La Nana Bayou Watershed Protection Plan

Draft Chapter 4 – Potential Pollution Sources

The previous chapter discussed what impairments and concerns exist within La Nana Bayou: excessive bacteria (*E. coli*) and elevated nutrient concentrations (nitrogen and total phosphorus). The sources of these pollutants are categorized as either a "point source" or "nonpoint source." Point sources enter receiving waters at identifiable locations, while nonpoint sources enter the water body via runoff. Potential pollution sources in the watershed were identified through stakeholder input, project partners and watershed monitoring and are summarized in Table 1 below.

Table 1 Summary of Pollutant Impacts and Causes by Source.

| Pollutant Source	Potential Impacts	Potential Causes
Wastewater Treatment Plants and Sanitary Sewer Overflows	Bacteria and nutrients from untreated wastewater may enter waterbodies	- Overflow during large storm events - Systemic failures due to age, lack of routine maintenance, etc.
Wildlife and Livestock	Direct and indirect transfer of bacteria from waste; erosion of soil from riparian degradation	- Animals directly depositing feces into waterbody or in riparian area - Wallowing and rooting in riparian areas cause erosion and soil issues
Pets	Direct and indirect transfer of bacteria from waste	- Pet owners not properly disposing of waste in public areas and at home - Lack of education regarding impacts from improper pet waste management
Urban Stormwater Runoff	Water may quickly enter waterbody and carry bacteria, litter, oils and nutrients with it, especially during flood conditions	- Impervious surfaces (e.g. parking lots, roadways) - Dumping chemicals in storm drains - Excessive application of fertilizers and pesticides
Illegal Dumping	Direct and indirect contamination of waterbody from trash and decaying carcasses	- Litter and animal carcasses dumped near waterbodies - Trashed areas tend to stay trashed
On-site Sewage Facilities (Septic Systems)	Improper treatment or disposal of waste may cause wastewater with harmful bacteria to surface and enter waterbodies through runoff, especially from households close to rivers and creeks	- Poor functionality due to site design, age, lack of maintenance (e.g., routine pumping) - Incorrect treatment of waste (e.g., not chlorinating system properly, pouring household chemicals down drain, etc.)
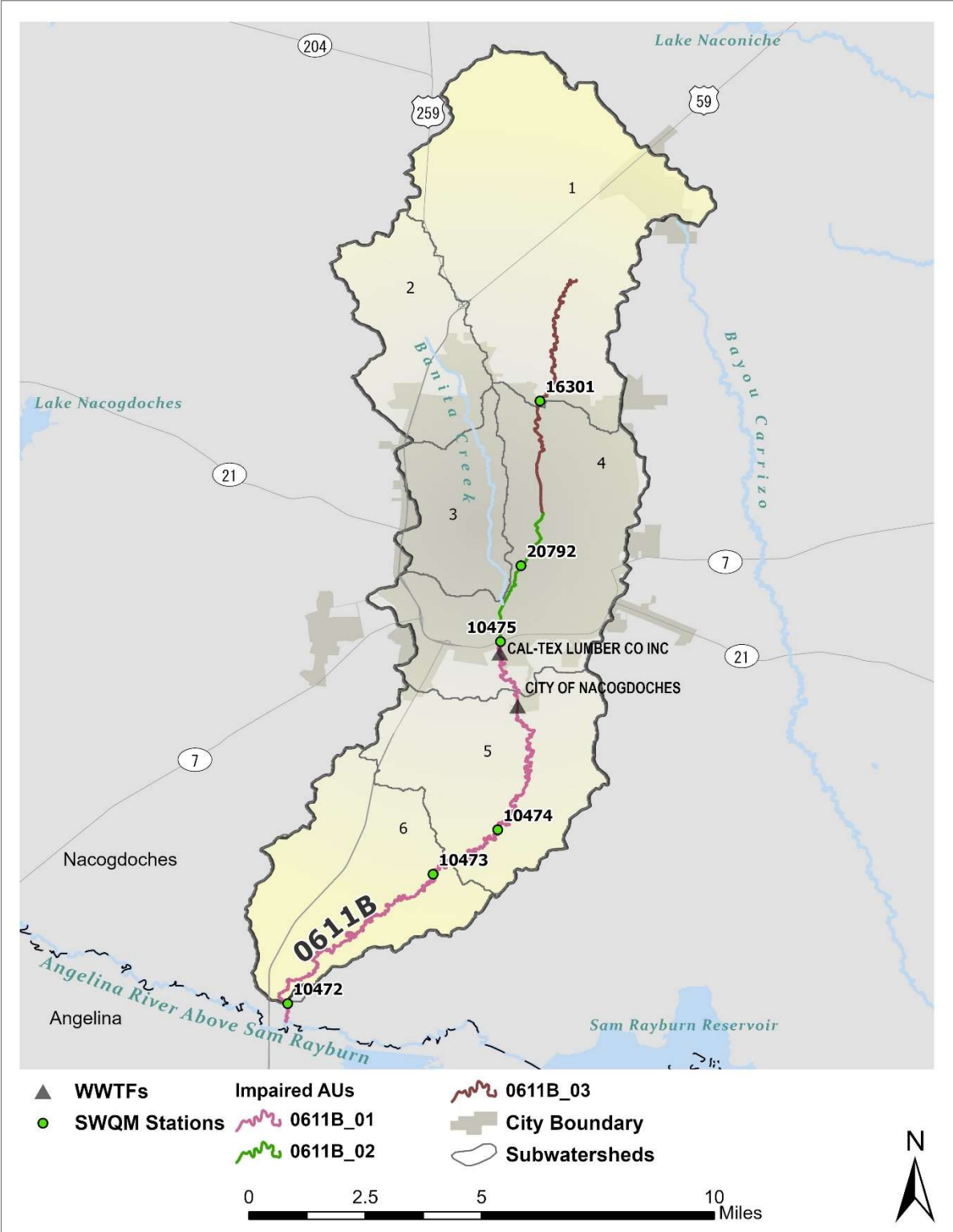
Figure 1 *La Nana Bayou subwatersheds, water quality monitoring stations, and permitted wastewater outfalls*

Point Source Pollution

Point sources of pollution are regulated end-of-pipe outlets for cooling water, wastewater, or stormwater originating from industrial or municipal treatment systems (TCEQ and TSSWCB 2016) and are regulated by permits from the National Pollutant Discharge Elimination System (NPDES) and the Texas Pollutant Discharge Elimination System (TPDES). These can include municipal and industrial wastewater treatment plants (WWTP), general wastewater, and general stormwater permits. Other examples of point source pollution include Confined Animal Feeding Operations (CAFOs), concrete production, wastewater evaporation ponds, pesticide general permits, and Multi-Sector General Permits.

Wastewater Treatment Plants (WWTPs)

In the La Nana Bayou watershed, two facilities have discharge permits according to TPDES (Figure 1). Only one active municipal WWTP exists in the watershed and is permitted by the City of Nacogdoches (STP 2A WWTP; TPDES permit #WQ0010342004) to discharge of 12.88 million gallons of treated effluent daily (MGD) into La Nana Bayou with a maximum *E. coli* concentration of 126 colonies per 100 mL. The other facility permitted to discharge wastewater to La Nana Bayou is the Cal-Tex Lumber Company (TPDES permit #WQ0004198000). Their permit allows for the discharge of industrial cooling, storm, and wash water from their milling facility. No permit limits exist for flow rate or *E. coli* concentrations for Cal-Tex Lumber because it is not a wastewater treatment facility.

Table 2 *Reported Data from the WWTP in La Nana Bayou (April 2017 – April 2022).*

Facility Name (TPDES Permit No.)	Flow (MGD)		Bacteria (mpn/100 mL)		Exceedance Violations
	Permitted	Average	Permitted	Average	
City of Nacogdoches (#WQ0010342004)	12.88	6.33	126	1.45	None

Sanitary Sewer Overflows

Sanitary sewers are systems that collect and transport wastewater to appropriate treatment facilities. The release of raw sewage from these lines, or sanitary sewer overflow (SSO) events, happen when sewer lines fail due to age, lack of maintenance, or are overloaded during rain events. In Nacogdoches, two SSO events were reported between 2016 and mid-2021 (Table 3).

Table 3 *SSO events in Nacogdoches County between January 2016 and April 2021.*

Facility	Date	Gallons	Cause
Pilgrim's Pride @ 928 Martin Luther King Jr. Blvd.	1/12/2016	6700	Pump failure causing overflow into parking lot
Pilgrim's Pride @ 2842 FM 1275	10/18/2017	200	Alarm and retaining curb failure caused discharge into drainage ditch

Nonpoint Source Pollution

Nonpoint source pollution occurs when rainfall causes runoff of pollutants into drainage ditches, lakes, rivers, or other water bodies (TCEQ and TSSCWB 2016). These sources can include bacteria from livestock or pet waste, wildlife waste, urban and agriculture runoff, failing OSSFs, and other sources.

Wildlife, Deer, and Feral Hogs

Wildlife is present in all watersheds and prone to congregate in stream and riparian areas due to food, water and shelter availability. Wildlife-derived *E. coli* may enter waterways through direct deposition or from indirect fecal material transfer via runoff. Estimates of most wildlife including raccoons, opossums, and birds are difficult to ascertain; therefore, management commonly focuses on two species with practical management options: white-tailed deer and feral hogs (Table 4).

Table 4 *Deer and feral hog estimates for the La Nana Bayou watershed.*

Animal	Applicable LCLU Classes	Acres in Watershed	Density (acre/animal)	Estimated Population in Watershed
Feral Hog*	Forest, Pastures, Shrub/Scrub, Wetlands	39,574	33.33	1,187
Deer**		39,574	56.49	700

*Feral hogs were estimated based upon a density of 33.3 acres per hog (Wagner and Moench 2009).
**Deer populations are estimated based upon Texas Parks and Wildlife Department (TPWD) estimates of 56.49 acres per deer (Alan Cain, personal communication, Jan 25, 2021).

Both species prefer similar land classes: forest, pasture, shrub, and wetlands. While they mostly travel through riparian corridors, they can also be found in the pastures, croplands, and rangelands, especially at night. Feral hogs in particular are significant contributors of fecal bacteria to waterbodies as they spend much of their time wallowing in and around the water. These non-native, invasive hogs also cause erosion and soil loss issues due to their rooting and wallowing habits.

Livestock

Domestic livestock or the use of their manure as fertilizer can introduce *E. coli* into the watershed. La Nana Bayou livestock populations were estimated using the United States Department of Agriculture (USDA) National Agricultural Statistics Survey (NASS) data. Since NASS data are county-based, populations for cattle, horses, hogs, sheep and goats were estimated based upon percentage of rural area within the watershed (Table 5).

Table 5 National Agricultural Statistics Survey based livestock estimates for the La Nana Bayou watershed.

Nacogdoches County NASS Numbers Scaled to Watershed	Livestock				
	Cattle	**Hog**	**Horse**	**Goat**	**Sheep**
	2,900	4	98	40	17

Several animal feeding operations (AFOs) exist in the watershed. These operations are required to obtain a Water Quality Management Plan (WQMP) from the Texas State Soil and Water Conservation Board (TSSWCB) before operations can begin. WQMPs are reviewed and agreed to by local soil and water conservation districts and NRCS. Discharge of animal waste is not allowed through the plans. Five AFOs exist in the watershed including poultry (broilers) and dairy operations that are planned to house 709,100 broilers and 190 dairy cows. WQMPs developed for these operations describe management practice required for each operation and include nutrient management, prescribed grazing, waste management, watering facilities. Management varies by plan and is designed to fit the specific operation and property.

Pets

Cats and dogs can be a major contributor to *E. coli* in a watershed if pet waste is not properly discarded. Domestic pets are associated with human populations thus most cats and dogs in the La Nana Bayou watershed are expected to be in and near the City of Nacogdoches. Nationwide survey data suggests that there are 0.457 cats and 0.614 dogs per household in the US (AVMA, 2018), which equates to approximately 8,247 cats and 11,079 dogs in the La Nana Bayou Watershed. Additionally, public survey research conducted in the Eastern US indicates that waste from roughly 40% of dogs is not properly disposed of (CWP 2021). Similarly, 30% of all cats are estimated to be outdoor cats whose waste is not properly discarded (APPA 2014). While these numbers are not from the watershed, they provide some insight regarding potential pet waste influences on water quality and are assumed applicable for watershed pollutant loading assessments.

Stormwater

Rainfall generated stormwater is a vehicle for almost all pollutant types that impact surface water bodies. Debris, dissolved pollutants, fecal matter, nutrients (nitrogen, phosphorus, etc.), sediment and more are transported overland and into water bodies when sufficient rainfall occurs to create runoff. This is a natural and important process but excess quantities of any of these constituents can be detrimental to instream water quality. Runoff occurs from all land cover and soil types when rainfall rates exceed the soil's infiltration capacity. Impervious surfaces including buildings, parking lots, and roadways common in developed land uses all increase runoff generation, volume above what would occur naturally. In developed areas, the timing when water arrives in the stream is also altered and generally leads to increased peak flows which lead to higher flooding potential. Combined, these factors can all have adverse effects on instream water quality.

Illegal Dumping

Improper waste disposal is an issue across La Nana Bayou watershed and the surrounding area. Although most trash items dumped are not necessarily major sources of bacteria and nutrient pollution, areas that are littered tend to become dumping areas for others as well, which can cause blockages and flooding or more surface area for bacteria to grow on. Other commonly dumped items like animal carcasses and common household chemical containers can contribute additional bacteria and nutrients to the watershed.

On-site Sewage Facilities (OSSFs)

Since much of the watershed is rural, most residents outside of Nacogdoches rely on OSSFs to treat domestic wastewater. OSSFs are an acceptable wastewater treatment alternative for households unable to connect to municipal systems. If an OSSF is properly designed, installed, routinely inspected and properly managed, they can provide an adequate level of treatment and disinfection. However, failing OSSFs can lead to nonpoint bacterial contamination within a watershed.

Improper site design, age, and lack of maintenance like regular pumping and proper chlorination can cause OSSFs to fail in their ability to treat waste before it enters the environment. The ability of the soil to adsorb wastewater affects the ability of a conventional OSSF to function as well. The NRCS developed soil suitability rankings based on topography, saturated hydraulic conductivity, depth to the water table, ponding, flooding, and more (NRCS, 2020) and divided soils into three categories: not limited, somewhat

limited, and limited. If an OSSF is not properly designed for the soil type and site, systems in a somewhat limited or very limited increase the risk of failure. The soils in the La Nana Bayou watershed are considered somewhat limited or very limited (Figure 2).
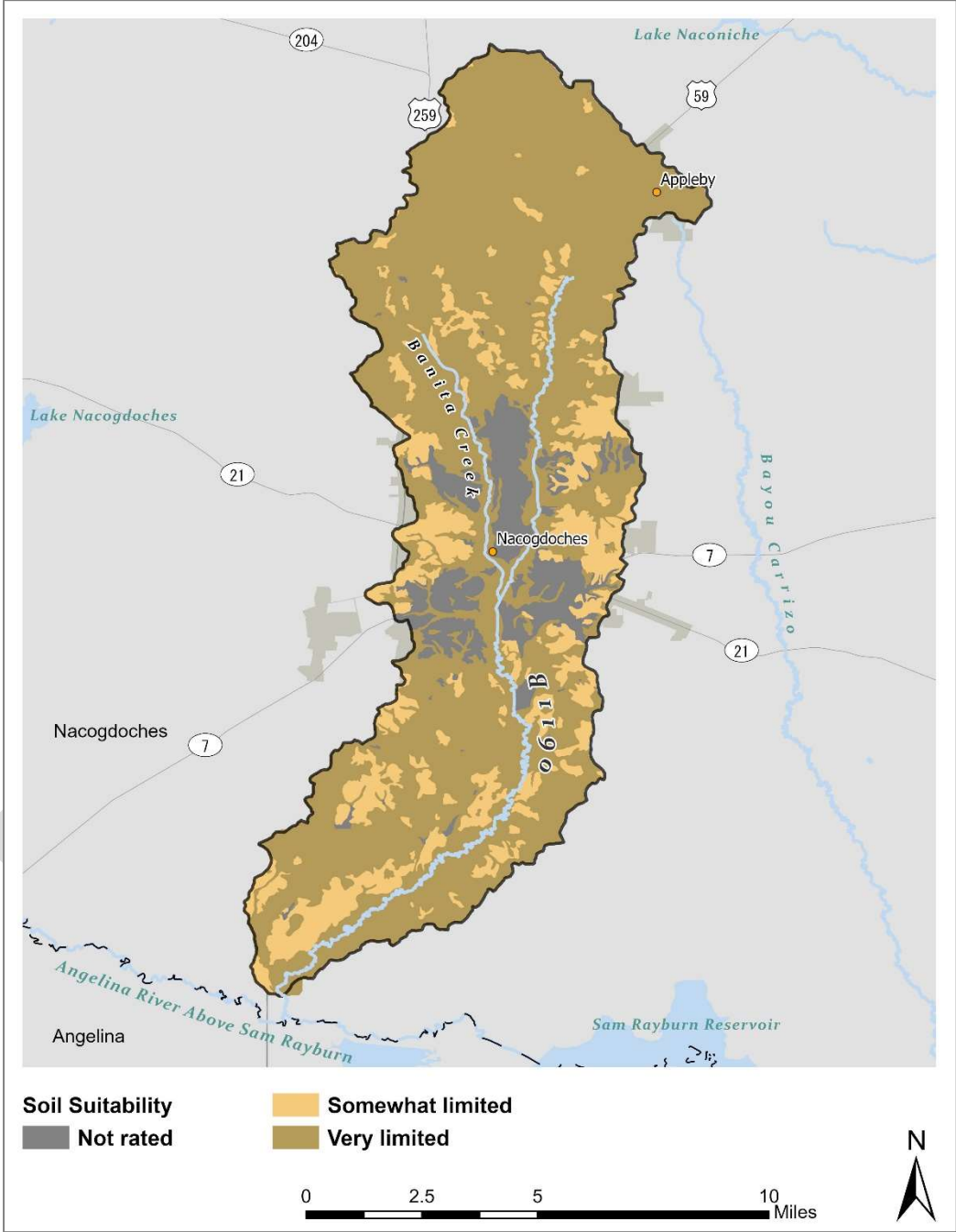

Figure 2 *USDA NRCS Soil Suitability ratings for the La Nana Bayou watershed.*

A total of 2,838 OSSFs (Figure 3) are estimated across the watershed. This estimate was developed based upon 911 address points occurring outside of municipal service regions as reported by Nacogdoches County (2018) and reviewed by the City of Nacogdoches and the Angelina Neches River Authority to verify areas connected to centralized sewer service. The Nacogdoches County Environmental Services Department Designated Representative estimates that about 30% of OSSFs in the county are failing (personal communication, Nov. 2021). Applying this number to the La Nana Bayou watershed, roughly 851 OSSFs are expected to be failing.
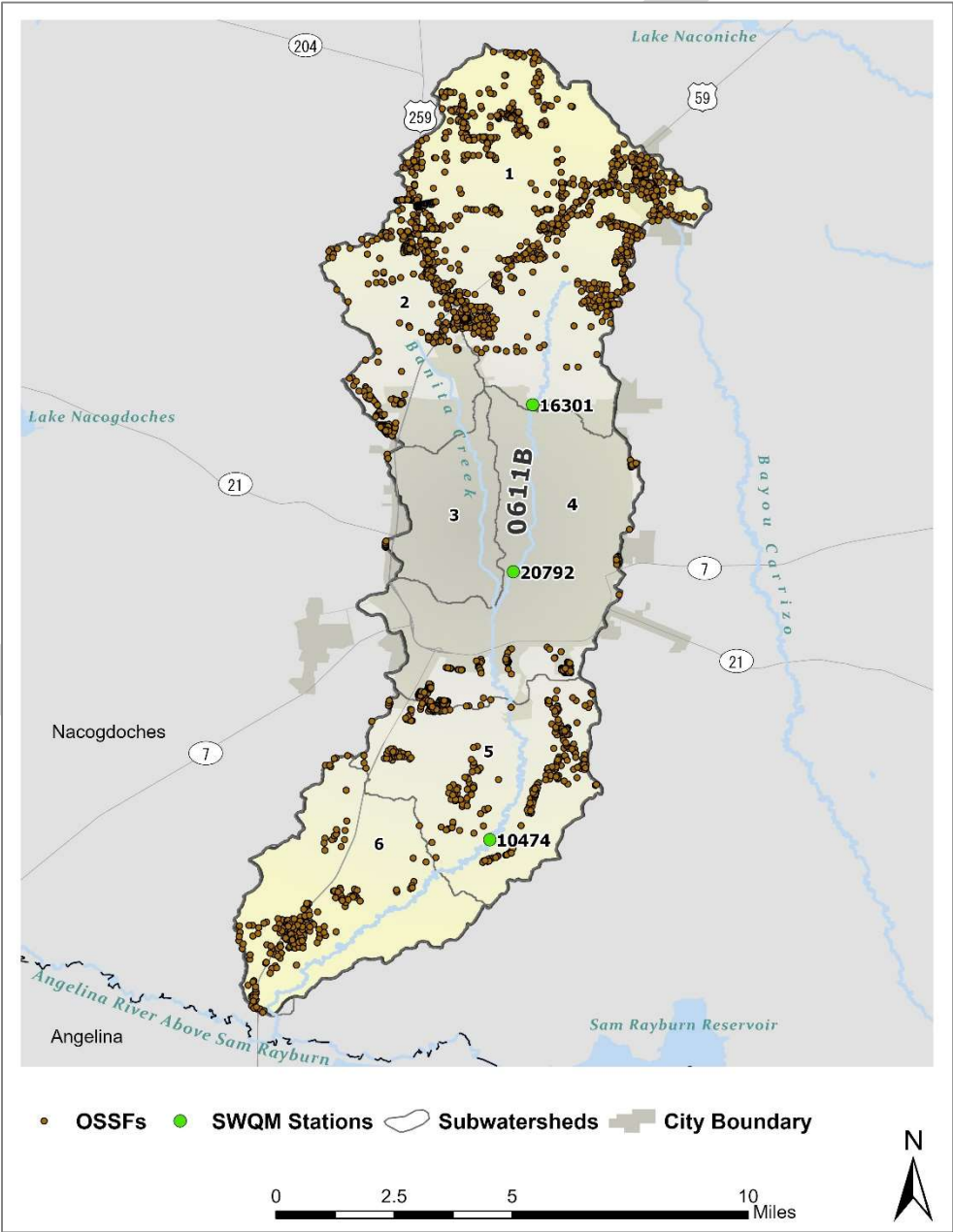

Figure 3 *Estimated OSSF locations in the La Nana Bayou watershed.*

References

APPA 2014. American Pet Products Association National Pet Owners Survey. Accessed November 16, 2021 online at: https://www.americanpetproducts.org/pubs_survey.asp

AVMA 2019. American Veterinary Medical Association U.S. Pet Ownership Statistics. Accessed September 29, 2021 online at: https://www.avma.org/resources-tools/reports-statistics/us-pet-ownership-statistics

CWP 2021. Center for Watershed Protection: Pollution Prevention Fact Sheet: Animal Waste Collection. Accessed November 16, 2021 online at: https://www.stormwatercenter.net/Pollution_Prevention_Factsheets/AnimalWasteCollection.htm

Wagner, K. L. and Moench, E. 2009. Education Program for Improved Water Quality in Copano Bay. Task Two Report. College Station, TX: Texas Water Resources Institute. TR-347. https://oaktrust.library.tamu.edu/handle/1969.1/93181.

Nacogdoches County 2019. Address Points Shapefile, Dec, 26, 2019. Accessed October 1, 2021 online at: http://co.nacogdoches.tx.us/maps/public_geodata_downloads/