



Water Quality Summary, 2016

Overview

The Gulf Coast Network (GULN) Water Quality Monitoring Program began collecting samples in September 2007. The program was developed primarily from protocols of the U. S. Geological Survey (USGS) National Water-Quality Assessment Program and the Texas Commission of Environmental Quality's (TCEQ) Surface Water Quality Monitoring Program. The GULN program monitors 54 sites across seven parks which are sampled on a set rotation.

The GULN Water-Quality Program was designed to provide an integrated assessment of the spatial and temporal distribution of general water-quality conditions and the transport of major inorganic constituents of stream and estuary water in relation to hydrologic conditions and major sources.

The network began long-term monitoring of water quality at Big Thicket National Preserve (BITH) with quarterly sampling in October 2007. In October 2013, monitoring was increased to monthly sampling at the same six sites: Menard Creek, Big Sandy Creek, Little Pine Island Bayou, Turkey Creek, Village Creek at McNeely Bridge, and its mouth at the Neches River. Field measures include water temperature, specific conductance (SpC), pH, dissolved oxygen (DO) and turbidity. Samples are collected for *Escherichia coli* (*E. coli*), chloride, sulfate, total dissolved solids, alkalinity, hardness, calcium, magnesium, ammonia, nitrate, nitrite, and phosphorous.

This brief summarizes data collected from January, 1 2016 through December 31, 2016. Water quality data are available upon request to the Gulf Coast Network or on our website: <http://science.nature.nps.gov/im/units/guln/index.cfm>.



Figure 1. Village Creek at McNeely Bridge, January 12, 2016. Image by Whitney Granger. All streams in the preserve were at flood stage following extensive rains.

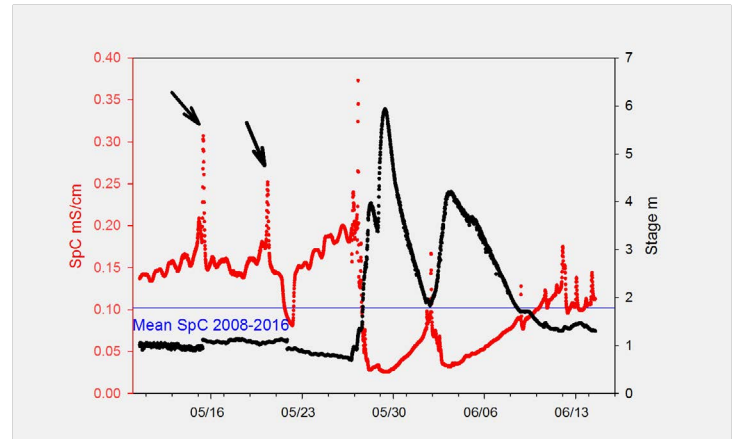


Figure 2. Specific conductance (SpC) at Menard Creek May 10 through June 14, 2016. The mean SpC is 0.102 mS/cm from 74 routine visits between 2008 and 2016. The arrows indicate episodes of high SpC not related to runoff.

Significant Findings

Highlights of Calendar Year 2016 Monitoring

There were 25 violations of state water-quality standards and screening limits documented during 2016. In seven samples, pH was below the lower limit of 6.0 SU. However, low pH is natural to all wadeable streams of the preserve and thus does not constitute an actual violation. Likewise, during the hot summer months when there is limited flow, DO concentrations below the lower limit of 3.0 mg/L were reported at Little Pine Island Bayou at Lance Rosier eight times. Elevated *E.coli* was found six times across all sites except Turkey Creek. High turbidity was found once at Little Pine Island Bayou. Both high bacteria and turbidity were associated with rainfall events that produced runoff. The state's proposed screening limit for ammonia was exceeded twice during the summer at Little Pine Island Bayou. The state limit for water temperature of 32.2°C was exceeded at Village Creek State Park one time.

Episodes of High Specific Conductivity

Specific conductance is a measure of water's ability to conduct electrical current. Distilled water is not conductive as it has no dissolved material. Conversely, seawater readily conducts electricity due to the abundance of dissolved ions. Elevated SpC was first detected in 2015, and was found to be caused by increased concentrations of chloride and sulfate at Menard Creek and Little Pine Island Bayou. To document the frequency and duration of high SpC, an autonomous device was placed in Menard Creek where it measured SpC and stage (water depth) every 15 minutes between May 10 and June 14, 2016 (Figure 2). There were at least two episodes of elevated SpC over these 35 days. It is likely that brines (a common chloride source) from oil and gas activities were released into the Menard Creek watershed causing this spike in SpC. The preserve is working with the Texas Railroad Commission (the state regulatory authority over petroleum exploration) to determine the source of the chloride and sulfate.

Water Quality Standards

The state of Texas designates the waters of the preserve as “High Aquatic Life Use.” Village Creek is further designated as “Primary Contact Recreation” (high likelihood of ingesting water) and as a public water supply, while the rest of the streams are designated “Secondary Contact Recreation” (low likelihood of ingesting water). Designated uses are used to set water-quality standards. Temperature and sulfate standards are different for Pine Island Bayou and its tributary of Little Pine Island Bayou (sites LPIB and LPLR) than the remaining five sites on Village and Menard Creeks (MCMC). Dissolved oxygen has a higher standard in the spring than the rest of the year. Some parameters do not have state standards but are measured for accurate interpretation of results.

Parameter	Criteria
Ammonia as N	Screening < 0.33 mg/L
Chloride	< 150 mg/L
Specific conductance	No state standard
Dissolved oxygen	> 3.0 mg/L, Spring season: > 4.5 mg/L
<i>E. coli</i>	< 394 MPN/100 mL, single sample
Flow	No state standard
Hardness, total	No state standard
Nitrite as N	Screening <1.95 mg/L
pH	Between 6.0 and 8.5 SU
Phosphorous, total	Screening < 0.69 mg/L
Sulfate	< 50 mg/L (PIB), < 75 mg/L (VC MC)
Total Dissolved Solids	< 300 mg/L
Water temperature	< 35°C (PIB), < 32.2°C (VC MC)

Future Monitoring

Monthly water-quality sampling will continue throughout calendar year 2017.

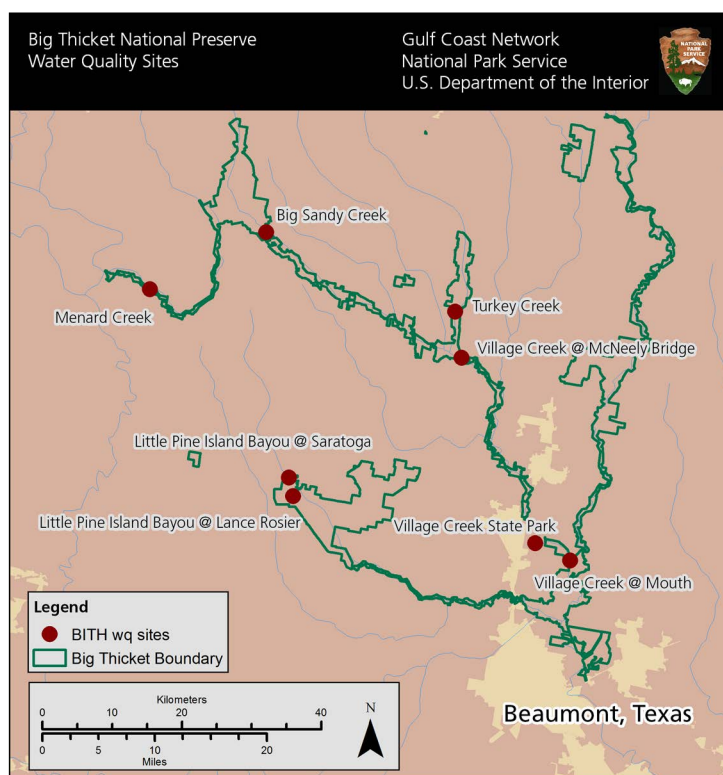


Figure 3. Map of Big Thicket National Preserve water-quality monitoring sites.

About the Gulf Coast Network

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as “Vital Signs Monitoring,” to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

The NPS Vital Signs Monitoring Program addresses five goals for all parks with significant natural resources:

- Determine the status and trends in selected indicators of the condition of park ecosystems,
- Provide early warning of abnormal conditions,
- Provide data to better understand the dynamic nature and condition of park ecosystems,
- Provide data to meet certain legal and Congressional mandates, and
- Provide a means of measuring progress towards performance goals.

Effective long-term management and stewardship of natural resources in the Gulf Coast Network begins with baseline knowledge of these resources. To acquire this knowledge, an inventory program was established by the National Park Service with the goal of acquiring baseline information for a variety of resources, from bibliographic information to species occurrence and distribution.

For More Information

GULN Home Page:

<http://science.nature.nps.gov/im/units/guln/index.cfm>

GULN Reports & Publications:

<http://science.nature.nps.gov/im/units/guln/publications.cfm>

About the NPS Inventory & Monitoring Program:

<http://science.nature.nps.gov/im/index.cfm>

Data Downloads via the Natural Resource Information Portal:

<http://irma.nps.gov>