar County and other partners, is developing a comprehensive watershed master plan for the Leon Creek Watershed in Bexar County. Given the watershed's existing density and projected growth of development, the initial phases of the project focused on evaluating flooding conditions and proposing feasible mitigation solutions. Subsequent phases will incorporate other strategies such as improving water quality, identifying appropriate low impact development techniques, identifying stream restoration and mitigation banking opportunities, and investigating sustainable solutions to keep the watershed physically, chemically and biologically healthy.

MAJOR WATERSHED EVENTS

Changes in land use associated with urbanization, impervious cover and ambient low flow coupled with the extended drought conditions are several factors affecting the Upper Leon Creek Watershed.

IMAGES

See Figure 1907-2 and 1907-3 for pictures of this segment.

<table>
<thead>
<tr>
<th>Table 1907-1: 2015 Coordinated Monitoring Schedule for Segment 1907 - Upper Leon Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seg_AU</strong></td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>1907_01</td>
</tr>
</tbody>
</table>

TABLES AND FIGURES
### Table 1907-3: Municipal & Industrial Wastewater Outfalls in Segment 1907 – Upper Leon Creek

<table>
<thead>
<tr>
<th>Wastewater Outfall</th>
<th>Permittee</th>
<th>Status</th>
<th>Type</th>
</tr>
</thead>
</table>

1 Temperature was converted from °F to °C, the criteria for temperature are listed as maximum values at any site within the segment.
2 The indicator bacteria for freshwater is E. coli.
3 The aquifer protection use applies to areas in the contributing, recharge, and transition zones of the Edwards Aquifer.
Upper Leon Creek Watershed (Segment 1907) 2011 NLCD Land Cover

Legend

- Leon Creek Watershed
- Land Cover
  - Barren Land 0.55%
  - Cultivated Crops 0.12%
  - Deciduous Forest 6.07%
  - Developed, High Intensity 2.69%
  - Developed, Low Intensity 10.83%
  - Developed, Medium Intensity 9.20%
  - Developed, Open Space 18.21%
  - Evergreen Forest 33.69%
  - Herbaceous 5.06%
  - Open Water 0.03%
  - Shrub/Scrub 13.35%
  - Woody Wetlands 0.18%

Figure 1907-1 Land Cover Map for Segment 1907
Figure 1907-2: Downstream of the low water crossing at Station 12851 – Leon Creek in Raymond Russell Park

Figure 1907-3: Above the low water crossing at Station 12851 – Leon Creek in Raymond Russell Park
Medio Creek, Segment 1912, extends upstream from its confluence with the Medina River in southwest Bexar to a point 1.0 Kilometer (0.6 miles) upstream of Interstate Highway 35 in San Antonio in Bexar County. Segment 1912A, the upper portion of Medio Creek, continues up to approximately 1.0 mile upstream of the Bexar/Medina County line. Segment 1912A, the Upper Medio Creek, is the only unclassified segment of the Medio Creek Watershed assessed in the Draft TCEQ 2014 Integrated Assessment. See Table 1912-1 for the stations and number of proposed sampling events to be collected in the TCEQ 2015 fiscal year.

Medio Creek is dry or intermittent and becomes perennial below the San Antonio Water System’s Medio Creek Water Recycling Center located north of U.S. Highway 90 West. Total approximate drainage area is 53.6 square miles. Medio Creek is effluent-dominated throughout its perennial reach and no major tributaries contribute to the flow within Medio Creek. Instream habitat types in Medio Creek generally alternate between pools, glides and riffles throughout its length and some large impoundments are present within the perennial portion of the creek. Segment 1912A, the Upper Medio Creek is the only unclassified segment of the Medio Creek Watershed assessed in the Draft TCEQ 2014 Integrated Assessment.

HYDROLOGIC CHARACTERISTICS

There are no USGS gage stations as identified on the United States Geological Survey website located at http://waterdata.usgs.gov/tx/nwis/current/?type=flow. Increase flows in the Lower Medina River may back up flow in the Medio Creek during moderate to heavy rainfall events. Historical observations of the Medio Creek area just upstream of the confluence with Medina River indicate that backed up flow during heavy rainfall events often times results in ponding of water in the flood plain that may persist several months depending on environmental conditions. Under mild stormwater events, post-rainfall flows generally return to normal within a week.

IMPAIRMENT/AREA OF INTEREST DESCRIPTION

Segment 1912 is located in Texas Blackland Prairies Ecoregions and is identified in the Draft TCEQ 2014 Integrated Assessment as being a freshwater perennial stream with an intermediate aquatic life use designation. Segment 1912A is located in Ecoregion 32 and is identified in the TCEQ Integrated Report as being a freshwater intermittent stream with a minimal aquatic life use designation. Both segments are not designated for domestic water supply use. Like all segments in the San Antonio River Basin, these segments are designated for primary contact recreation. Primary contact activities are presumed to involve a significant risk of ingestion of water such as wading by children, swimming, water skiing, diving, tubing, surfing, handfishing as defined by Texas Parks and Wildlife Code, §66.115; including whitewater activities: kayaking, canoeing, and rafting. Concerns in Segment 1912 include:

- Assessment Unit 1912_01: Concerns for nutrients have been identified.
- Assessment Unit 1912A_01: Concerns for nutrients have been identified.

See Table 1912-2 for Site-Specific Uses and Criteria for Segment 1912. Details of the Draft TCEQ 2014 Integrated Assessment can be seen in Table 1912-3. Details of the concerns for Medio Creek Watershed, as identified in the Draft TCEQ 2014 Integrated Assessment, can be seen in Table 1912-3.

LAND USE/LAND COVER

The Medio Creek Watershed is characterized by a mixture of land uses and cover. The upper and lower portions of the watershed are characterized by larger areas of forest, shrub, herbaceous and agricultural areas. Higher levels of development occur in the middle portion along Loop 1604 and south of Interstate Highway 90 through the City of Von Ormy.

Information used to generate the Land Cover Maps was obtained from the San Antonio River Authority’s GIS Department, and includes National Land Cover Database (NLCD) 2011 data created by the Multi-Resolution Land Characteristics (MRLC) Consortium located at http://www.mrlc.gov/nlcd2011.php, and TCEQ Assessment Units data created by the Texas Commission on Environmental Quality located at http://www.tceq.state.tx.us/gis/download-tceq-gis-data. See Figure 1912-01 for more details.

According to the Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile located
at http://www.tceq.state.tx.us/gis/download-tceq-gis-data, there are 3 permitted and one pending permitted discharges in Segment 1912. See Table 1912-4 for details.

POSSIBLE CAUSES OF IMPAIRMENT OR INTEREST

Medio Creek is a waste water dominated stream which may account for the high nutrient levels as well as runoff from residential fertilizer usage from agricultural and urban land coupled with the drought conditions experienced over the assessment period.

POTENTIAL STAKEHOLDERS

- Local Municipalities
- Landowners
- Texas A&M AgriLife Extension Service
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- San Antonio Water System

RECOMMENDATIONS FOR IMPROVING WATER QUALITY

SARA and the TCEQ should continue routine monitoring and provide quality assured data to TCEQ for assessment. SARA should continue to work with partners to implement BMPs identified in the Watershed Master Plan once it is completed.

SPECIAL PROJECTS

SARA Medina River Watershed Master Plan, 2011-2014: SARA and its consultant, Malcolm Pirnie/ARCADIS-US, together with stakeholders, the City of San Antonio, Bexar County and other partners are developing a high-level, long-range master plan for the Medina River Watershed, including portions of Medio Creek. The Master Plan will address potential water quality and flooding issues in a “holistic” or integrated manner, with planning emphasis on sustainable, non-structural solutions. This includes green infrastructure, low impact development programs, stormwater best management practices, and protection of riparian corridors through voluntary measures. Examples of these measures include conservation easements as well as development of parks and open spaces. In addition to sustainable solutions, traditional approaches such as complete streets (curbs) and sustainable sites will be considered when alternatives are being evaluated.

MAJOR WATERSHED EVENTS

Above U.S. Highway 90 West, Medio Creek is normally dry or intermittent. During stormwater events, runoff could be expected to be high in nutrients from agricultural and residential fertilizers. The amount of development taking place in this area could also be contributing to the amount of stormwater runoff as the result of impervious cover. Below U.S. Highway 90 West, flow in Medio Creek is dominated by effluent from the Medio Creek Water Recycling Center. While this effluent is of high quality, it can also be high in nutrients.

IMAGES

See Figure 1912-2 and 1912-3 for pictures of this segment.
# TABLES AND FIGURES

## Table 1912-1: 2015 Coordinated Monitoring Schedule for Segment 1912 - Medio Creek

<table>
<thead>
<tr>
<th>Seg_AU</th>
<th>TCEQ Segment AU Description</th>
<th>Stations in the Seg_AU</th>
<th>Station Short Description</th>
<th>Collection Entity</th>
<th>Monitoring Type</th>
<th>DO</th>
<th>Habitat</th>
<th>Nkton</th>
<th>Conventional</th>
<th>Bacteria</th>
<th>Field</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912_01</td>
<td>Entries segment</td>
<td>13016</td>
<td>MEDIO CREEK AT HIDDEN VALLEY CAMPROUND</td>
<td>SARA</td>
<td>BS RT</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>1912A_01</td>
<td>Entries water body</td>
<td>12735</td>
<td>MEDIO CREEK AT US 90 WEST</td>
<td>TCEQ</td>
<td>RT</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
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</tbody>
</table>

## Table 1912-2: Site-Specific Uses and Criteria for Segment 1912 - Medio Creek

<table>
<thead>
<tr>
<th>Segment</th>
<th>Station Description</th>
<th>Use</th>
<th>Attendance Use</th>
<th>Domestic Water Supply</th>
<th>Chlorine (mg/L)</th>
<th>Total Dissolved Solids (mg/L)</th>
<th>Dissolved Oxygen (mg/L) Min (mg/L)</th>
<th>Dissolved Oxygen (mg/L) Average (mg/L)</th>
<th>pH Range (X)</th>
<th>Temperature (°C)</th>
<th>Nutrient Screening Levels</th>
<th>Nutrient Screening Levels</th>
<th>Nutrient Screening Levels</th>
<th>Nutrient Screening Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>Medio Creek</td>
<td>PCR</td>
<td>Intermediate</td>
<td>150</td>
<td>150</td>
<td>780</td>
<td>4.0</td>
<td>3.0</td>
<td>4.0</td>
<td>6.5-9.0</td>
<td>35</td>
<td>0.33</td>
<td>1.95</td>
<td>0.17</td>
</tr>
</tbody>
</table>

1 Temperature was converted from °F to °C, the criteria for temperature are listed as maximum values at any site within the segment.
2 The indicator bacteria for freshwater is E. coli.

## Table 1912-3: Draft 2014 Texas Integrated Report: Assessment Results for Segment 1912 - Medio Creek

<table>
<thead>
<tr>
<th>Seg_AU</th>
<th>Designated Use</th>
<th>Method</th>
<th>Parameter Description</th>
<th>Criteria</th>
<th>% of Samples Exceeding Criteria</th>
<th>Mean of Samples Exceeding Criteria</th>
<th>% of Samples Exceeding Criteria</th>
<th>Data Set Qualifier</th>
<th>Level of Support</th>
<th>Impairment Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912_01</td>
<td>General Use</td>
<td>Nutrient Screening Levels</td>
<td>Total Phosphorus</td>
<td>0.69</td>
<td>51</td>
<td>48</td>
<td>1.18</td>
<td>AD</td>
<td>CS</td>
<td></td>
</tr>
<tr>
<td>1912A_01</td>
<td>General Use</td>
<td>Nutrient Screening Levels</td>
<td>Nitrate</td>
<td>1.95</td>
<td>51</td>
<td>27</td>
<td>6.75</td>
<td>AD</td>
<td>CS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Use</td>
<td>Nutrient Screening Levels</td>
<td>Total Phosphorus</td>
<td>0.69</td>
<td>40</td>
<td>40</td>
<td>2.95</td>
<td>AD</td>
<td>CS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Use</td>
<td>Nutrient Screening Levels</td>
<td>Nitrate</td>
<td>1.95</td>
<td>41</td>
<td>32</td>
<td>10.33</td>
<td>AD</td>
<td>CS</td>
<td></td>
</tr>
</tbody>
</table>

Dataset Qualifier Codes:
- **AD** = Adequate Data (50 or more samples)
- **CS** = Screening level concern

## Table 1912-4: Municipal & Industrial Wastewater Outfalls in Segment 1912 - Medio Creek

<table>
<thead>
<tr>
<th>Wastewater Outfall</th>
<th>Permittee</th>
<th>Status</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bexar Metropolitan Development Corp.</td>
<td>Bexar Metropolitan Development Corp.</td>
<td>Current Permit</td>
<td>Wastewater</td>
</tr>
<tr>
<td>Medio Creek Water Recycling Center</td>
<td>San Antonio Water System</td>
<td>Current Permit</td>
<td>Wastewater</td>
</tr>
</tbody>
</table>
Medio Creek Watershed (Segment 1912)
2011 NLCD Land Cover

Legend

- Medio Creek Watershed
- Barren Land 0.36%
- Cultivated Crops 6.84%
- Evergreen Forest 8.36%
- Hay/Pasture 1.57%
- Deciduous Forest 13.56%
- Herbaceous 7.29%
- Mixed Forest 0.11%
- Open Water 0.26%
- Developed, High Intensity 2.15%
- Shrub/Scrub 20.26%
- Developed, Low Intensity 12.75%
- Developed, Medium Intensity 11.04%
- Developed, Open Space 14.04%
- Woody Wetlands 1.38%
- Emergent Herbaceous Wetlands 0.03%

Figure 1912-1 Land Cover Map for Segment 1912
Figure 1912-2: Medio Creek, Station 12916 – Medio Creek at Hidden Valley Ranch

Figure 1912-3: Upper Medio Creek, just upstream of Station 12735 – Medio Creek at US 90 West
REFERENCES


TCEQ. 2014 Texas Surface Water Quality Standards. These standards were adopted by the Texas Commission on Environmental Quality (TCEQ), on February 12, 2014, and received by EPA for review on April 29, 2014. TCEQ website accessed on Jan 26, 2015. http://www.tceq.state.tx.us/waterquality/standards/eq_swqs.html


TCEQ. 2014 Draft TCEQ Integrated Report. The TCEQ will make necessary changes to the draft report and bring the Draft 2014 Texas Integrated Report before the Commissioners for approval to submit to EPA. The Draft and summary of the comments and responses will be posted on the TCEQ’s Website. TCEQ website accessed on Jan 26, 2015. https://www.tceq.texas.gov/waterquality/assessment

TCEQ. Coordinated Monitoring Schedules, past and current. The TCEQ Coordinated Monitoring Schedule is hosted and maintained by the Lower Colorado River Authority. Website accessed on Jan 26, 2015. https://cms.lcra.org/

TCEQ. Texas Commission on Environmental Quality Permitted Wastewater Outfalls shapefile. Each dataset is available in shapefile (shp), file geodatabase (gdb), and Google Earth (kmz) formats. Download GIS datasets maintained by the TCEQ. Website accessed in December 2014. http://www.tceq.state.tx.us/gis/download-tceq-gis-data,


Texas Water Development Board Water Data for Texas. The website is a product of the Texas Water Development Board (TWDB) Surface Water Resources division and is made possible by the support of management and staff at TWDB. Website accessed on Jan 26, 2015. http://waterdatafortexas.org/reservoirs/basin/san-antonio


USGS. Current and historical conditions for Texas USGS Gage Station. Stream flow. Provides surface-water data, including gage height (stage), stream flow (discharge) and water quality parameter (field measurements) where available. Website accessed on Jan 26, 2015. http://waterdata.usgs.gov/tx/nwis/current/?type=flow