Chapter 1: Introduction to Watershed Management

Background

Water sampling shows Davidson Creek has high bacteria concentration and low dissolved oxygen. The creek fails human health standards and aquatic life standards and is listed as impaired under the federal Clean Water Act sections 305(b) and 303(d).

Because Davidson Creek drains to Yegua Creek and then into the Brazos River, pollution effects can harm downstream areas as well. Restoring clean and safe water in these areas requires community participation and targeted actions to lead towards lasting improvements.

What is a Watershed?

A watershed is a land area defined by elevation that drains water to a single outlet such as a stream, river, lake, or ocean. Water enters a watershed mainly from rainfall and underground springs. All land on earth lies in some watershed, and these areas can be as large as a continent, or as small as a backyard. Larger watersheds can contain smaller watersheds that in turn contain even smaller subwatersheds.

Both natural processes and human activities influence water within watersheds. A healthy watershed is a dynamic area which supports native species and meets the physical and chemical standards needed for balanced ecosystems (USEPA, 2012).

The Watershed Approach

The watershed approach is widely recognized by state and federal water resource management agencies as the leading method for protecting and improving surface water quality (USEPA, 2023). The U.S. Environmental Protection Agency (EPA) describes the approach as “a flexible framework for managing water resource quality and quantity within a specified drainage area or watershed” (USEPA, 2008). This flexibility allows communities to tailor solutions to local issues and adjust strategies as conditions change. A major advantage of the watershed approach is that it focuses on natural hydrologic boundaries, rather than political borders.

Stakeholders are anyone who lives, works, or has interest in the watershed. In this approach, stakeholders combine local knowledge with scientific information to help make decisions about managing the watershed (USEPA, 2008). They are the primary decision-making body for watershed planning and may include individuals, groups, businesses, organizations, or agencies.

The watershed approach to water resource management culminates in development of a watershed protection plan (WPP). A WPP is a voluntary and locally led plan that coordinates action and resources across public and private partners.

The EPA has outlined nine key elements (USEPA, 2008) of successful watershed planning. Although WPPs vary in methodology, content, and strategy based on local priorities, successful plans include these nine essential elements:

1.) Identify causes and sources of impairment,
2.) Estimate pollutant load reductions from proposed management strategies,
3.) Describe proposed management strategies,
4.) Specify technical and financial need for implementation,
5.) Plan information, education, and public participation,
6.) Set a schedule for implementation,
7.) Define milestones to track progress,
8.) Establish a criteria for success, and
9.) Conduct water quality monitoring

Adaptive Management

Adaptive management of WPPs treat the plans as living documents to allow for continued success and flexibility in the face of uncertainty. It relies on cycles of planning, monitoring, evaluating, and adjusting. This process lets stakeholders respond to new information and changing conditions to remain effective and relevant (USEPA, 2000).

In complex systems like watersheds, environmental conditions and pollutant sources can change over time. By embracing adaptive management, stakeholders can respond more effectively to these changes (Williams et al., 2009). As the plan is implemented, regular water sampling will help guide necessary changes, allowing management efforts to adjust to evolving watershed conditions. Adaptive management increases resilience, improves outcomes, and strengthens collaboration.

Education and Outreach

Public education and outreach are essential to a plan's success. An informed community can support implementation, promote stewardship, and encourage behavior changes that reduce nonpoint source pollution.

Community workshops and other events provide a delivery platform for educational materials and information throughout the WPP implementation process. Education and outreach strategies are embedded into all watershed management measures.

Chapter 2: Watershed Overview

Water movement in a watershed depends on many interacting characteristics. Physical features such as watershed size, slope, soil type, geology, vegetation, and land use and land cover all affect how runoff travels across the landscape. These features determine how much water runs off, how quickly water flows, how much water soaks into the soil, and how easily pollutants reach nearby streams, ponds, lakes and rivers. Additionally, short-term weather patterns and longer-term climate can affect how much water enters the system and how pollutants move and persist. Climate often sets the timing and volume of flow in the watershed.

This chapter provides a summary of the physical characteristics, geography, and water management of the Davidson Creek watershed. The summary draws on state and federal data sources and local stakeholder knowledge. Gathering and interpreting this information is essential to identify likely pollution sources and to recommend effective solutions for improving and protecting water quality in Davidson Creek.

Watershed Characteristics

The Davidson Creek watershed includes roughly 140,082 acres in central Texas and spans parts of Burleson and Milam counties (Figure 2- 1).

The main waterway, Davidson Creek, is an intermittent stream. Streamflow may cease during dry periods, leaving perennial pools in some areas. The creek meanders roughly 59 miles before joining Yegua Creek, a tributary of the Brazos River.

The Davidson Creek watershed is largely rural. Land is mostly improved pasture, hay meadows, and deciduous-mixed forest throughout, with urban development concentrated around the city of Caldwell. Several and unincorporated communities across the watershed include Center Line, Beaver Creek, Cade Lakes, Chriesman, and Lyons.

At the heart of the watershed is the City of Caldwell, the county seat of Burleson County. Located along a major travel route in the 1800s Old San Antonio Road (Camino Real), Caldwell has a rich history (Alford, 2023). Later, the arrival of two major railroads grew Caldwell into a key agricultural supply center. Present day Caldwell remains a regional hub, with State Highways 21 and 36 intersecting in the city, reinforcing Caldwell's role as modern crossroads for the county (Alford, 2023).

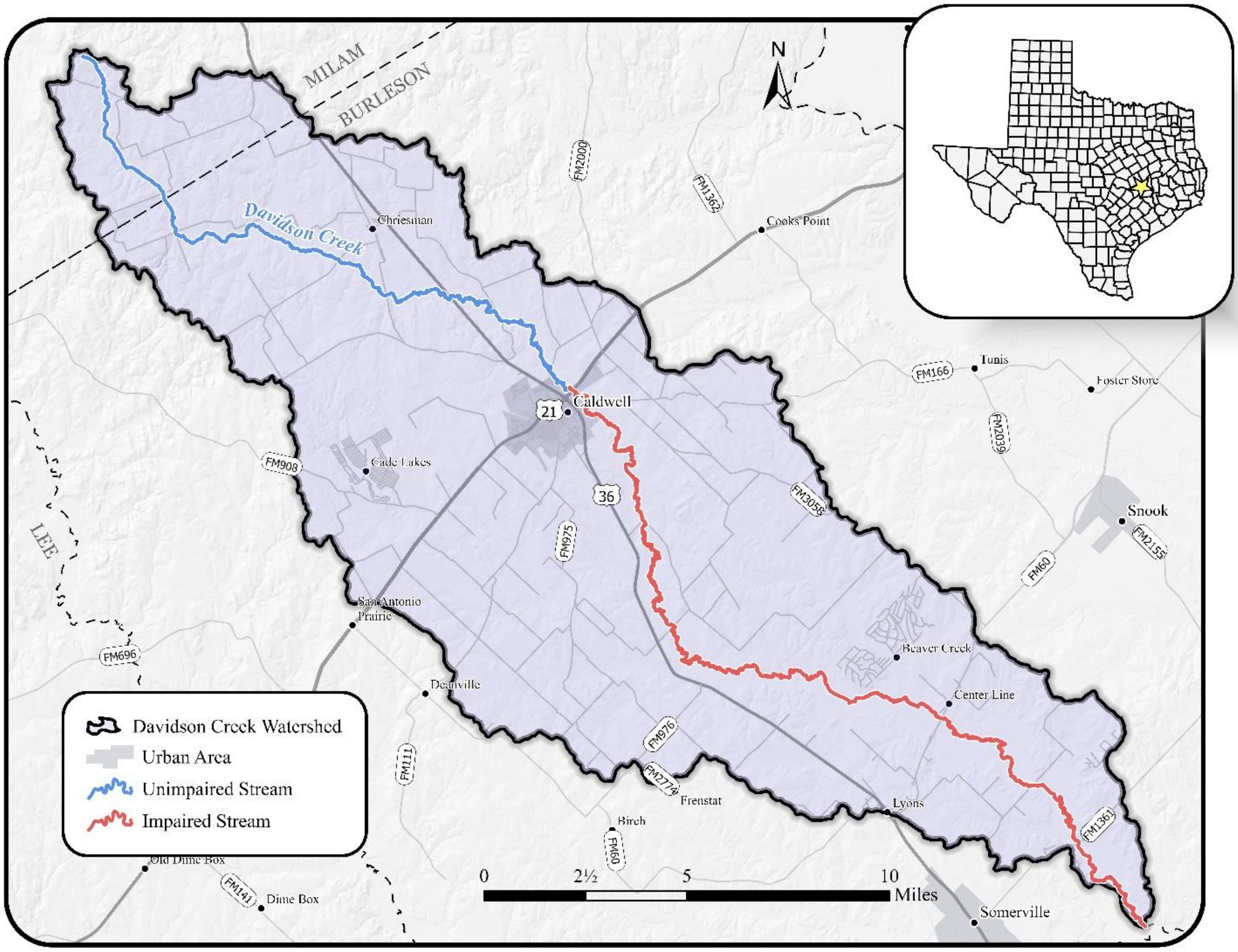

Figure 2- 1. Overview of the Davidson Creek Watershed within Burleson and Milam Counties.

Elevation and Topography

Topography is one of the fundamental drivers of how water moves through a watershed. The slope and elevation affect the speed and direction of water flowing across the landscape. Steeper slopes generate faster runoff and increase the risk of erosion. Flatter areas slow water down allowing more water to soak into the ground; however, these areas are often more likely to flood.

Elevations for the Davidson Creek watershed were determined using 10-meter resolution Digital Elevation Models (DEMs) for Burleson and Milam counties (USGS, 2023). According to this data, elevation across the watershed ranges from about 644 feet above mean sea level in southern Milam County to about 186 feet at the southern tip of the watershed near Somerville, Texas (Figure 2- 2).

In addition to elevation, physical soil characteristics can provide even more information on infiltration and runoff.

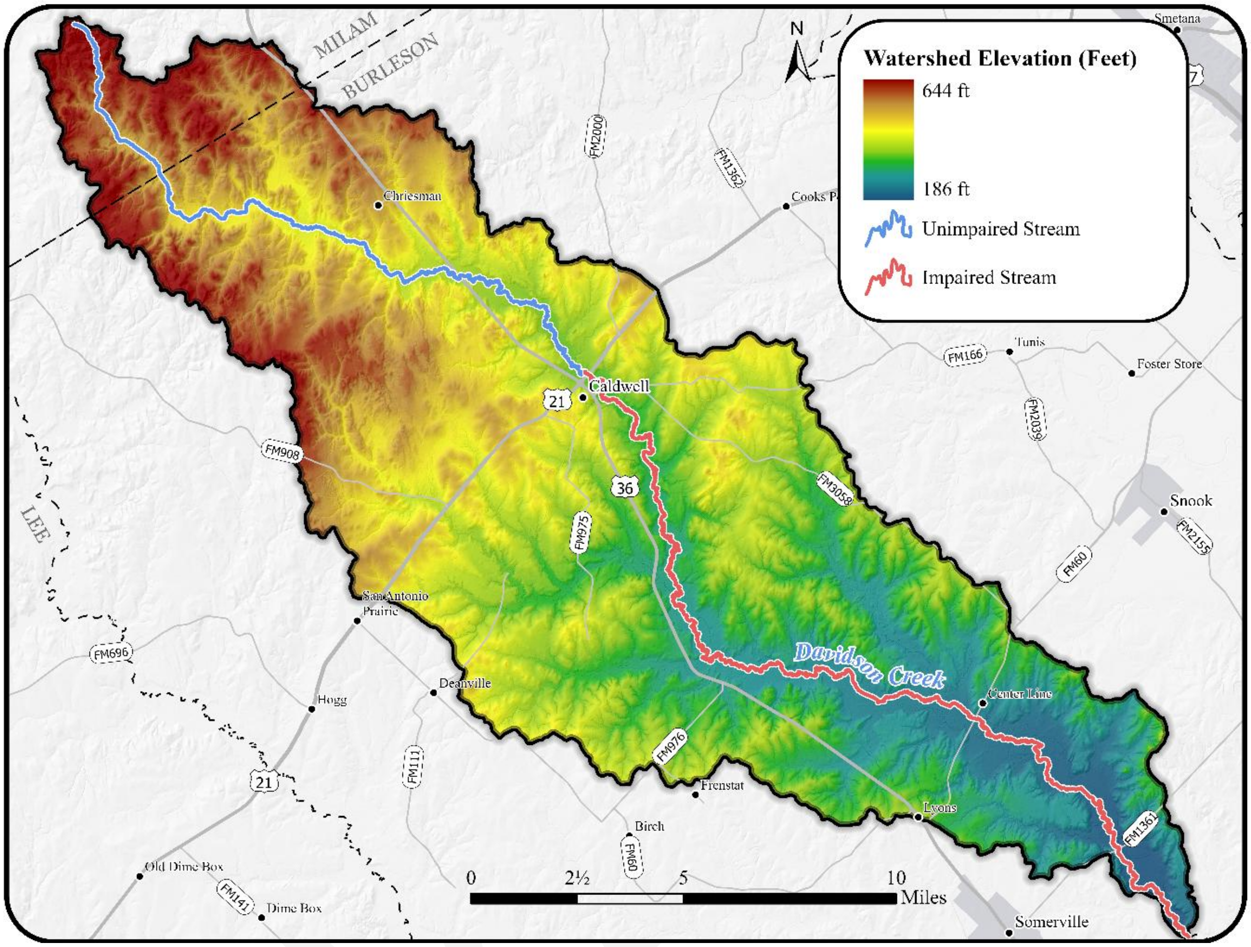

Figure 2- 2. Elevation of the Davidson Creek watershed.

Soils

Soil characteristics strongly shape how water behaves within a watershed, influencing infiltration, runoff, and subsurface flow. Properties such as texture, structure, and grain-size control how quickly water enters and moves through soil layers. The way water responds to soil affects the volume of streamflow, groundwater recharge, and the watershed's susceptibility to erosion and flooding. Additionally, soil limitations such as poor drainage or high clay content can limit land use options and agricultural practices.

Soil characteristics of the Davidson Creek watershed were obtained from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database (USDA, 2019). Two datasets were important for this assessment. First, the hydrologic soil group (HSGs) dataset classifies soils into four main categories that indicate how well soil can absorb wastewater when fully wet and not covered by plants. Second, the septic suitability ratings indicate how suitable soils are for treating wastewater from On-Site Sewage Facilities (OSSFs), commonly known as septic systems.

Hydrologic Soil Groups

HSGs classify soils by infiltration rates when receiving precipitation from long-duration storms. The primary HSGs are identified as A, B, C, and D, plus three dual classifications (A/D, B/D, and C/D) used for soils that would otherwise fall into Group D, but drained soil shows properties of a different classification. Only soils that are in Group D in their undrained condition have a dual class. The four primary classifications for HSGs are described below:

Group A – Soils have high water infiltration rates when fully wet. Water soaks in quickly indicating a low runoff potential. These soils layers are typically deep, allow for rapid water draining through the layer and are composed primarily of sands or gravelly sands.

Group B – Soils have a moderate infiltration rate when fully wet. These soils layers range from moderately deep to deep. These soils are moderately well-drained or well-drained soils that allow for water to pass through quickly. They have moderately fine textures to moderately coarse textures.

Group C – Soils have a slow infiltration rate when fully wet. They often have a layer that blocks water from moving down or have fine or moderately fine textured soils. These soils have a slow rate of water transmission through the layer.

Group D – Soils have a very low infiltration rate when thoroughly wet with a high potential for runoff and ponding. Soils in this group consists mostly of clays with high shrink-swell potential, a high water table, and a claypan (or clay layer) at or near the surface, or soils that are shallow over nearly impenetrable material. These soils have a very slow rate of water transmission through the layer.

Soils within the Davidson Creek watershed vary widely (**Error! Reference source not found.Error! Reference source not found.**). Most of the watershed is classified as Group D (38%**Error! Reference source not found.**), followed by Group C (29%) and Group A (25%) (USDA, 2019). Groups C and D have low infiltration rates and high runoff potential when fully wet, increasing the likelihood of erosion and expanding the transport of pollutants. HSGs in the upper watershed north of State Highway 21 and the City of Caldwell are primarily Group A soils, which absorb water quickly and produce less runoff. Contrast between north and south HSGs shows different pollution pathways and management priorities for each region.

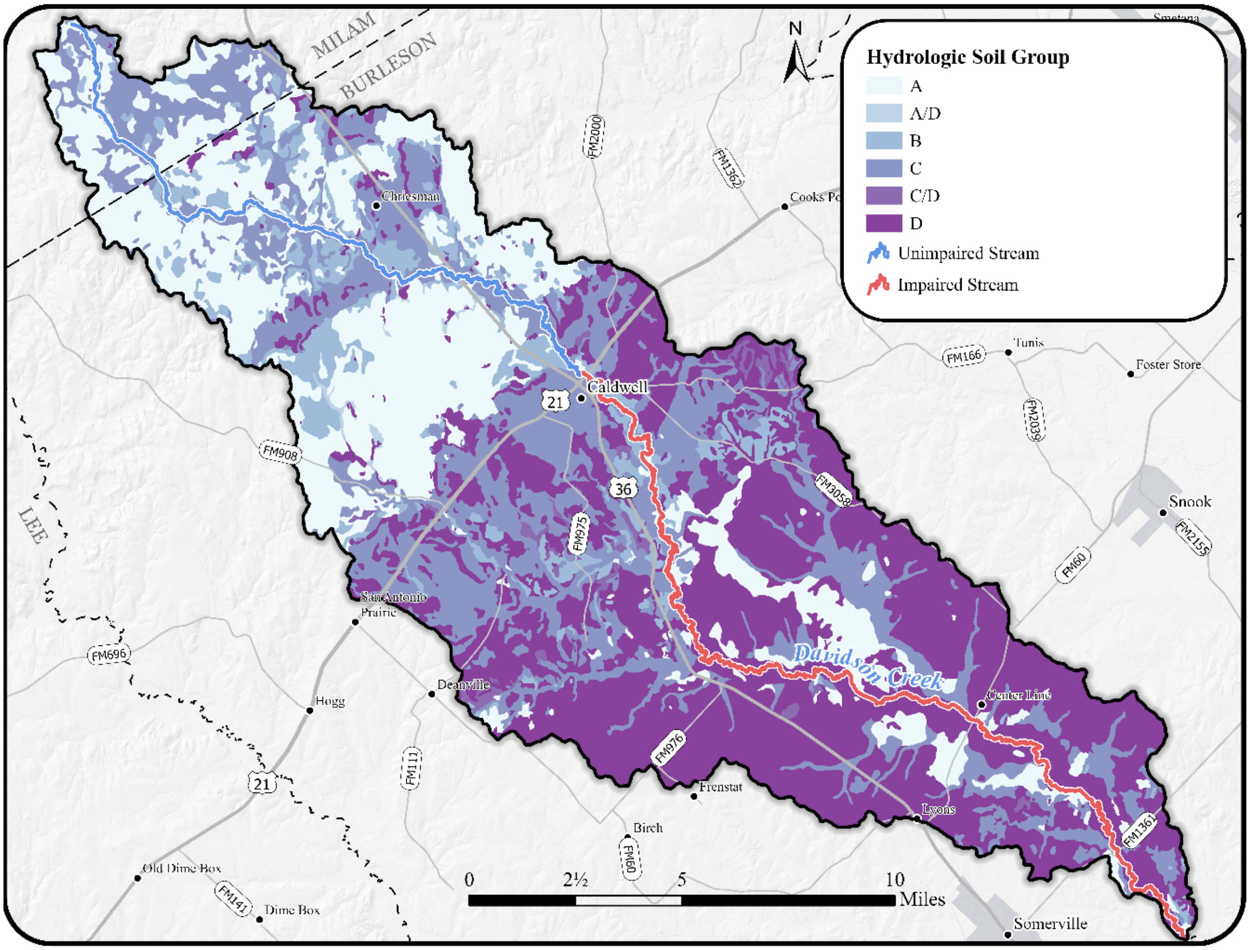

Figure 2- 3. Hydrologic Soil Groups for the Davidson Creek Watershed.

On-site Sewage Facility Suitability Ratings

The USDA NRCS evaluates soil to determine how suitable it is for septic tank absorption fields (areas where wastewater is released into the ground as part of OSSF design). This evaluation is critical for rural and semi-rural areas that are not connected to a city sewer system. Ratings are based on key soil and site features that may limit how well soil can handle wastewater. These characteristics include soil textures, depth to bedrock or groundwater, flooding risk, and hydraulic conductivity (how easily water moves through the soil). Soils are rated in three categories:

Not Limited – Soils with features favorable to OSSF use, any limitations are easily managed, reliable performance and low maintenance is expected.

Somewhat Limited – Soils have some limitations but with proper design and planning, OSSFs can be installed successfully and perform well with regular maintenance.

Very Limited – Soils are unfavorable for OSSF use. Limitations are often difficult to overcome and major soil improvement or specific designs are needed. OSSFs installed in these soils are expected to have high maintenance needs.

Most soils within the watershed are rated “Very Limited” (79%) or “Somewhat Limited” (20%) (USDA, 2019). Like HSGs, there is a regional difference in the watershed from north to south (Figure 2- 4). Understanding how these conditions also interact with land use and land cover patterns is essential for effectively reducing pollutant loading and developing management strategies.

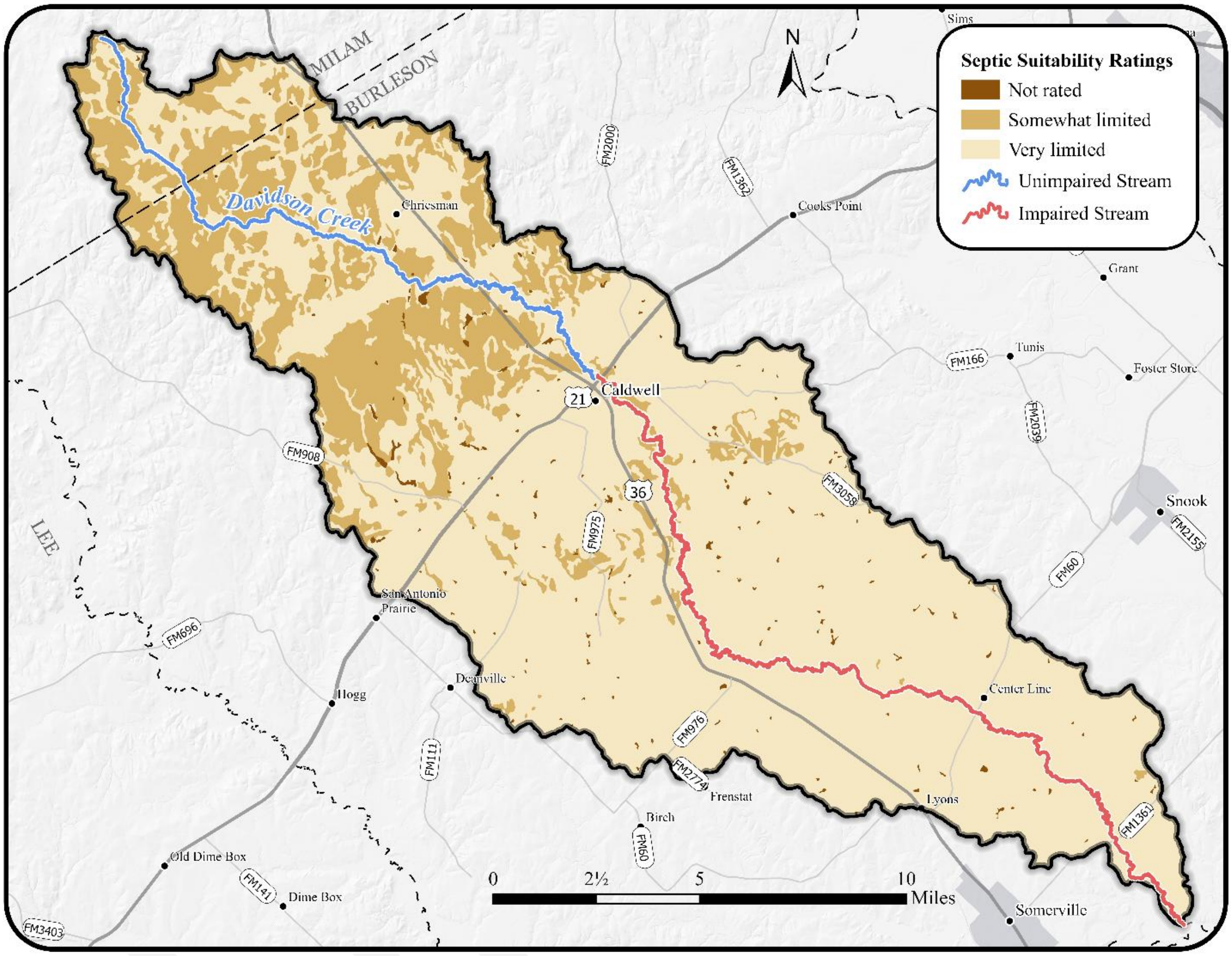

Figure 2- 4. Davidson Creek watershed septic suitability ratings.

Land Use and Land Cover

Land use and land cover (LULC) are part of a watershed’s unique fingerprint and play a major role in its overall health and function. Like soil characteristics, the way that land is used and what is growing on it affects how pollutants are carried into nearby streams. Changes in LULC can disrupt natural hydrologic processes, increasing nonpoint source pollution, degrading wildlife habitat, and damaging water quality. Detailed understanding of LULC conditions are important for identifying potential pollutant sources and establishing effective management practices.

LULC for the Davidson Creek watershed was determined using the National Land Cover Database (NLCD), which provides nationwide data on LULC at a 30-meter resolution. This database helps track both current and past changes in LULC. According to the annual 2023 NLCD data (USGS, 2024), the most common LULC in the Davidson Creek watershed was pasture/hay fields and deciduous-mixed forests which cover about 64% and 19% of the watershed, respectively (Figure 2-5: Table 2- 1). Pasture and hay fields are areas planted with grasses or legumes for livestock grazing or hay production. Deciduous-mixed forests contain areas dominated by trees taller than five meters. In addition, open and low intensity developed areas, with less than 50% impervious surfaces, make up only about 7.5% of the watershed.

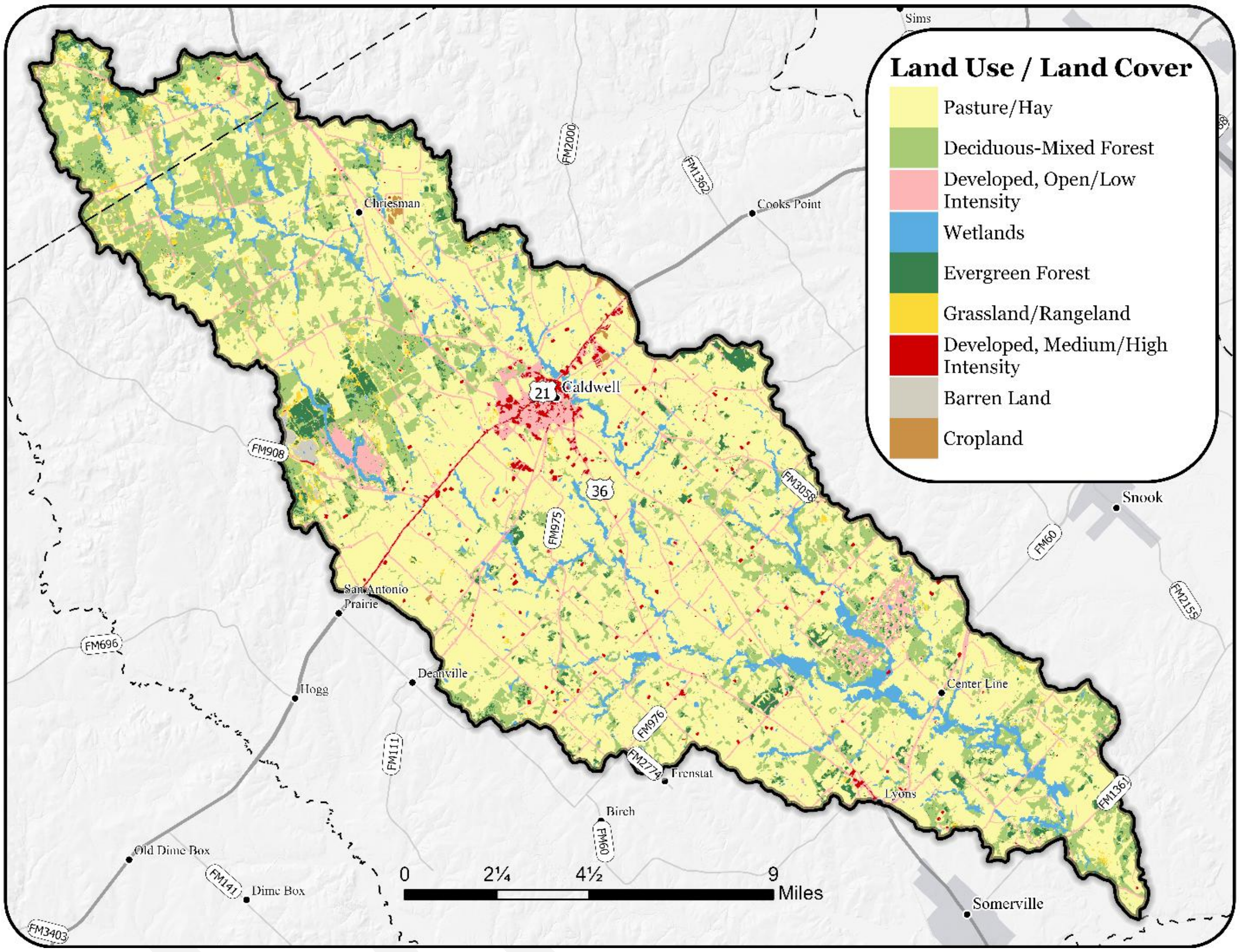

Figure 2- 5. Land use and land cover adapted from NLCD database for 2023.

Table 2- 1. LULC for the Davidson Creek Watershed using annual NLCD LULC for 2023.

	Classification	Area (acres)	Percent of Watershed
	Pasture/Hay	89,244.93	63.71%
	Deciduous-Mixed Forest	25,980.74	18.55%
	Developed, Open/Low Intensity	10,472.10	7.48%
	Wetlands	7,145.94	5.10%
	Evergreen Forest	3,708.96	2.65%
	Grassland/Rangeland	1,659.11	1.18%
	Developed, Medium/High Intensity	1,326.31	0.95%
	Barren Land	316.56	0.23%

	Cropland	227.10	0.16%
	Total	**140,081.75**	**100.00%**

Ecoregions

Ecoregions are land areas with similar natural resources and ecological processes (USEPA ORD, 2012). Scientists often use a four-level classification system. Level I is the most general overview, while Level IV offers a detailed breakdown of ecoregions (Griffith et al., 2007). The Davidson Creek watershed level IV ecoregions are 32b, the Southern Post Oak Savanna, and 33c, the San Antonio Prairie (Figure 2- 6).

The Southern Post Oak Savanna ecoregion is the main ecoregion (79%) found in the Davidson Creek watershed, especially north and south of Caldwell. It is a transitional zone between the piney forests of eastern Texas and the open prairie to the west. Wooded areas in this ecoregion are commonly hardwood tree species. Other common land cover types may include improved pasture and rangeland (USEPA ORD, 2012).

The San Antonio Prairie ecoregion (21%) stretches as a long, narrow band across central Texas cutting across the Brazos River floodplain. Soil in this area is characterized as fertile and moderately leached, however, there are some clay-rich soils and dark humus-rich soils. This ecoregion is also made up of upland prairies that may be covered by little bluestem and yellow Indiangrass. The land cover in this region may include woodland, improved pasture, rangeland, and some cropland (USEPA ORD, 2012).

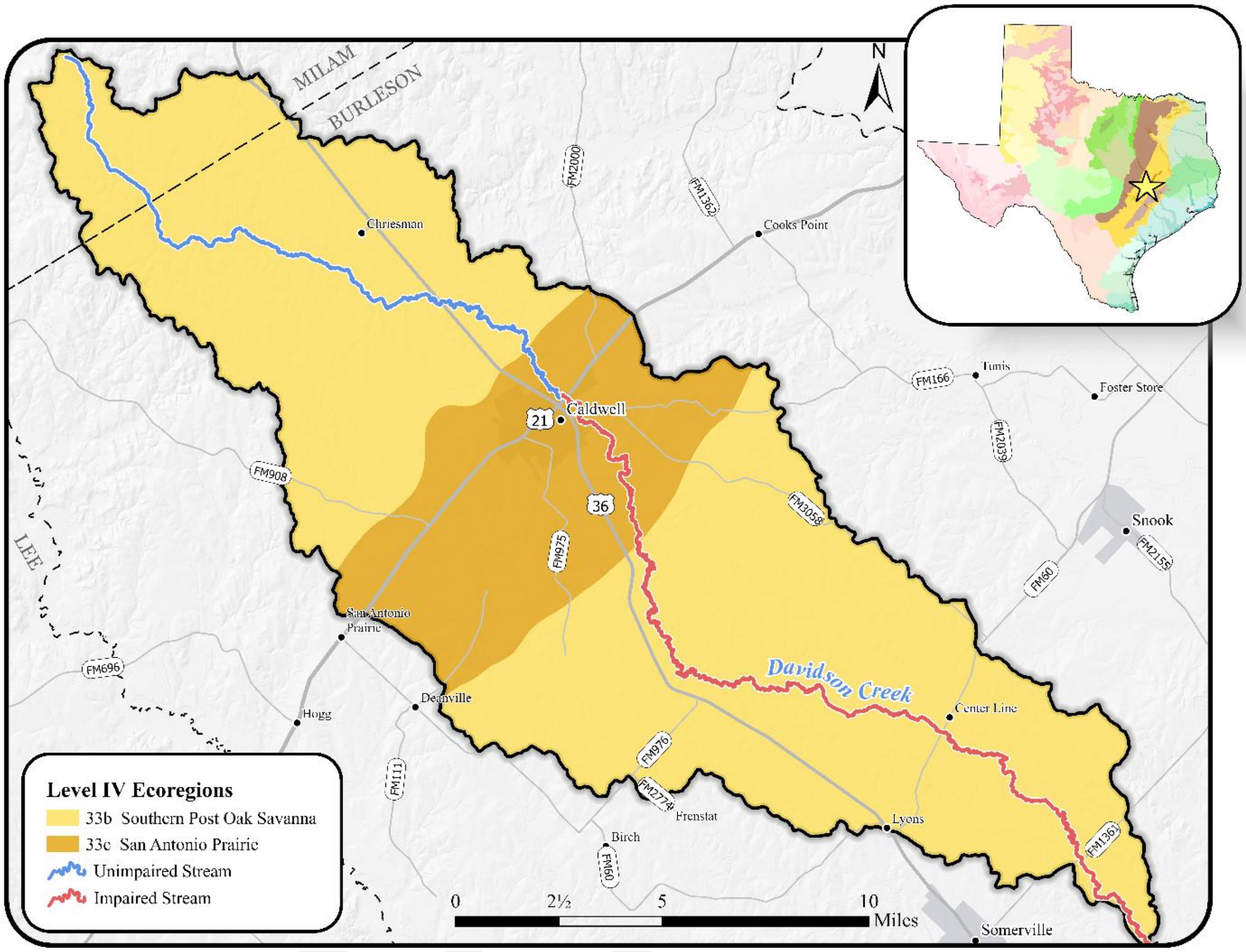

Figure 2- 6. Davidson Creek watershed level IV ecoregions.

Climate

The Davidson Creek watershed lies in a warm, humid climate region with hot summers (Larkin and Bomar, 1983). Most of the moisture in the area is affected by the warm, damp air moving in from the Gulf of America, although drier air from inland regions sometimes blows southward through the watershed. Average annual precipitation ranges from 38 to 42 inches per year across the watershed, with a clear east-to-west decreasing gradient (PRISM Climate Group at Oregon State University, 2022; **Error! Reference source not found.**).

There are no active weather stations from the Global Historical Climatology Network (GHCN) within the Davidson Creek watershed boundary. Therefore, the nearby Somerville Dam, TX USC00418446 weather station was used to determine the approximate precipitation and temperature data for this watershed (NOAA, 2025;

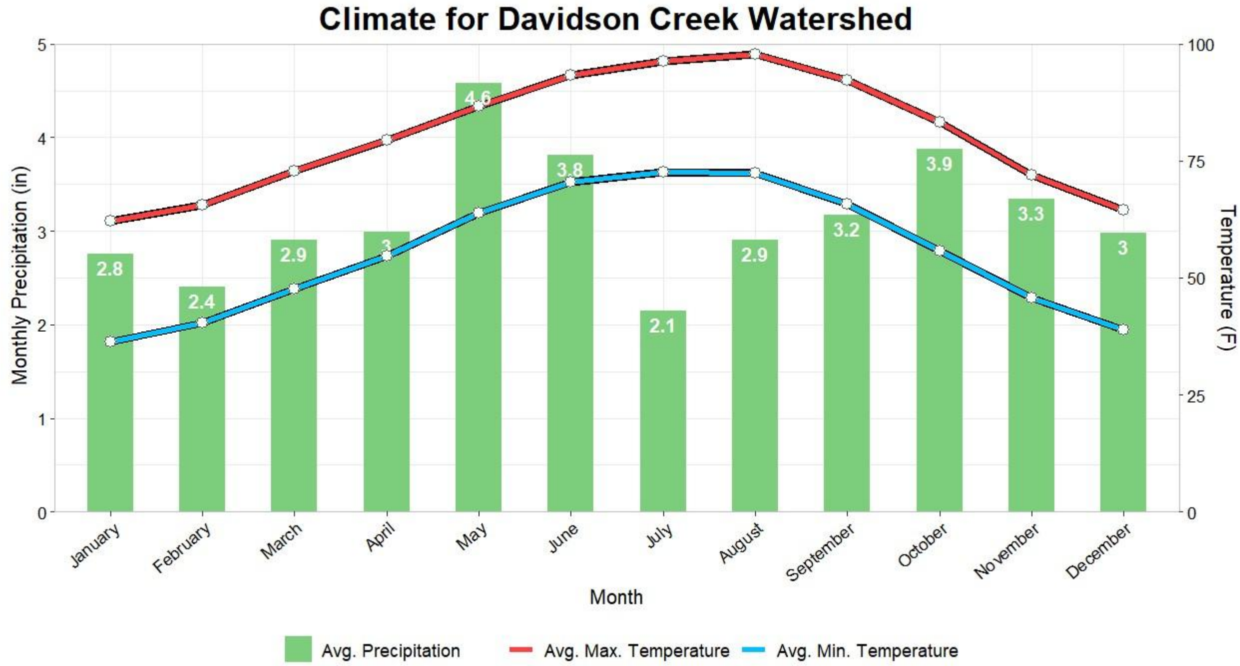

Figure 2- 8). Average monthly minimum air temperature indicates that January is generally the coldest month around 36.6 degrees Fahrenheit. Conversely, the average monthly maximum peaks in August at around 96.5 degrees Fahrenheit, although June, July, August, and September averages also remain over 90 degrees Fahrenheit. Average annual rainfall recorded at the Somerville Dam weather station between 1991 to 2025 was 37.9 inches. Rainfall normally peaks in May with the lowest occurring in July (NOAA, 2025).

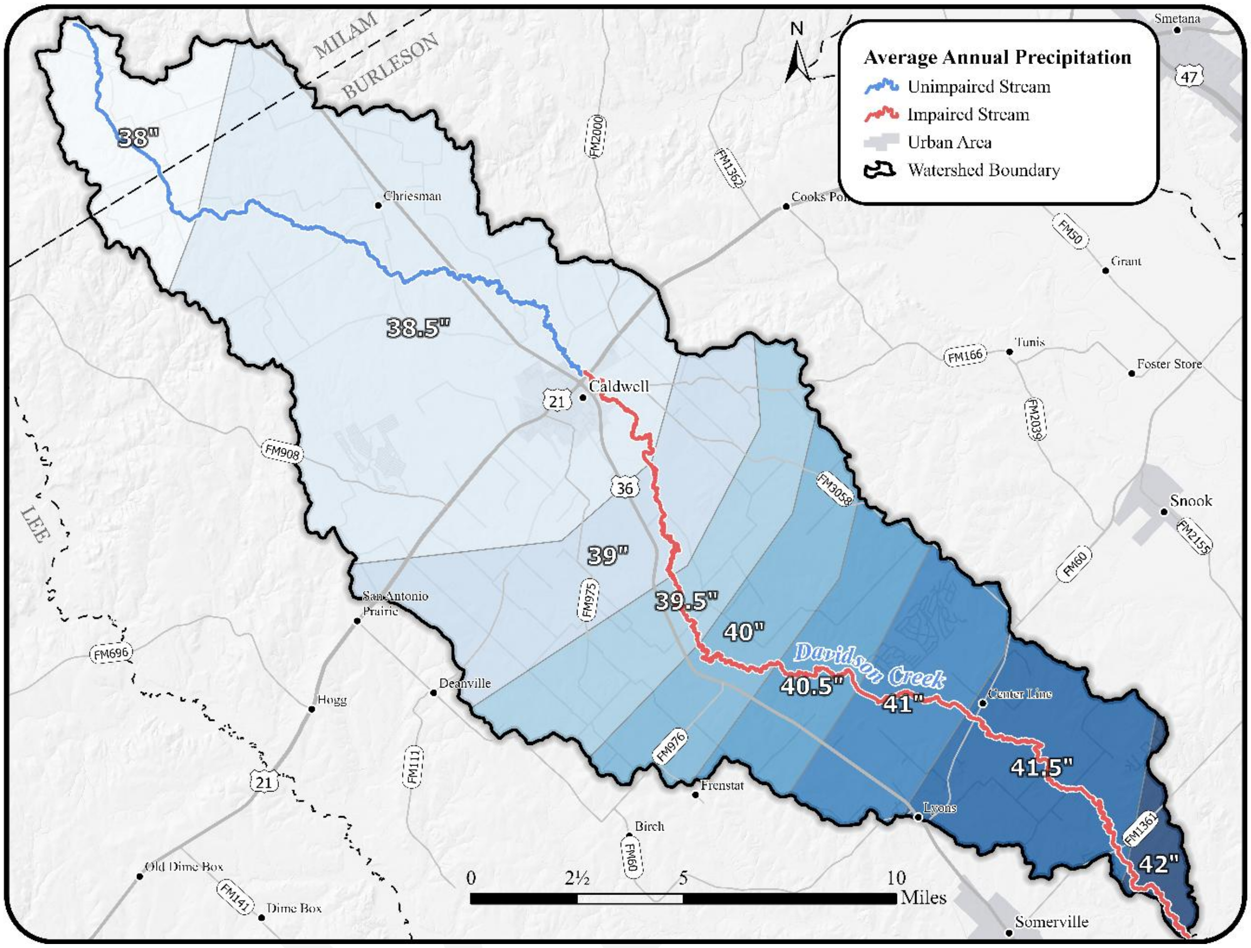

Figure 2- 7. Davidson Creek watershed 30-year annual precipitation normals from 1991-2020.

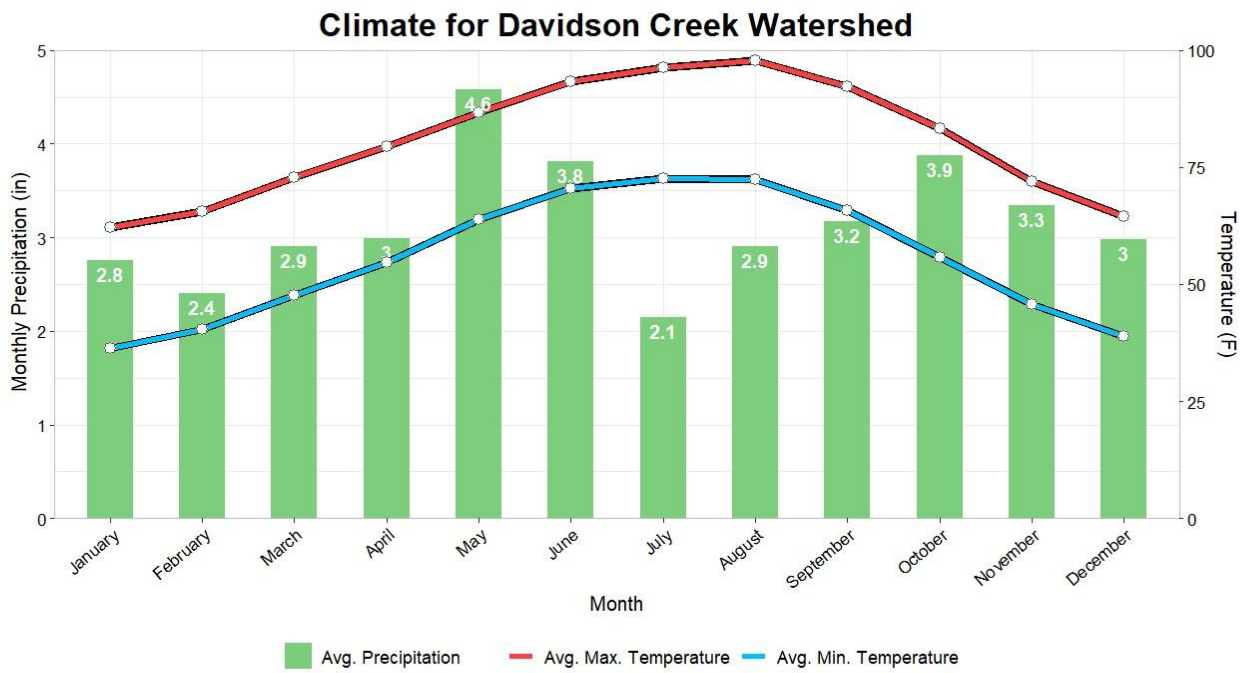

Figure 2- 8. Monthly climate data, including precipitation, maximum, and minimum air temperature for Somerville Dam, Texas, 1991– 2025.

Groundwater

Texas has numerous aquifers that supply groundwater, which is a vital source of water for many communities. The Texas Water Development Board (TWDB) identifies nine major aquifers that produce substantial amounts of water over wide areas, and twenty-two minor aquifers that either produce smaller amounts of water over large areas or large amounts of water over small areas. The Carrizo-Wilcox aquifer is the only major aquifer that underlies the Davidson Creek watershed, however there are three minor aquifers: the Queen City, Sparta, and Yegua-Jackson (Figure 2- 9 through 2- 12).

The Carrizo-Wilcox aquifer is mainly used for irrigation and public water supply (TWDB, 2011). It includes both confined and unconfined zones. Unconfined areas are directly recharged by surface water. These zones often appear at the ground surface and are known as outcrops (Figure 2- 9). Conversely, confined zones are trapped by layers of rock or clay above and below the aquifer. They are also under greater pressure and can result in artesian wells or springs, where groundwater flows to the surface without assistance. Confined zones are also called sub crops (Figure 2- 9). In the Davidson Creek watershed, most of the Carrizo-Wilcox aquifer is confined below the ground, only outcropping for 233 acres in the northern region.

According to the TWDB, this aquifer is mostly made up of sand with layers of gravel, clay, or silt and has a saturated thickness depth of nearly 3,000 feet (TWDB, 2016). However, only the upper 670 feet of this aquifer contains freshwater, with more saline water below that depth. According to a TWDB 2016 study, the Carrizo-Wilcox aquifer does not contribute any groundwater flow to surface water in Burleson County, although there may be some contribution to surface water in the headwaters of Davidson Creek located in Milam County.

The Queen City aquifer lies above the Carrizo-Wilcox and outcrops in the northern part of the watershed, overall outcropping for about 22,651 acres (**Error! Reference source not found.**). Its thickness varies and ranges from 300 to 600 feet in Burleson County (TWDB, 2016). This aquifer likely contributes some groundwater flow to Davidson Creek (TWDB, 2016).

The Sparta aquifer sits above the Queen City aquifer and outcrops in about 18,333 acres just north of Caldwell (**Error! Reference source not found.**1). In Burleson County, its thickness ranges from 100 to 250 feet. It also likely contributes water to Davidson Creek.

The Yegua Jackson aquifer is completely unconfined and outcrops in the southern part of the Davidson Creek watershed, covering about 58,139 acres (**Error! Reference source not found.**2). It lies above all other aquifers in the region and likely provides the greatest quantity of groundwater to Davidson Creek.

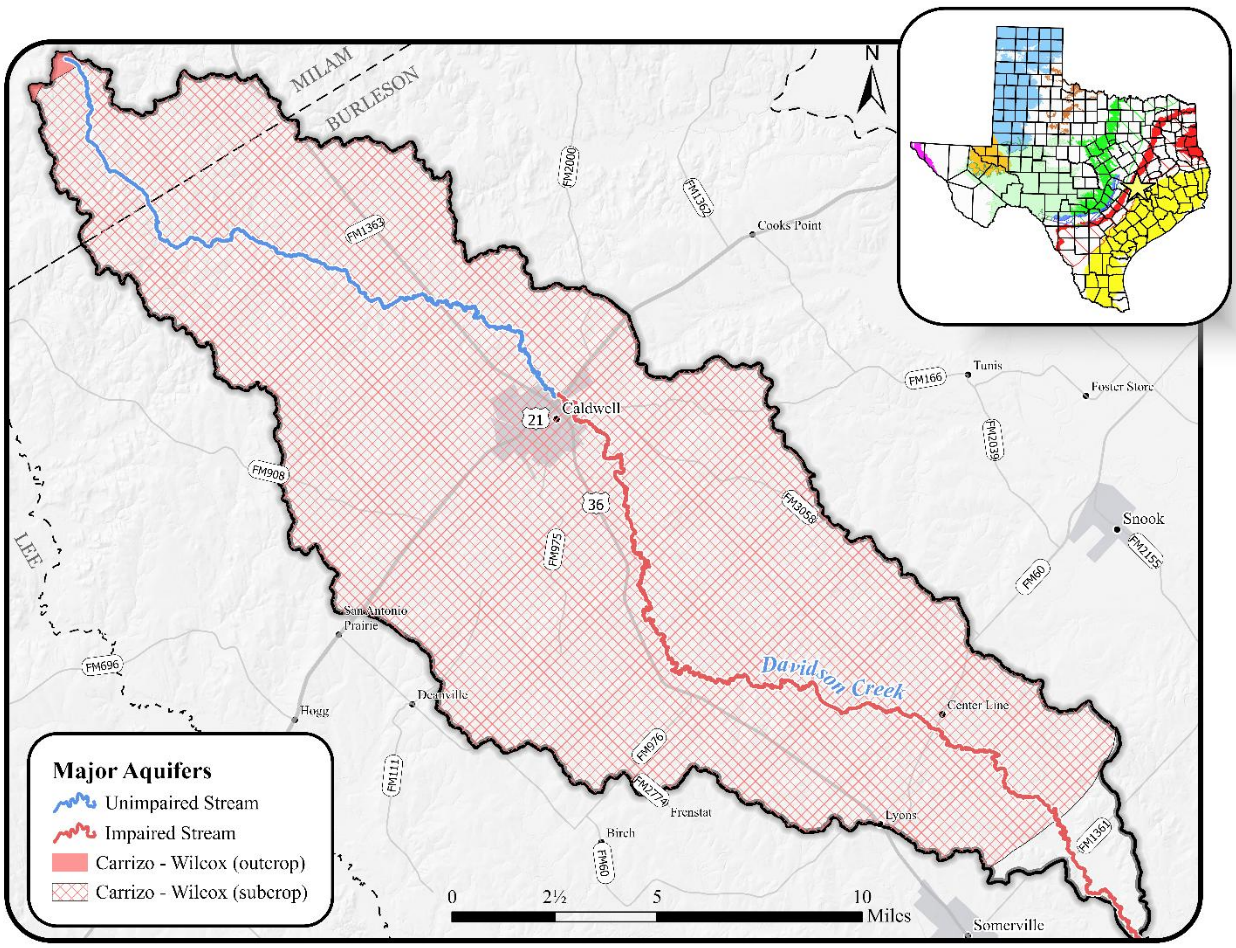

Figure 2- 9. Major aquifer within the Davidson Creek watershed.

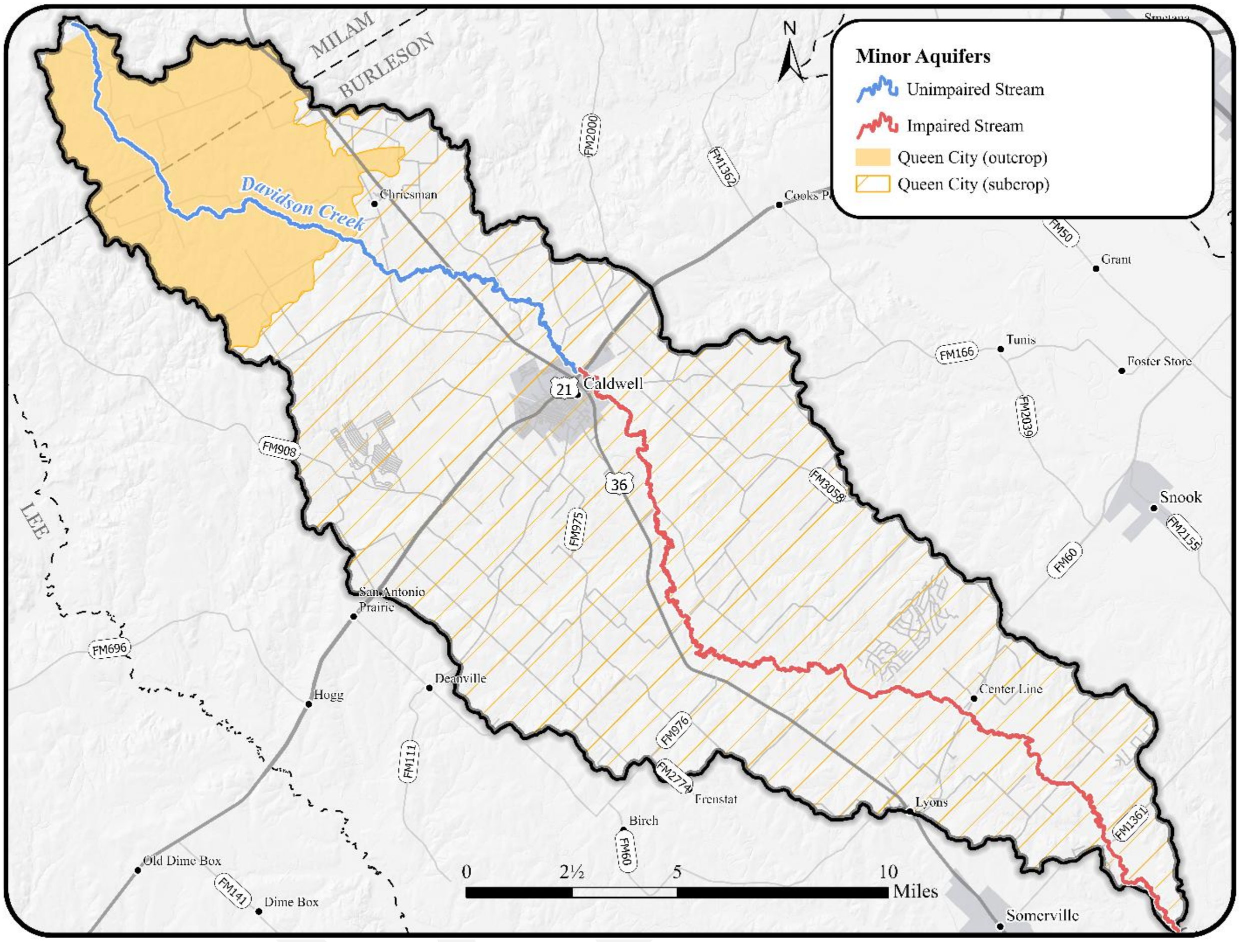

Figure 2- 10. Queen City minor aquifer underlying the Davidson Creek watershed.

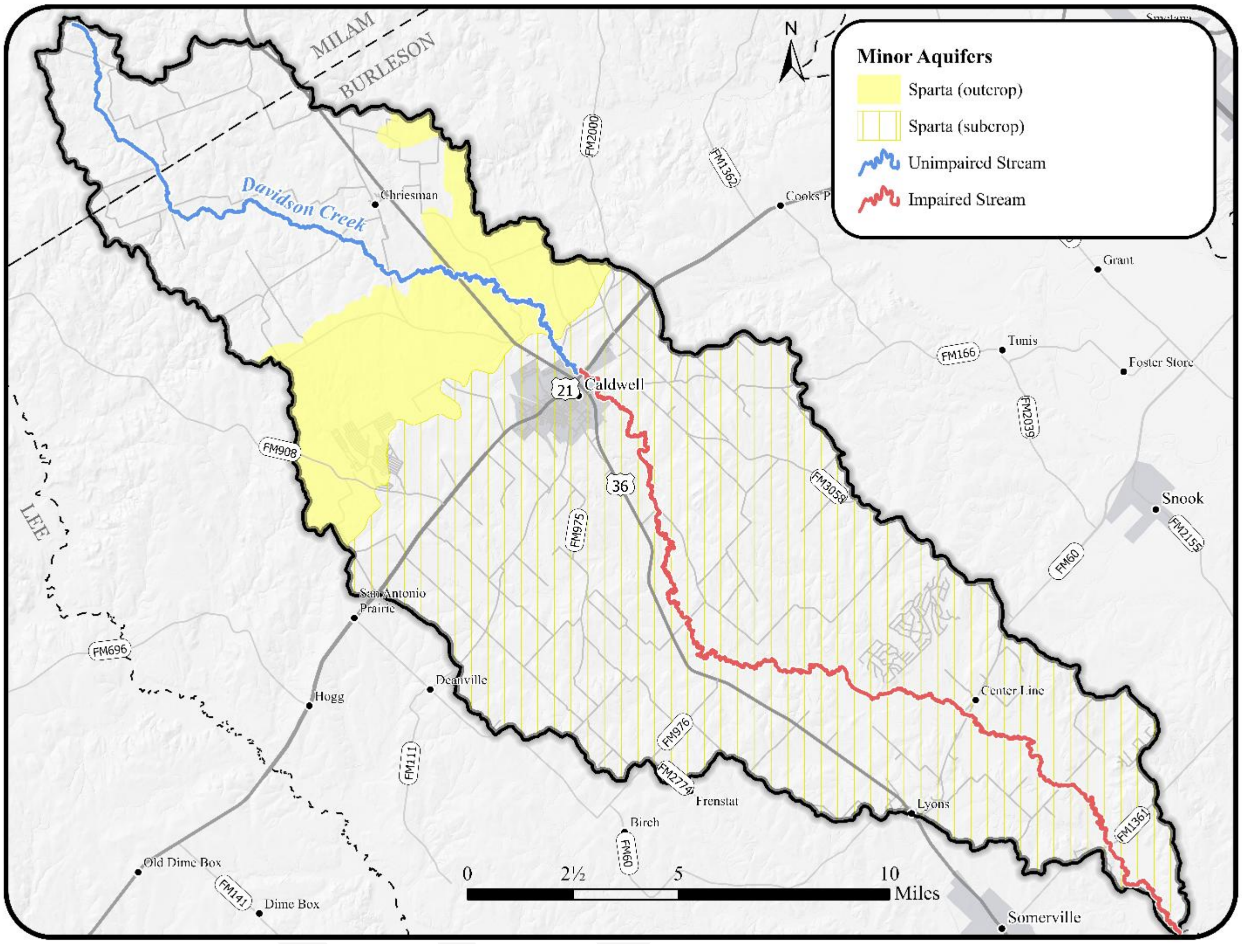

Figure 2- 11. Sparta minor aquifer underlying the Davidson Creek watershed.

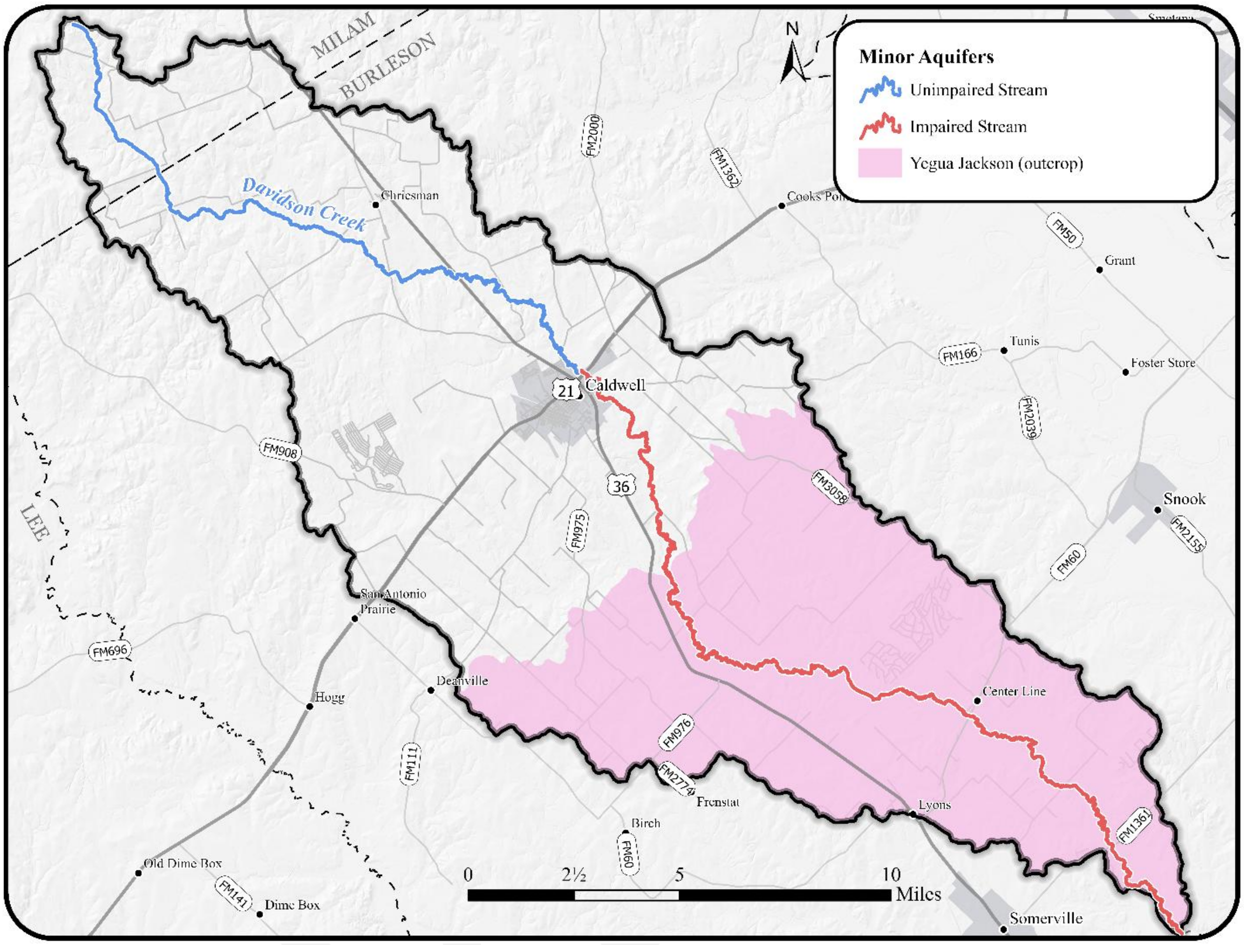

Figure 2- 12. Yegua Jackson minor aquifer underlying the Davidson Creek watershed.

Water Resource Management

In Texas, surface water is owned by the state and held in trust for the public. The Texas Legislature assigns responsibility for managing and distributing these water resources to various state agencies and regional river authorities. One mission of the TWDB is to help ensure the state has adequate and affordable water supplies. TWDB does this by collecting and sharing water-related data, supporting regional water supply and flood planning, and administering financial assistance for water infrastructure projects.

Another state agency, the Texas Commission on Environmental Quality (TCEQ), oversees the use and quality of surface water. TCEQ issues water rights permits to individuals, cities, and industries for purposes other than domestic and livestock use. The agency also sets state water quality standards, monitors conditions of surface waters, and regulates the discharge of pollutants to surface water systems to protect public health and the environment.

River authorities also play an important role in surface water management. Operating within river basins and sometimes following county boundaries, each river authority is enacted by its own specific legislation with slightly different mandates. Overall, they manage surface waters by developing water supply, conserving water, and collecting data. The Davidson Creek watershed is located within the Brazos River basin and under jurisdiction of the Brazos River Authority (BRA) (Figure 2- 114). BRA is the oldest and largest river authority in Texas, it was established in 1929 and currently serves around 70 counties (BRA, 2025). BRA operates infrastructure like reservoirs for water supply and flood control, provides drinking water and wastewater services to cities, and collects data on water quality, aquatic life, and habitat conditions. Under TCEQ's oversight, they share this information to help evaluate water quality across the state.

For groundwater, Texas relies on local groundwater conservation districts (GCD) to manage groundwater. GCDs are established through legislative action, landowner petitions, or by the TCEQ (TCEQ, 2023). In Milam and Burleson counties, the Post Oak Savannah Groundwater Conservation District (POSGCD) was established in 2001 through legislation to maintain the quantity and quality of groundwater within the region and provide local control over these resources (Figure 2- ; POSGCD, 2025). Other responsibilities of this GCD include the water conservation, protection of aquifers from pollution, protecting recharge areas, protecting users, controlling subsidence, and regulating groundwater transport beyond the district's boundaries (POSGCD, 2025).

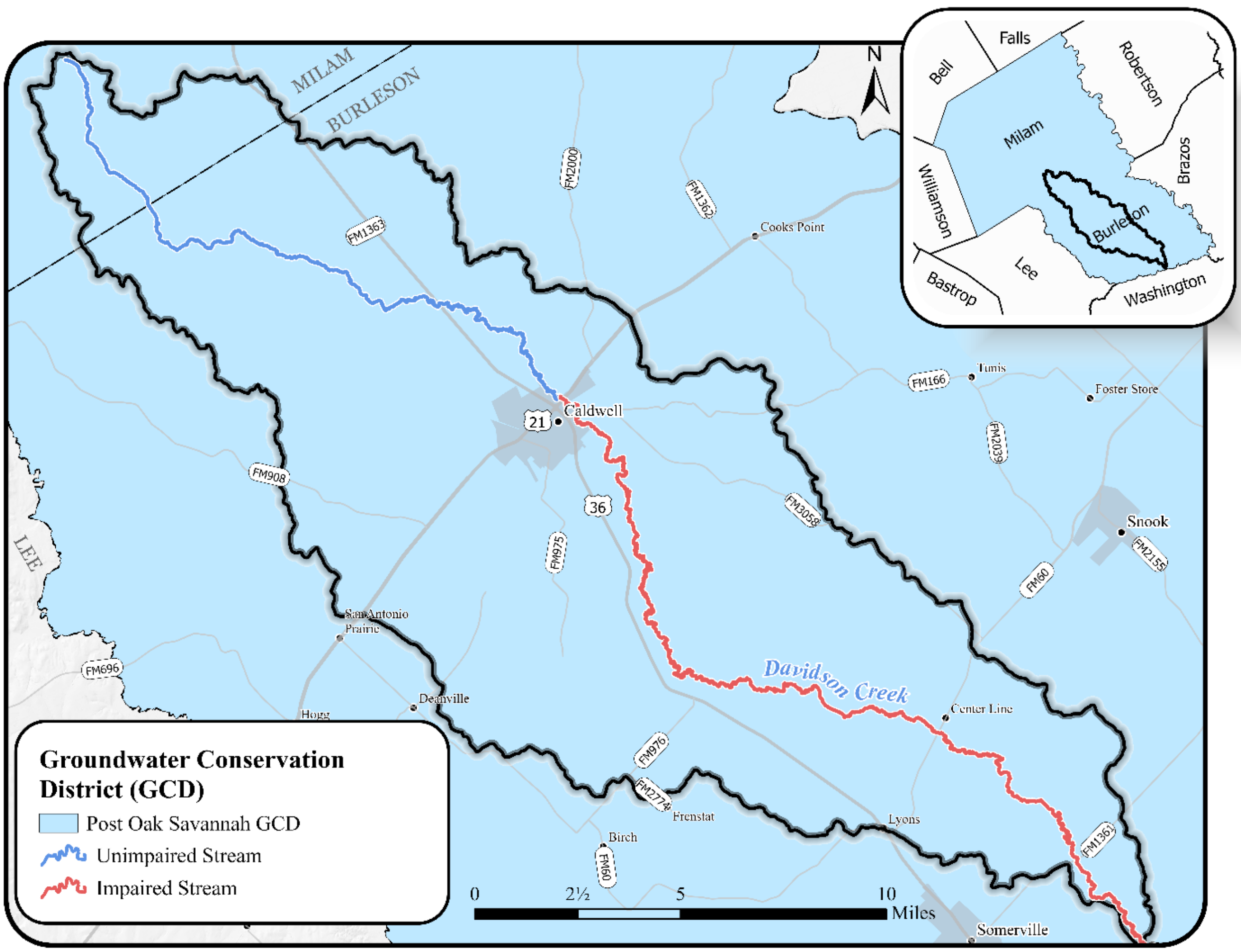

Figure 2- 13. GCDs with authority in the Davidson Creek watershed.

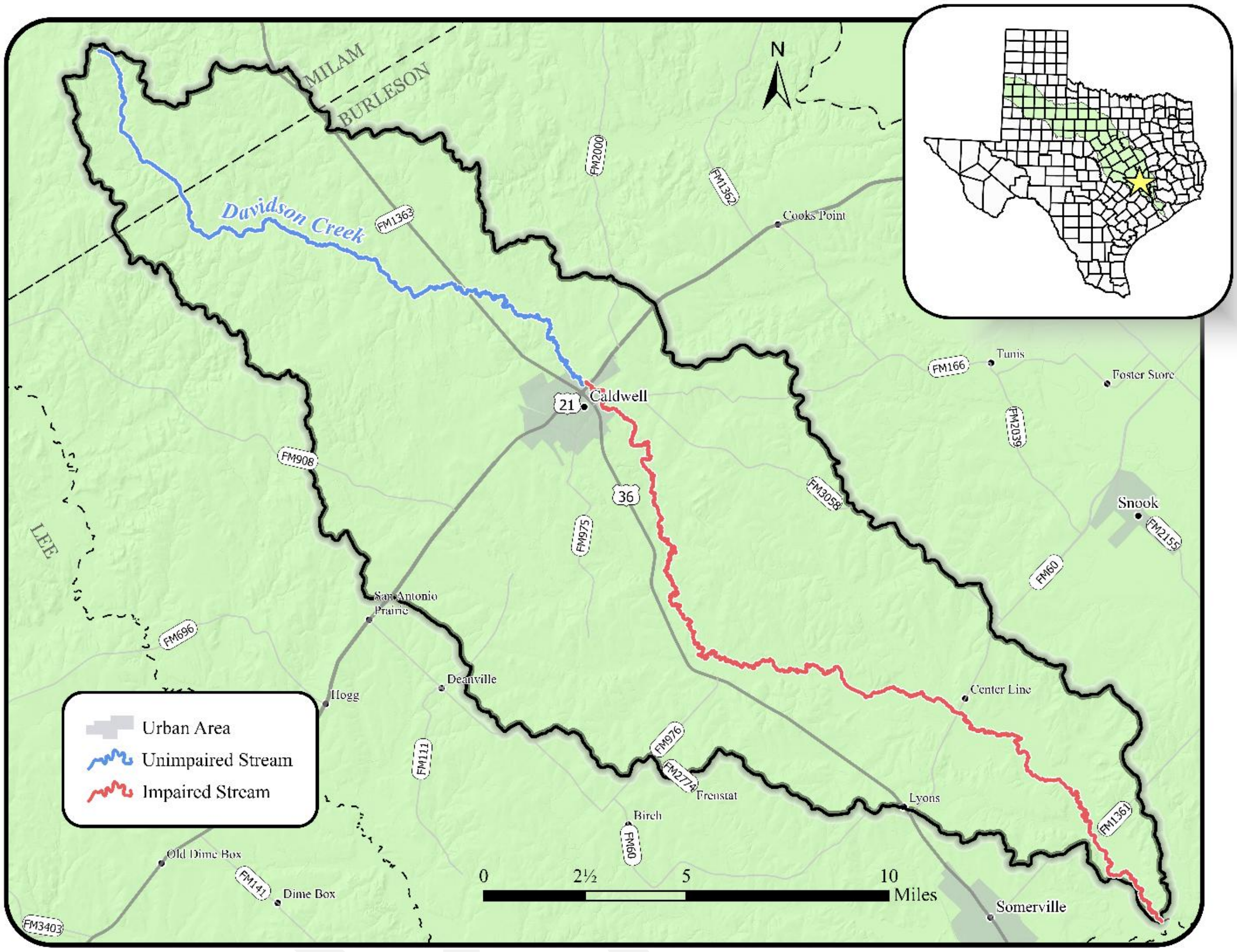

Figure 2- 114. Brazos River Authority in the Davidson Creek watershed.

Population

Davidson Creek watershed population estimates were developed using the United States Census Bureau (USCB) 2020 census blocks data (USCB, 2020). Based on these data, the estimated population is approximately 10,477. The area is sparsely populated with fewer than one person per acre on average (Figure 2- 125). Population density is highest in the city of Caldwell.

To project future water needs, the TWDB provides regional water plan data that includes population forecasts (TWDB, 2022). These forecasts provide decadal population projections for counties within Texas on a 50-year horizon. The most recent regional water plan released in 2022, features population projections from 2020 through 2070. Population growth for Burleson and Milam counties were used to estimate future population growth in the portion of each county in the watershed (Table 2-2).

Table 2- 2. Projected population in Davidson Creek watershed by county.

County in Watershed	2020	2030	2040	2050	2060	2070
Burleson	10,118	10,886	11,373	11,862	12,248	12,565

County in Watershed	2020	2030	2040	2050	2060	2070
Milam	359	380	395	415	431	447
Total	10,477	11,266	11,768	12,277	12,679	13,011

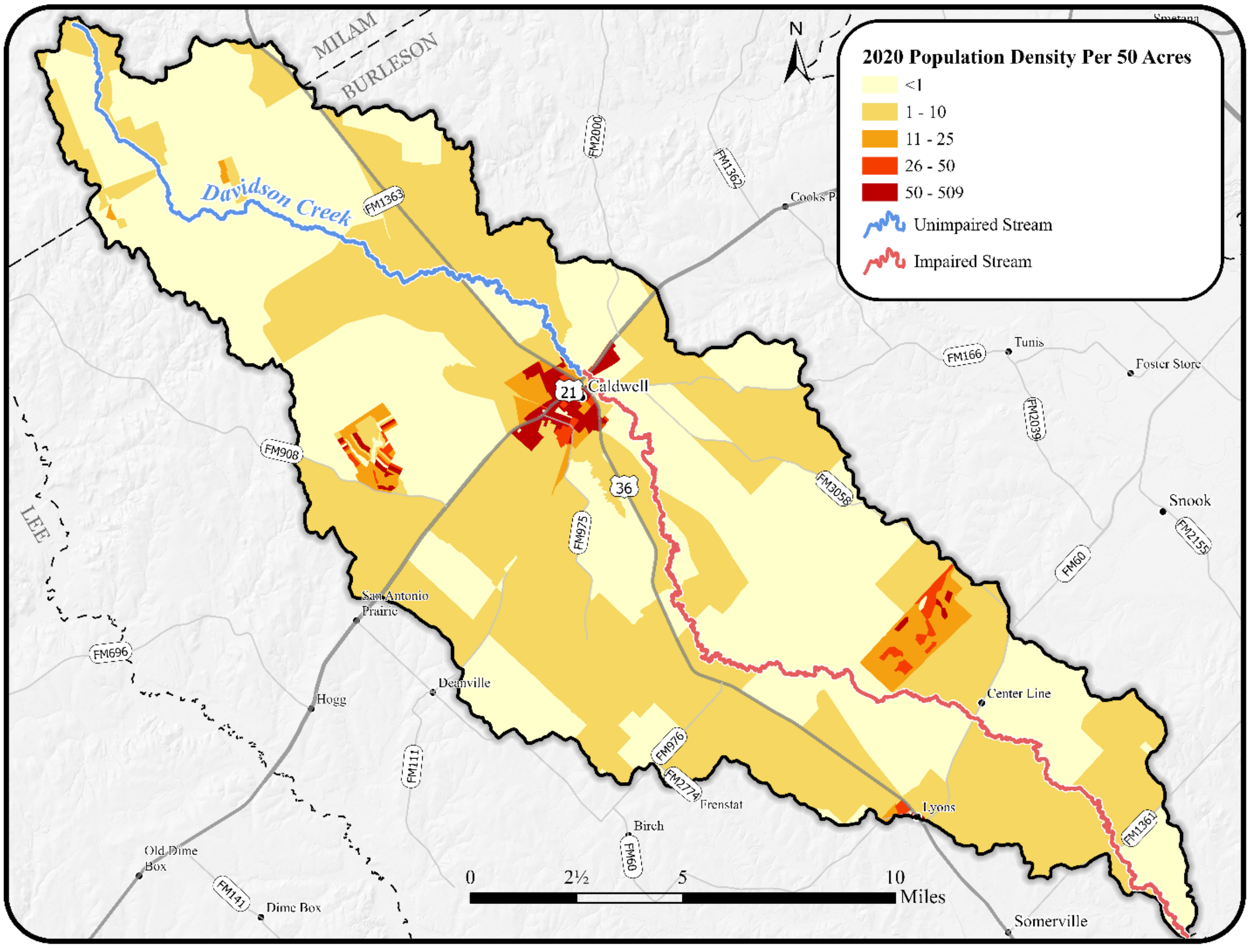

Figure 2- 125. Davidson Creek watershed 2020 population density by census block.

Chapter 3: Water Quality

In Texas, state agencies test surface water regularly to make sure it supports its intended uses defined by the Texas Surface Water Quality Standards (TSWQS). Designated uses often include aquatic life support, recreation in water, public drinking water supply, general use, and fish consumption. To verify whether waterbodies meet these applicable water quality standards, agencies assess specific water quality indicators including dissolved oxygen (DO), *Escherichia coli* (*E. coli)*, pH, temperature, total dissolved solids, sulfate, chloride, and various toxins. Each indicator is measured and compared to limits and guidelines set for each designated use. Data collected through sampling helps track changes in water quality over time. This provides a foundation for developing strategies to protect and improve conditions within the Davidson Creek watershed.

Texas Surface Water Quality Standards

The Clean Water Act (CWA) §303 requires all states to set standards that protect the chemical, physical, and biological integrity of the nation's waters. This means that Texas' regulations protect fish, wildlife, and human health in and on the water. They also consider the use and value of state waters for public drinking water, wildlife, recreation, agricultural, and industrial purposes. These standards are defined in the TSWQS which is reviewed and approved by the EPA (EPA, 2005). According to this mandate, the Texas Commission on Environmental Quality (TCEQ) publishes waterbody evaluations and classifications in the *Texas Integrated Report of Surface Water Quality for CWA Sections 305(b) and 303(d)* (TCEQ, 2024a) (Integrated Report). These reports are published approximately every two years and include the support level for each designated use, indicator, method, or parameter group for water bodies throughout the state.

A designated use describes specific goals and expectations for how a waterbody is used, such as contact recreation, aquatic life, and public water supply. Each designated use has a criterion that specifies the water quality condition a waterbody should attain to meet that use. Parameters like Chlorophyll-a and nutrients do not have regulatory criteria; instead, screening levels are assigned. Davidson Creek has the designated uses of Primary Contact Recreation 1, Aquatic Life, and General Use (Table 3-2).

Water Quality Monitoring and Assessments

To monitor and manage water quality, the TCEQ divides water bodies into segments based on similar physical and hydrological features. Segments are divided into smaller assessment units (AUs), which are the smallest areas (often no longer than 25 miles) used by TCEQ to evaluate water quality (TCEQ, 2024b). Davidson Creek includes only one segment, 1211A. In this watershed, segment 1211A is split into two AUs: 1211A_01and 1211A_02 (**Error! Reference source not found.**; **Error! Reference source not found.**).

TCEQ classifies AUs of impaired water bodies in Davidson Creek as "not supporting" (NS) their designated uses in the Integrated Report, 303(d) List.The TCEQ identifies a "concern", which is not an impairment listing, for water quality if the screening level was exceeded more than 20 percent of the time based on the number of exceedances for a given number of samples collected (TCEQ, 2024b). According to the 2024 Integrated Report, the TCEQ identifies AU 1211A_02 as having multiple problems supporting designated uses of the waterbody (TCEQ, 2024a; **Error! Reference source not found.**).). Because no historical water quality sampling has been conducted on the upper AU 1211A_01, no issues have been identified. Stakeholders have stressed the importance of obtaining more data on this AU, and as a result, an additional water quality monitoring study, the Davidson Creek Continued Monitoring (TSSWCB project# 25-51) has begun.

Table 3- 3. Davidson Creek Impairments or Concerns According to the *2024 Texas Integrated Report*.

Waterbody	Segment ID	AU ID	Parameter of impairment or concern	Level of support*
Davidson Creek	1211A	1211A _01	n/a	n/a
Davidson Creek	1211A	1211A _02	Bacteria	NS
			Dissolved Oxygen	NS

*** Level of support: NS = Non support**

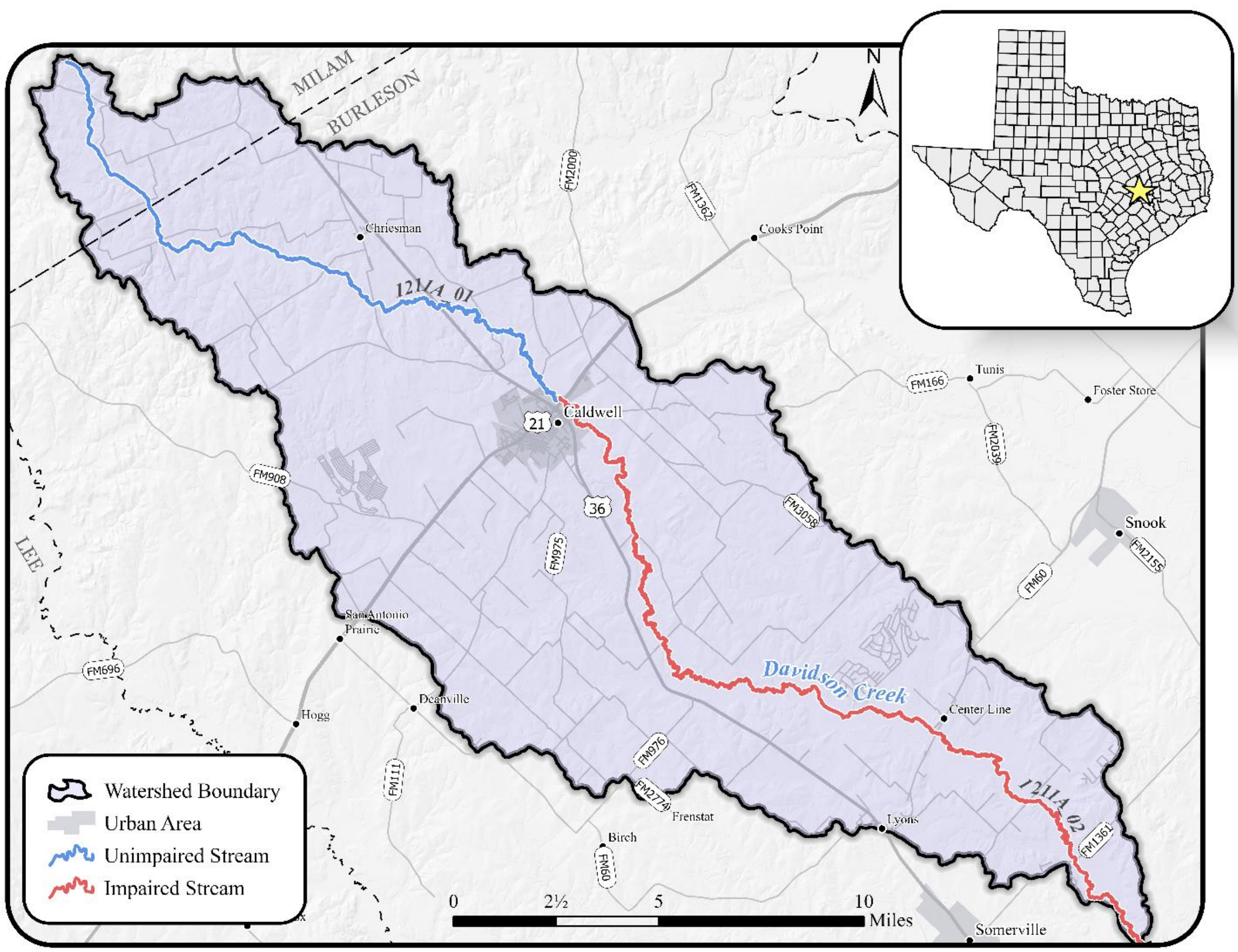

Figure 3- 13. Davidson Creek Segment and Assessment Unit Overview.

The most recent 2024 Integrated Report was based on water quality data collected between December 1, 2015, and November 30, 2022 (TCEQ, 2024b). Historically, water quality in Davidson

Creek has been monitored by various entities including the Brazos River Authority (BRA), the TCEQ, the United States Geological Survey (USGS), and the Texas Water Resources Institute (TWRI). In recent years, the USGS collected data monthly from November 2016 to July 2017, the TCEQ Surface Water Quality Monitoring (SWQM) Team collected data quarterly from November 2018 to December 2019, and the TWRI collected data monthly from December 2018 to August 2024. TWRI began collecting monthly data again starting in August 2025, this time on both AUs to allow for independent water quality analysis for each AU within the segment. This additional data collection is funded by the TSSWCB through January 2027. Currently monitored stations are indicated on Figure 3-2. Data collected by the agencies include instantaneous streamflow, *E. coli*, Secchi depth (water clarity), water temperature, dissolved oxygen (DO), specific conductivity, and pH.

Water quality, biological, and aquatic habitat data are put into the TCEQ's Surface Water Quality Monitoring Information System (SWQMIS), a statewide database that stores, manages, and makes water quality data publicly available. The data undergoes a rigorous quality control and evaluation process before being assessed for the statewide Integrated Report. To assess the data, parameters are compared to their criteria or screening level (Table 3- 2).

Table 3- 2. Davidson Creek Designated Uses and Criteria/Screening Levels (TCEQ, 2022).

AU ID	Designated Use	Parameter	Criteria/Screening Level
1211A _01	Aquatic Life	DO / grab screening level*	5.0 mg/L
		DO / grab minimum	3.0 mg/L
		24-Hour DO avg.	5.0 mg/L
		24-Hour DO min.	3.0 mg/L
	Primary Contact Recreation	Bacteria Geomean	126 MPN/100 mL
	General	Total Phosphorus	0.69 mg/L
		Nitrate*	1.95 mg/L
		Chlorophyll-a*	14.1 ug/L
		Ammonia*	0.33 mg/L
1211A _02	Aquatic Life	DO / grab screening level*	4.0 mg/L
		DO / grab minimum	3.0 mg/L
		24-Hour DO avg.	4.0 mg/L
		24-Hour DO min.	3.0 mg/L
	Primary Contact Recreation	Bacteria Geomean	126 MPN/100 mL
	General	Total Phosphorus*	0.69 mg/L
		Nitrate*	1.95 mg/L
		Chlorophyll-a*	14.1 ug/L
		Ammonia*	0.33 mg/L

***State screening level**

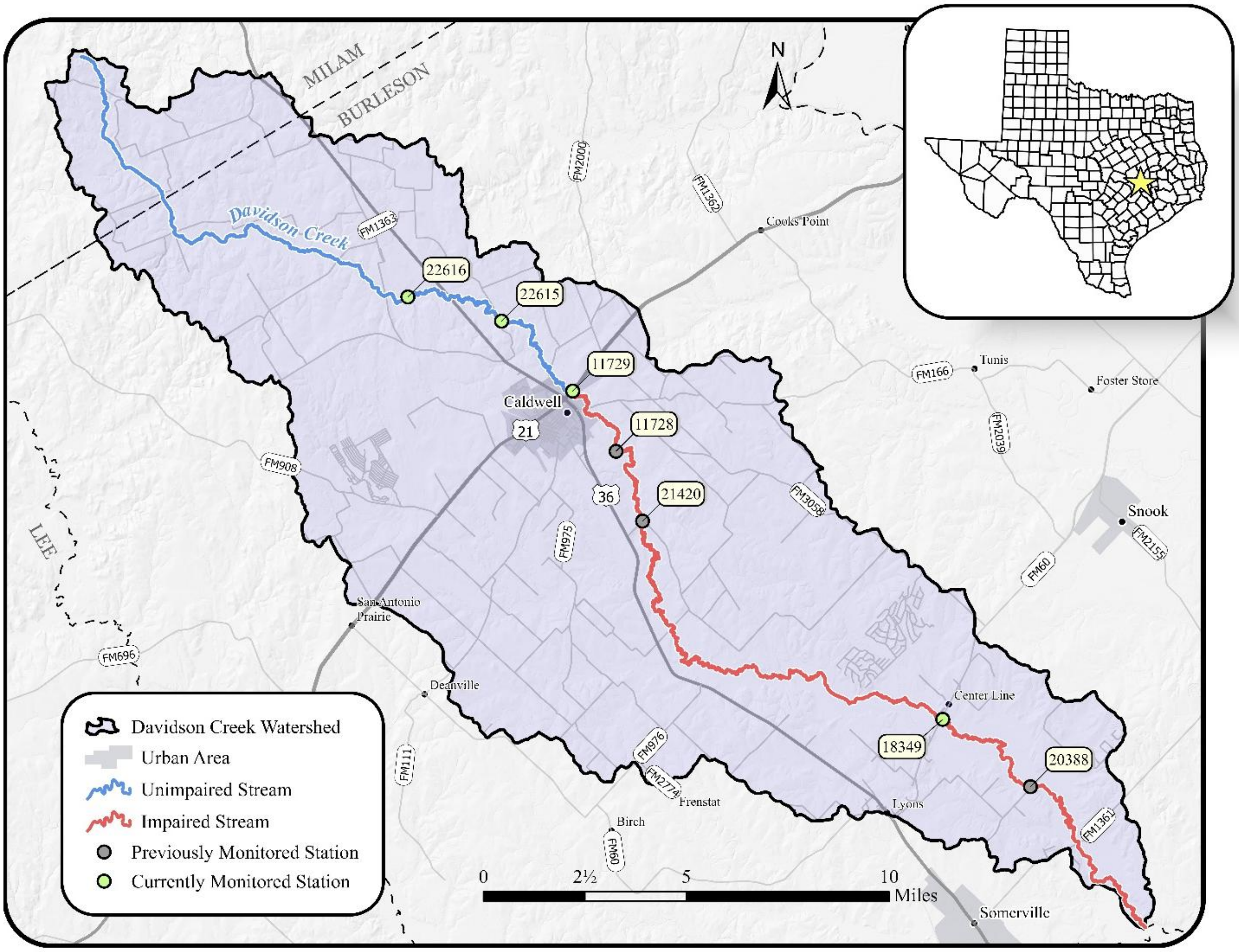

Figure 3- 2. All TCEQ SWQMIS stations in the Davidson Creek watershed.

Bacteria

The designated use associated with recreational activities that often results in the ingestion of water is Primary Contact Recreation 1. The indicator used to measure whether the water quality supports this designated use in freshwater is *E. coli*. The presence of this fecal indicator bacteria may indicate that associated pathogens from the intestinal tracts of warm-blooded animals or other sources could be reaching water bodies and may increase the risk of illness for people that recreate in them. Common sources of *E. coli* include wildlife, domestic livestock, pets, malfunctioning on-site sewage facilities (OSSFs), urban and agricultural runoff, sewage system overflows (SSOs), and direct discharges from wastewater treatment facilities (WWTFs). For Primary Contact Recreation 1 use, the geometric mean of *E. coli* concentrations in freshwater needs to be less than 126 MPN per100 mL based on at least 20 measurements. (TCEQ 2024a; TCEQ 2024b).

The Davidson Creek watershed exceeds the minimum data requirement, although there are large data gaps for *E. coli* from 2008 to 2018 (Figure 3- 3). Historical and recent *E. coli* data for Davidson

Creek indicate a consistent trend of fecal indicator bacteria geometric means significantly above the designated use criteria.

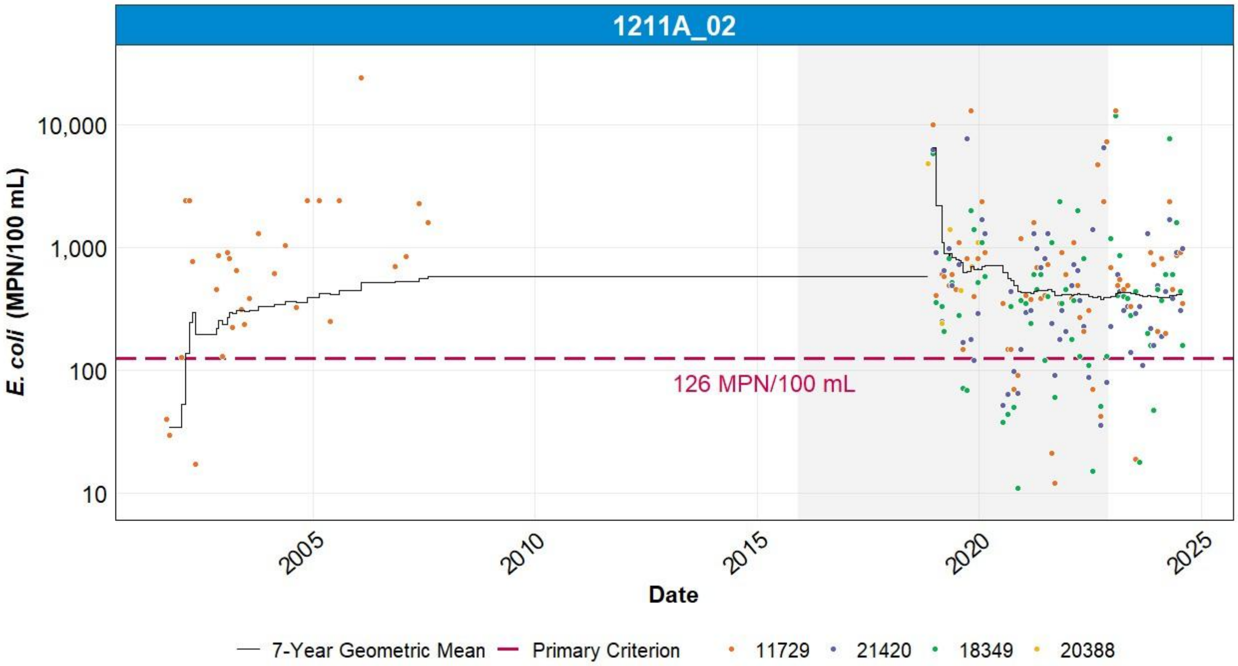

Figure 3-3. Davidson Creek historic *E. coli* data. The gray rectangle is the most recent TCEQ assessment period.

Dissolved Oxygen

For the Aquatic Life Use (ALU), dissolved oxygen concentrations are used to measure whether stream conditions are sufficient to support existing, designated, presumed, and attainable aquatic life. There are six subcategories of ALU which represent natural variability in local environmental conditions. Davidson Creek has two ALU designations, **high** in the upper AU (1211A_01) and **intermediate** in the lower AU (1211A_02). Each ALU designation has a corresponding dissolved oxygen criteria set by the TSWQS (Table 3-2; TCEQ, 2022).

Typically, DO concentrations vary throughout the day, with the highest levels of DO occurring in mid to late afternoon due to photosynthesis. DO concentrations are typically lowest just before dawn when photosynthesis is at its lowest. Seasonal fluctuations in DO are common because oxygen solubility decreases in water as temperature increases; therefore, it is common to see lower DO concentrations during the summer. While DO does fluctuate naturally, human activities can also cause abnormally low DO concentrations. Excessive organic matter (vegetative material, untreated wastewater, etc.) can result in depressed DO concentrations as bacteria break down materials and consume oxygen. Excessive nutrients from fertilizers and manures can also depress DO as aquatic plant and algae growth increase in response to nutrients. The increased plant respiration at night can also drive down DO concentrations.

Either a DO grab measurement (sampling method of collecting a water sample at a single point in time) or 24-hour DO measurement (collecting measurements over a 24-hour period) can be used for assessing ALU support. Each is assessed using two different thresholds, a mean screening level and a minimum value. The screening level is used to identify potential concerns and to indicate whether further assessment is needed to determine if conditions consistently pose risks to aquatic life. The minimum threshold refers to the lowest acceptable DO concentration measured during a sampling event, and it could indicate adverse conditions to aquatic life.

When evaluating DO levels, TCEQ requires that monitoring events be spaced over an index and critical period. The index period represents the warm-weather season of the year and spans from March 15th to October 15th. The critical period of the year is July 1st to September 30th and is the portion of the year when low streamflow, maximum temperatures and minimum DO levels typically occur across Texas (TCEQ, 2022).

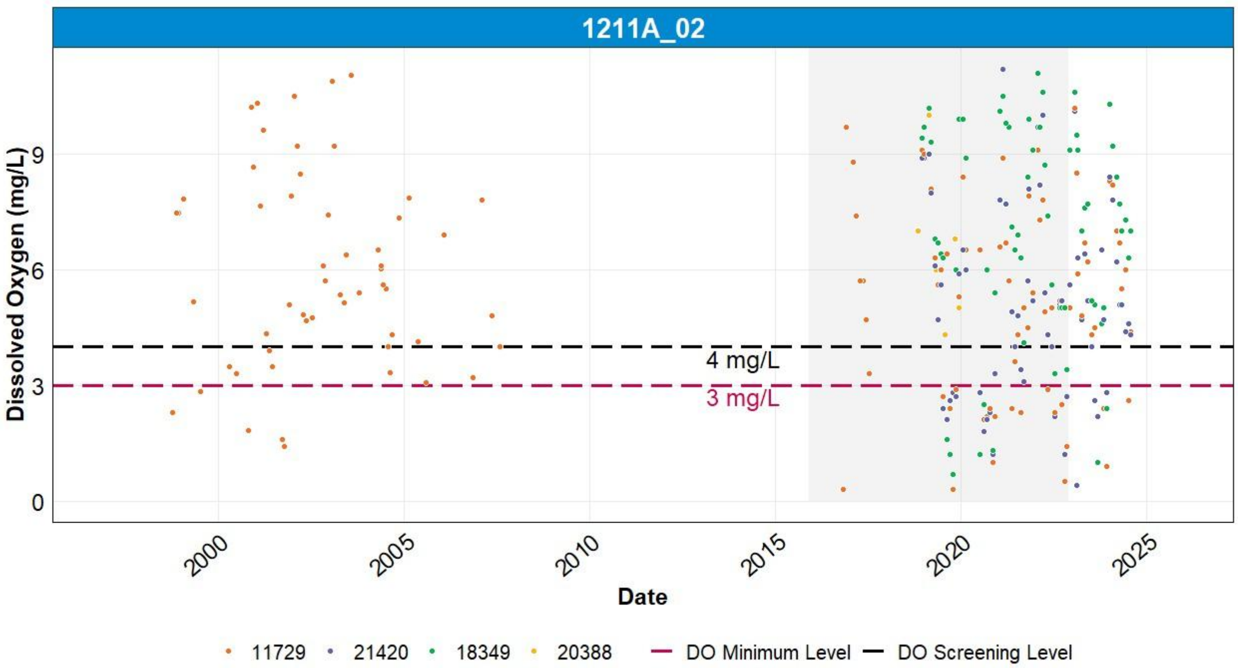

Figure 3-4. Davidson Creek historical grab DO measurements at all TCEQ SWQM stations. The gray rectangle denotes the most recent TCEQ assessment period.

For Davidson Creek AU 1211A_02, many grab DO measurements fall below the minimum threshold (Figure 3-4). The majority measurements that fell below the minimum threshold were collected between May and December, which also correlates with the period of the lowest flow for Davidson Creek (Figure 3-11). These low DO grab measurements indicated a need for additional sampling to further assess the water quality conditions. Two stations were measured for 24-hour DO, TCEQ SWQM stations 11729 and 20388 (Figure 3-5; Figure 3-6). Station 11729 showed a continued pattern of low DO, with seven 24-hour DO datasets falling below the average criteria and five falling below the minimum criteria during the late summer and fall (Figure 3-5). For station 20388, there were no excessively low DO measurements, although this may be because there were only three sampling events conducted in July, November and December (Figure 3-6). There were no DO data to assess on the Davidson Creek AU 1211A_01.

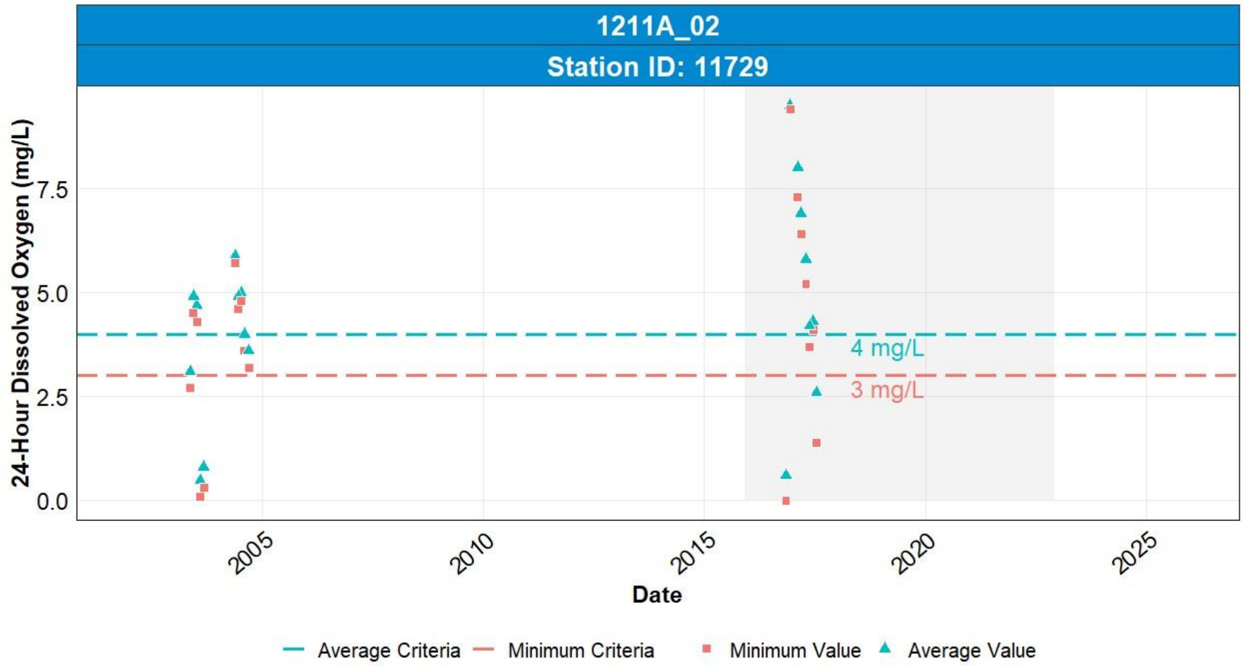

Figure 3-5. 24-hour DO measurements for TCEQ SWQM station 11729. The gray rectangle denotes the most recent TCEQ assessment period.

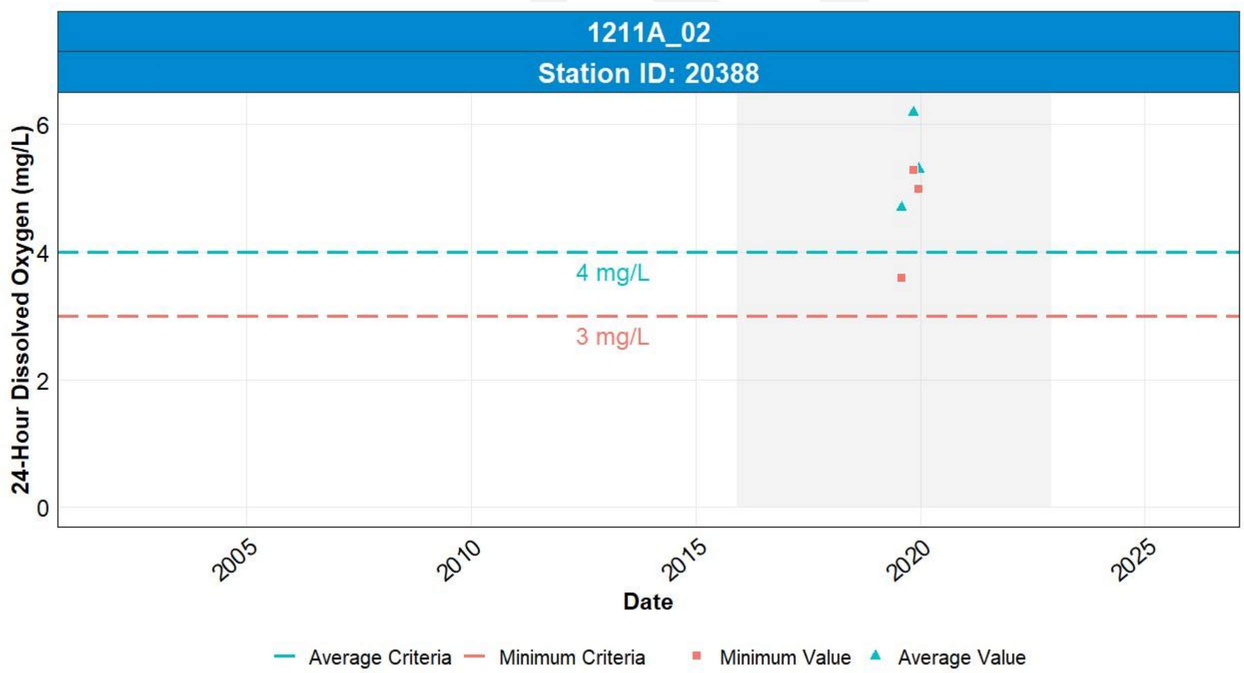

Figure 3-6. 24-hour DO measurements for TCEQ SWQM station 20388. The gray rectangle denotes the most recent TCEQ assessment period.

Nutrients

For General Use, some parameters used to indicate use support include total phosphorus, nitrate, chlorophyll-a, and ammonia. General Use is intended to safeguard freshwater streams from excessive toxicity to aquatic life, livestock or domestic animals and prevent degradation of water quality. Although reservoirs have designated use criteria for nutrients, freshwater streams do not. Only nutrient screening levels are designated for ammonia, nitrate, total phosphorus, and chlorophyll-a (Table 3-2; TCEQ, 2022).

Nutrients, specifically nitrogen and phosphorous, are used by aquatic plants and algae. Excessive nutrients can lead to plant and algal blooms, which also results in reduced DO levels. Nutrient sources include WWTF and OSSF effluent, direct deposition of animal fecal matter, illegal dumping, groundwater inflows, and fertilizers runoff from yards and agricultural fields. Additionally, nutrients bind to soil and sediment particles; therefore, runoff and erosion events that result in heavy sediment loads can also increase nutrient concentrations in water bodies receiving eroded soil.

Chlorophyll-a, nitrate, and total phosphorus data from Davidson Creek are graphed below, along with their associated screening level and monitoring station numbers where data were collected (Figure 3-7 through Figure 3-10). While there were some isolated instances when nutrient concentrations exceed screening levels, overall data does not indicate consistent nutrient problems.

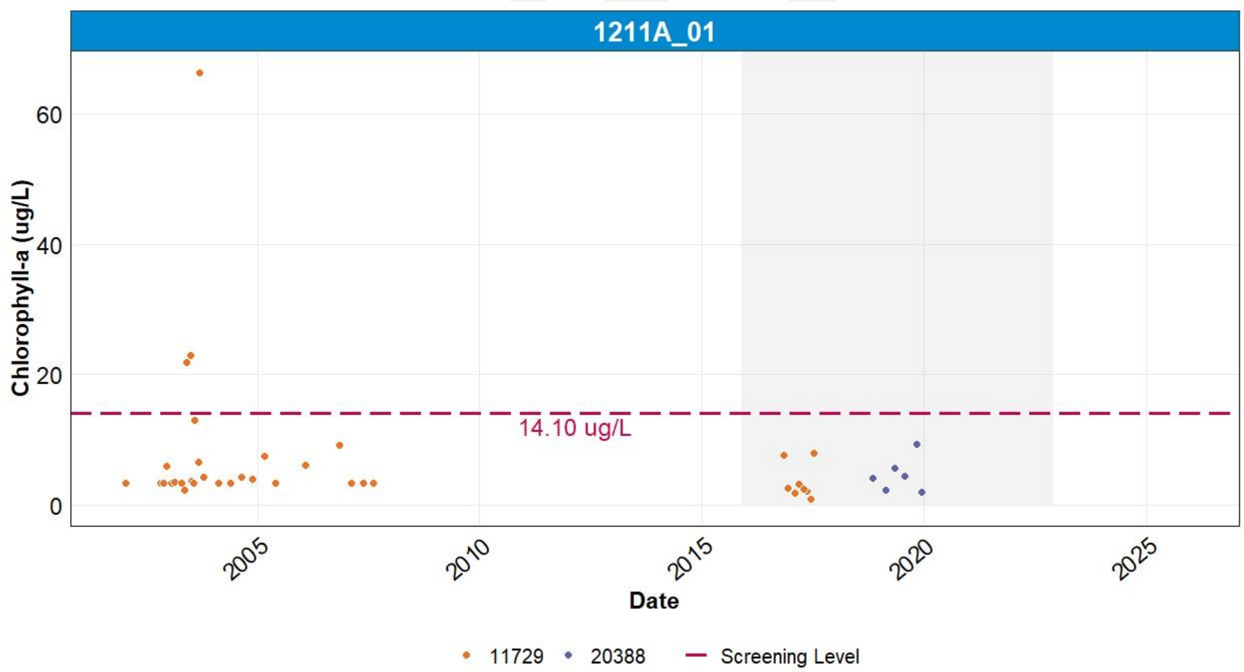

Figure 3-7. Chlorophyll-a measurements for Davidson Creek. The gray rectangle denotes the most recent TCEQ assessment period.

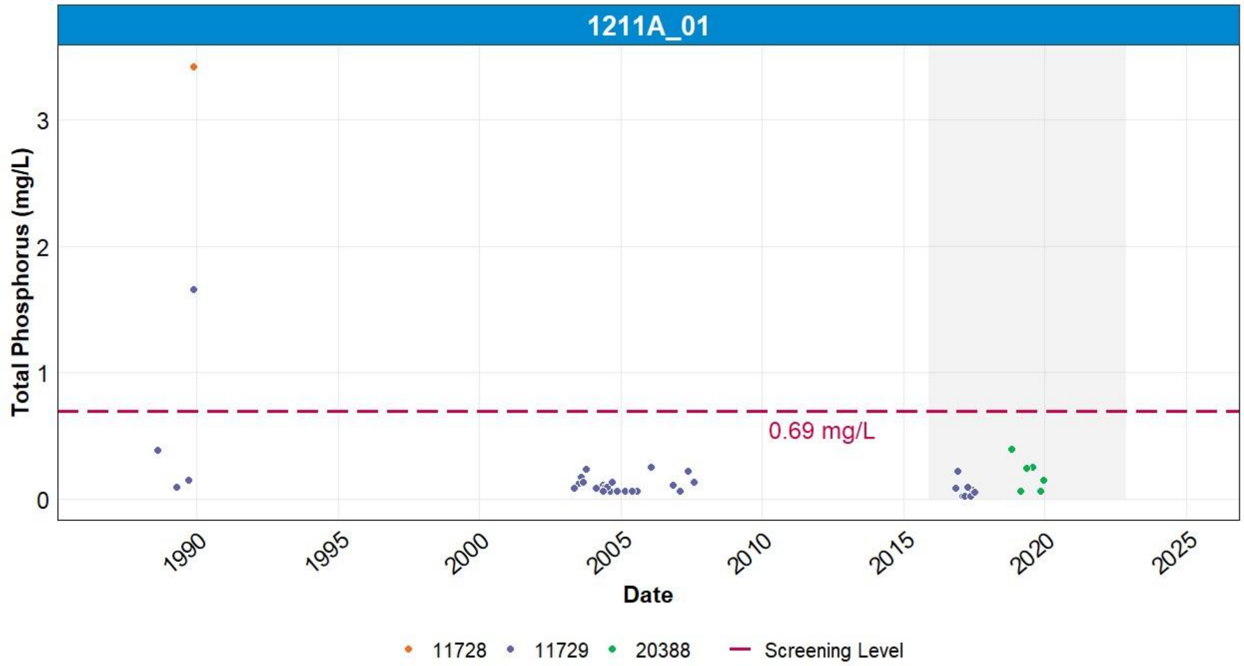

Figure 3-8. Total Phosphorus in Davidson Creek. The gray rectangle denotes the most recent TCEQ assessment period.

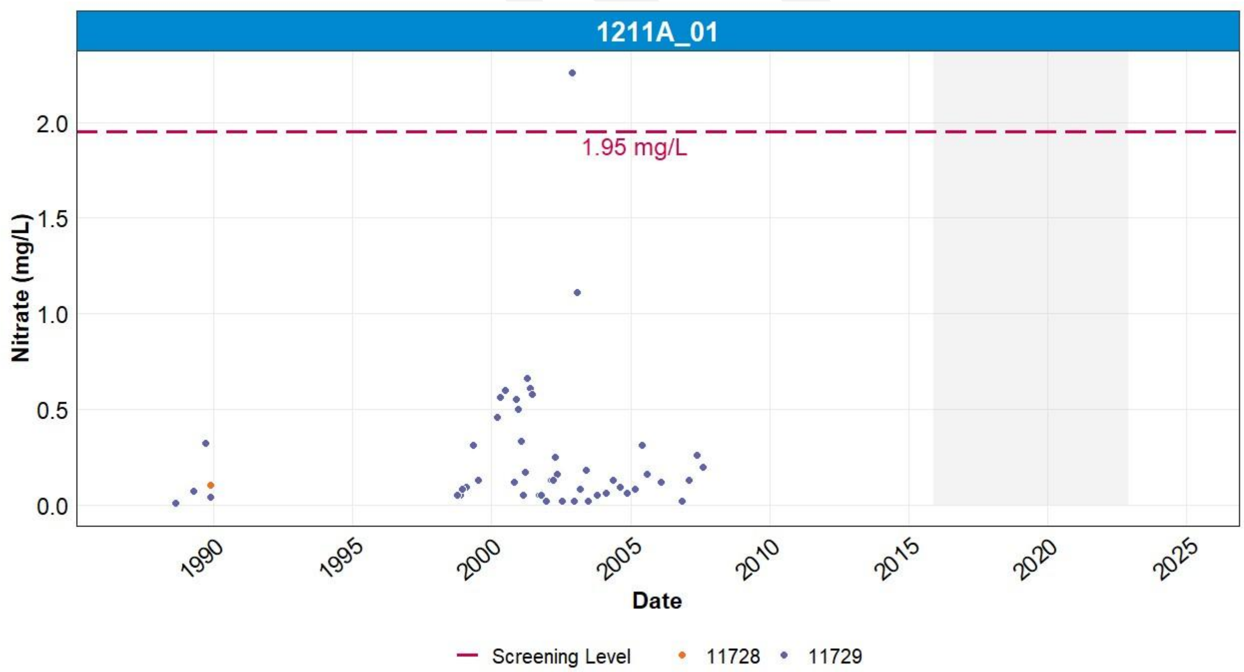

Figure 3-9. Nitrate in Davidson Creek. The gray rectangle denotes the most recent TCEQ assessment period.

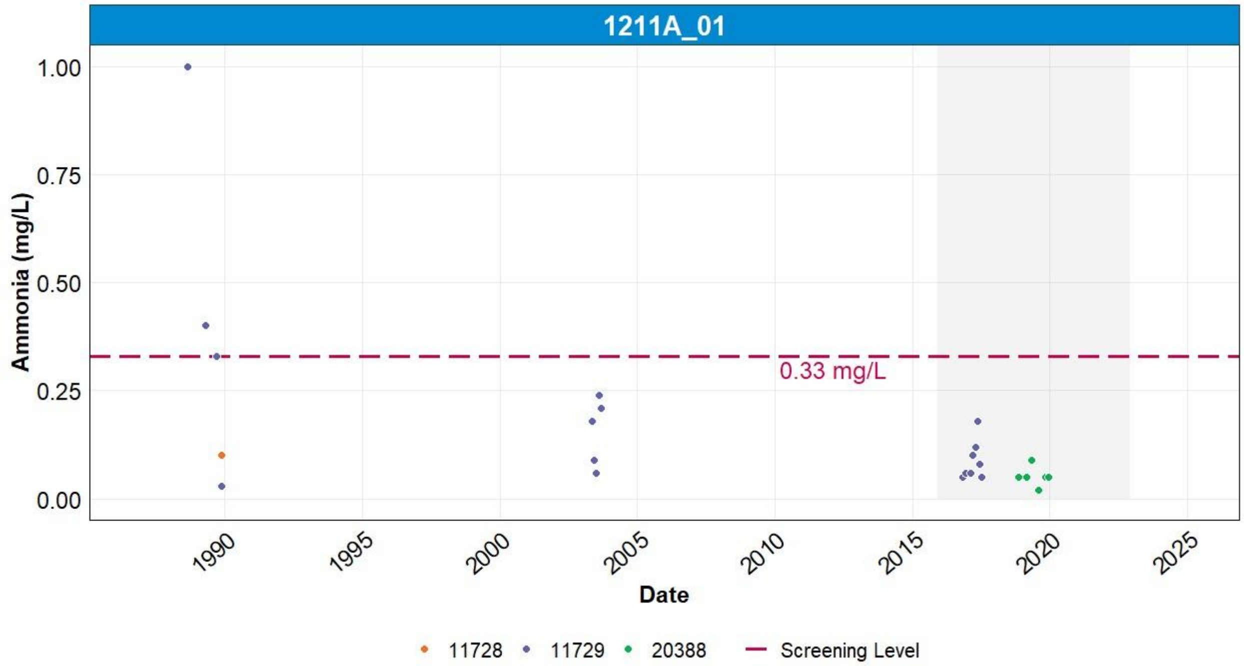

Figure 3-10. Ammonia in Davidson Creek. The gray rectangle denotes the most recent TCEQ assessment period.

Flow

Streamflow is always changing in response to both natural (e.g., precipitation events) and man-made (e.g., changes in land cover) factors. From a water quality perspective, streamflow is important because it influences the ability of a waterbody to assimilate pollutants throughout the watershed. If the streamflow is high, then pollutants could be rapidly distributed throughout the watershed, more easily diluted, and the stream may have higher DO. If the streamflow is very low, then pollutants may not travel very far, they may be concentrated, and low DO situations may arise. Therefore, when assessing water quality data, the streamflow volume needs to be reviewed concurrently (TCEQ, 2024b). Figure 3-11 shows the monthly median streamflow for station 18349 using the USGS stream gage flow at the same site.

Based on this plot, Davidson Creek generally has less water in the summer and fall (June through December). This doesn't entirely line up with the precipitation seasonality, as May, June and October generally have the highest average rainfall of the year. This may be due to water rapidly moving out of the watershed, or it could be due to other influences on streamflow like WWTF discharges and water diversions and impoundments. Additional hard-to-measure influences could be rainwater infiltrating the sandy soil to contribute to groundwater recharge or groundwater contributing to baseflow.

Water rights in the Davidson Creek Watershed allow both water diversions and impoundments. All existing water rights are outlined in the table below (Table 3- 3; TCEQ, 2025a). Water rights are permitted by the TCEQ and are required to report annual water use. While there are five water rights holders, only one user reported any water usage in the most recently posted data in 2023 (TCEQ, 2025a). This water rights holder was the BRA, which has the flexibility to divert from many different watersheds in the Brazos River basin, and therefore, annually reported usage is based on diversions in the whole basin.

Table 3- 3. Davidson Creek water rights.

Water Right ID	Use	Volume
C5281	Impoundment – Recreational	Up to 60 acre-feet
C5282	Impoundment – Recreational	Up to 675 acre-feet for two impoundments
P5851*	Diversion – Domestic, municipal, agricultural, industrial, mining and recreation	Between 333,736 acre-feet and 469,623 acre-feet (diverted from many watersheds throughout the Brazos River basin)
P4140	Diversion – Flood Control	Up to 435 cfs
C5283	Impoundment – Recreational	Up to 104.7 acre-feet for five impoundments

*BRA

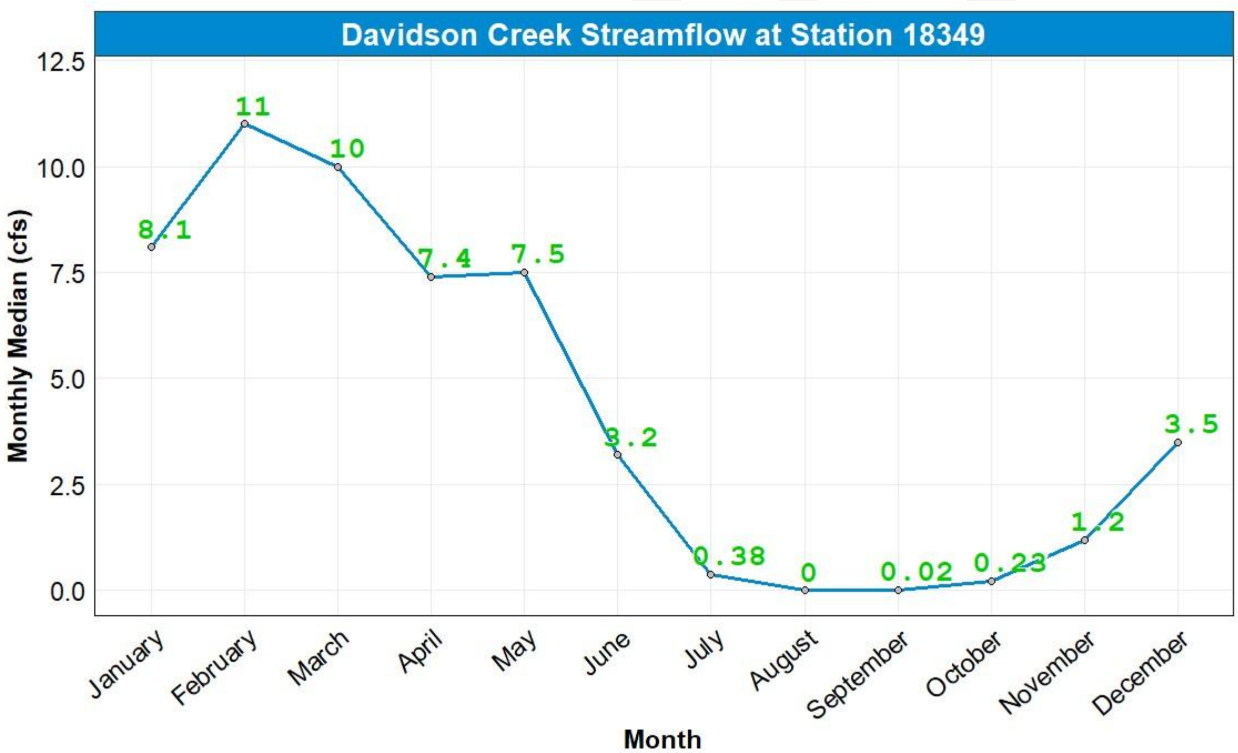

Figure 3-11. Monthly median streamflow at the Davidson Creek USGS gage near Lyons, Texas co-located with TCEQ SWQM station 18349.

Chapter 4: Potential Pollutant Sources

This chapter describes potential pollutant sources in the watershed and will provide context for management measure selections to achieve pollutant reduction goals and improve water quality within the watershed. Identified pollutant sources outlined here will be analyzed in later chapters to help quantify their potential impacts, highlight subwatersheds where their potential impacts may be greatest, and help inform feasible management strategies.

Pollutants can originate from a variety of sources and impact water quality in different ways. These sources are classified as either point sources or nonpoint sources, depending on how pollutants enter the environment. Both types may contribute to the degradation of water bodies by introducing contaminants through runoff or direct discharge into the waterbody.

Point sources enter waterways at clear points of discharge, such as those from pipes or ditches, and operate under permits subject to regulatory oversight. Permits aim to allow pollutants to be discharged at a rate that does not degrade water quality. In Texas, point source discharges are managed under the Texas Pollutant Discharge Elimination System (TPDES), administered by the TCEQ. The TCEQ issues permits that specify limits on the volume and type of pollutants that can be discharged. Common point sources include municipal and industrial wastewater treatment facilities, runoff from construction sites, and municipal separate storm sewer systems (MS4) in urban areas. Failures in permitted systems do occur and result in intermittent discharges that are usually at defined points. An example of this is sanitary sewer overflows (SSOs).

In contrast, nonpoint source (NPS) pollution originates from diffuse sources without a single discharge point. Carried by rainfall and surface runoff, NPS pollution may or may not be regulated through permitting and is instead managed through voluntary practices and responsible land stewardship. Common examples of nonpoint sources include OSSFs and animal waste (pets, livestock, wildlife, and feral hogs).

The sections below describe potential sources of bacteria and nutrients that may contribute to water quality concerns or impairments in the Davidson Creek watershed. These sources were identified and estimated using publicly available databases, as well as local knowledge and input by stakeholders and project partners. Identified sources of bacteria and nutrients, along with their potential causes and impacts on water quality, are summarized in Table 4- 1.

Table 4- 1. Summary of potential pollutant sources in the Davidson Creek watershed.

Type	Pollutant Sources	Potential Causes	Potential Impacts
Point Source	WWTF and SSO	Systematic failure due to age, routine maintenance needs, or overflow during severe storm events	Bacteria and nutrients from untreated wastewater may enter waterbodies
	Permitted Stormwater	Rainfall caused runoff from impervious pavements (roads, parking lots, etc.), excessive erosion at construction sites.	Bacteria, litter, oils, and nutrients washed into waterbodies during rainfall runoff

Type	Pollutant Sources	Potential Causes	Potential Impacts
Nonpoint Source	Livestock	Direct deposition of feces into water, waste transport via runoff and soil disturbance	Pollutant transport, soil erosion and degradation from runoff, direct bacteria and nutrient deposition from animal waste
	Wildlife	Direct deposition of feces into water, waste transport via runoff, soil disturbance, wallowing and rooting in riparian areas	Pollutant transport, soil erosion and degradation from runoff, direct bacteria and nutrient deposition from animal waste
	Pets	Lack of proper disposal of waste in public areas and homes, limited options of proper disposal practices and lack of education	Introduction of bacteria and nutrients directly to waterways
	OSSFs	Poor functioning due to site design, lack of routine maintenance, incorrect treatment of waste, lack of maintenance education	Introduction of bacteria and nutrients through rainfall runoff or subsurface migration
	Illegal Dumping	Litter and/or animal carcasses dumped in or near waterbodies	Deposition of bacteria, nutrients, chemicals, and other pollutants from trash and decaying carcasses

Livestock

Livestock are widespread throughout rural watersheds in Texas. During high rainfall events, runoff from pastures and rangeland transports fecal matter and potentially harmful pathogens into nearby creeks and streams. In areas where livestock have direct access to streams, animals may deposit waste directly into the water.

To reduce these potential impacts, land management practices such as installing streamside buffer zones, rotational grazing practices, alternative water sources, hardened stream crossings, cover cropping or fencing to manage stream access can reduce the time livestock spend near sensitive stream areas and reduce negative impacts on water quality.

Because precise watershed-level livestock counts are not available, populations for horses, goats, pigs, and sheep were estimated using the USDA National Agricultural Statistics Services' (NASS) dataset and USGS NLCD Grazeable land use and land cover (USDA NASS, 2022; USGS, 2024; Figure 2- 5). Grazeable land was classified as grassland/rangelands, pasture/hay, and deciduous-mixed forests. See Appendix A for more details on calculated livestock populations. Total estimated livestock populations for the Davidson Creek Watershed are outlined in Table 4- 2. During meetings with stakeholders, these estimates were discussed and verified.

For cattle, there were three approaches considered. The chosen method verified by stakeholders to estimate cattle population was based on USDA NRCS and Farm Service Agency (FSA) stocking rates and adjusting for what stakeholders would typically consider. These stocking rates were 10 acres per head of cattle for unimproved pasture (grassland/rangeland and deciduous-mixed forests LULC) and 6 acres per head of cattle for improved pasture improved pasture (pasture/hay LULC). Estimated Davidson Creek watershed livestock populations are outlined in Table 4- 2.

Table 4- 2. Estimated grazing livestock populations in the Davidson Creek watershed.

	Cattle	Sheep/Lambs	Horse	Goats	Pigs/Hogs
Burleson	16,558	369	373	389	158
Milam	1,080	40	26	58	11
Watershed Total	**17,638**	**409**	**399**	**447**	**169**

Poultry

Poultry operations are common throughout much of central and east Texas. Poultry litter produced from these houses and applied to land as fertilizer are the primary concern for water quality. Runoff from precipitation could cause both nutrients and bacteria to travel overland and into creeks.

To mitigate these potential effects in Texas, commercial poultry facilities are required to obtain a Water Quality Management Plan (WQMP) through the Texas State Soil & Water Conservation Board (TSSWCB). WQMPs typically focus on litter management to protect water quality and are developed in consultation with a local Soil and Water Conservation District (SWCD). For these plans, land receiving litter applications must have soil tested yearly to determine the appropriate nutrient application rates and should have a buffer of at least 100 feet of well-vegetated ground between a waterbody and the applied litter. WQMPs outlines the litter application planned for on-farm, define what litter must be taken off-farm, requires storage of litter for up to 30 days, and includes more site-specific guidelines (TSSWCB, 2019).

There are currently four active poultry facilities in the Davidson Creek watershed as of 2025, all located in Burleson County (TSSWCB Personal Communication, September 18th, 2025). The TSSWCB estimates the litter produces by these facilities in 2025 (Table 4- 3; Personal Communication, September 18th, 2025). Of this litter produced, only a small percentage was applied as fertilizer within area covered by WQMP. The remainder must be shipped offsite, but its destination is unknown. There are potential plans for additional poultry facilities to be constructed in the watershed near Chriesman, although these would be required to obtain a WQMP as well. Due to regulations, poultry operations following their WQMP are assumed to have insignificant effect on the water quality of Davidson Creek.

Table 4- 3. Davidson Creek watershed estimated poultry and litter.

	Animal Units	Litter Produced (tons)	Litter Applied On-Site (tons)
Broilers	116,800	1,784	96
Layers	212,000	1,246	0
Total	**328,800**	**3,030**	**96**

Wildlife

Bacteria are common in the intestines of all warm-blooded animals. This means that all wildlife contribute nutrients and *E. coli* to waterbodies. Wildlife are naturally attracted to riparian corridors for water, food, and cover. With direct access to the stream channel, deposition of wildlife waste can be a concentrated source of bacteria to a waterbody. Fecal bacteria from wildlife are also deposited onto land surfaces, where they may be washed into nearby streams by runoff.

While mammal species such as raccoons, opossum, and many others are likely to contribute bacteria loads in area waterways, population estimates are only available for feral hogs and white-tailed deer. Deer and feral hogs have publicly available density estimates that enable this analysis. Distribution of these two species was estimated by applying population density estimates to the acres of suitable habitat within the Davidson Creek watershed. Suitable habitat includes land use and land cover classes such as cropland, deciduous-mixed forests, evergreen forest, grassland/rangeland, pasture/hay, and wetlands (see Figure 2- 4).

Deer

The Texas Parks and Wildlife Department (TPWD) conducts white-tailed deer population estimates at the deer management unit (DMU) level. These population estimates are produced using data from hunter-harvested deer and do not include white-tailed deer animal husbandry operations. There are several of these operations in the watershed, and while they are permitted by the TPWD, there is no publicly available information on the total population included with these operations.

Regional deer density from historical surveys in the TPWD DMU 19 South, were used to calculate an average population density as the watershed is covered entirely by this DMU watershed (TPWD, 2025). The average estimated deer population density of 34 per 1,000 acres was calculated from the past five survey years (Appendix A). Based on this population density, paired with the acres of suitable habitat LULC, a total population for deer in the watershed was calculated (Table 4-4).

Feral Hogs

Feral hogs are a significant potential contributor of pollutants. Feral hogs are a non-native, invasive species that continue to rapidly expand through Texas and inhabit similar land use types as white-tailed deer. Riparian corridors are prime habitat for feral hogs, with dense cover, food, and water readily available. In addition to direct bacteria deposition from fecal matter, extensive rooting and wallowing in riparian areas causes severe erosion and soil loss.

Statewide feral hog density estimates can range widely. During stakeholder meetings, many estimates of feral hog were discussed, however all previously used estimates were rejected by stakeholders as they were too low. The final decision was to use a density of 25 acres per hog. Based on this density paired with suitable habitat LULC, the Davidson Creek watershed feral hogs population was calculated (Table 4-4).

Table 4- 4. Estimated wildlife populations contributing to the Davidson Creek watershed pollutants.

Deer	Feral Hogs
4,352	5,119

On-Site Sewage Facilities

In rural areas, many homes and businesses are not connected to centralized wastewater treatment systems and rely on-site sewage facilities (OSSFs), commonly known as septic systems, to treat household wastewater. These systems are essential in areas without access to municipal sewer infrastructure, but they also present potential risks to water quality when they fail or are improperly maintained. OSSFs generally fall into two categories:

1.) **Anaerobic systems** - These are the traditional or conventional septic systems consisting of a septic tank and a drainage or distribution field that allows effluent to filter through the soil.
2.) **Aerobic systems –** These are advanced systems that may include aerated holding tanks that treat wastewater with oxygen, a disinfection unit, and typically disperse treated effluent using an above ground sprinkler system.

When OSSFs are properly designed, installed, and maintained, both system types can function effectively for many years. However, aging systems, inadequate maintenance, poor site conditions, and improper sizing can reduce their performance or lead to failure. When OSSFs are not functioning properly, they can pose a serious risk to water quality, contributing *E. coli*, nutrients, solids, and pathogens to the landscape and waterbodies. Untreated or partially treated wastewater can reach the ground surface and travel downslope or directly into nearby streams, especially after rainfall. Beyond environmental impacts, failing OSSFs can also pose significant public health risks by transmitting waterborne diseases such as cholera, giardiasis, and cryptosporidiosis. Contamination of drinking water sources and agricultural areas can further compound the issue.

In Texas, the Texas Commission on Environmental Quality (TCEQ), along with local authorized agents, oversee the regulation of OSSFs under state rules (30 TAC § 285). In the Davidson Creek watershed, Burleson and Milam Counties serve as the primary permitting and enforcement authorities. They are responsible for approving system designs, issuing permits, and ensuring compliance with maintenance and performance standards.

The potential locations and numbers of OSSFs within the Davidson Creek watershed were estimated using the Federal Emergency Management Agency's (FEMA) USA Structures data (FEMA, 2024). This data classifies buildings by occupancy type combined with national address data. Structures within existing Certificate of Convenience and Necessity (CCN) areas were assumed to be connected to centralized wastewater treatment and removed. Resulting information was cross-referenced with satellite imagery (Figure 4-1). Based on this method, 3,610 OSSFs were estimated for the Davidson Creek watershed. This estimated distribution of OSSFs does not identify locations of failing OSSFs.

Soil characteristics factor into an OSSFs performance and maintenance needs. How well a system treats effluent depends on characteristics like slope, drainage capacity, depth to groundwater, and flood potential. The USDA NRCS soil suitability ratings are paired with the estimated locations of OSSFs to determine potential septic system failure rates. Given the extensive occurrence of "Very Limited" soils for OSSF (79% of the watershed), the vast majority of these systems occur in areas with expected failure rates of at least 12% (Figure 4- 2; Reed, Stowe, and Yanke, 2001).

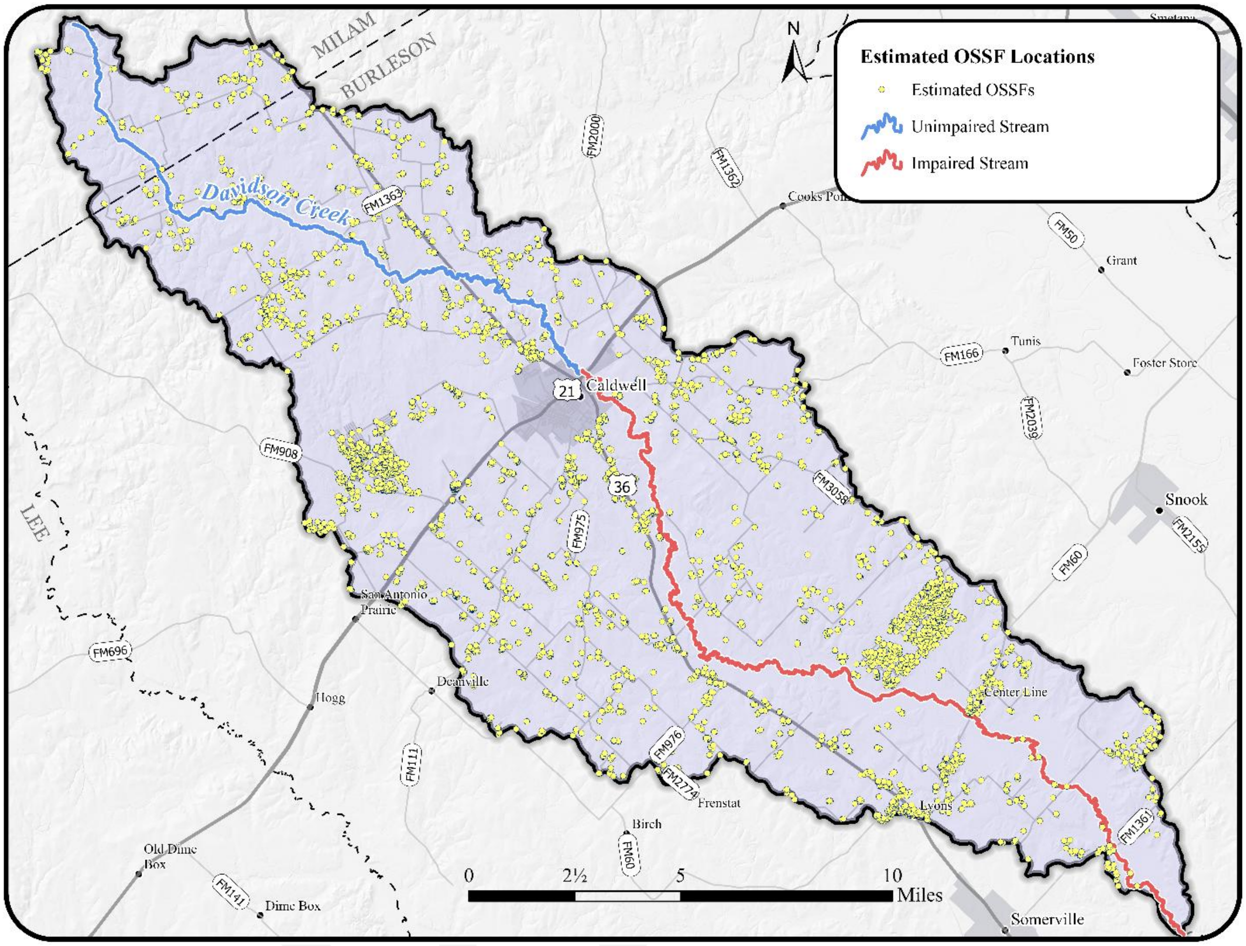

Figure 4- 1. Estimated locations of OSSFs in the Davidson Creek watershed.

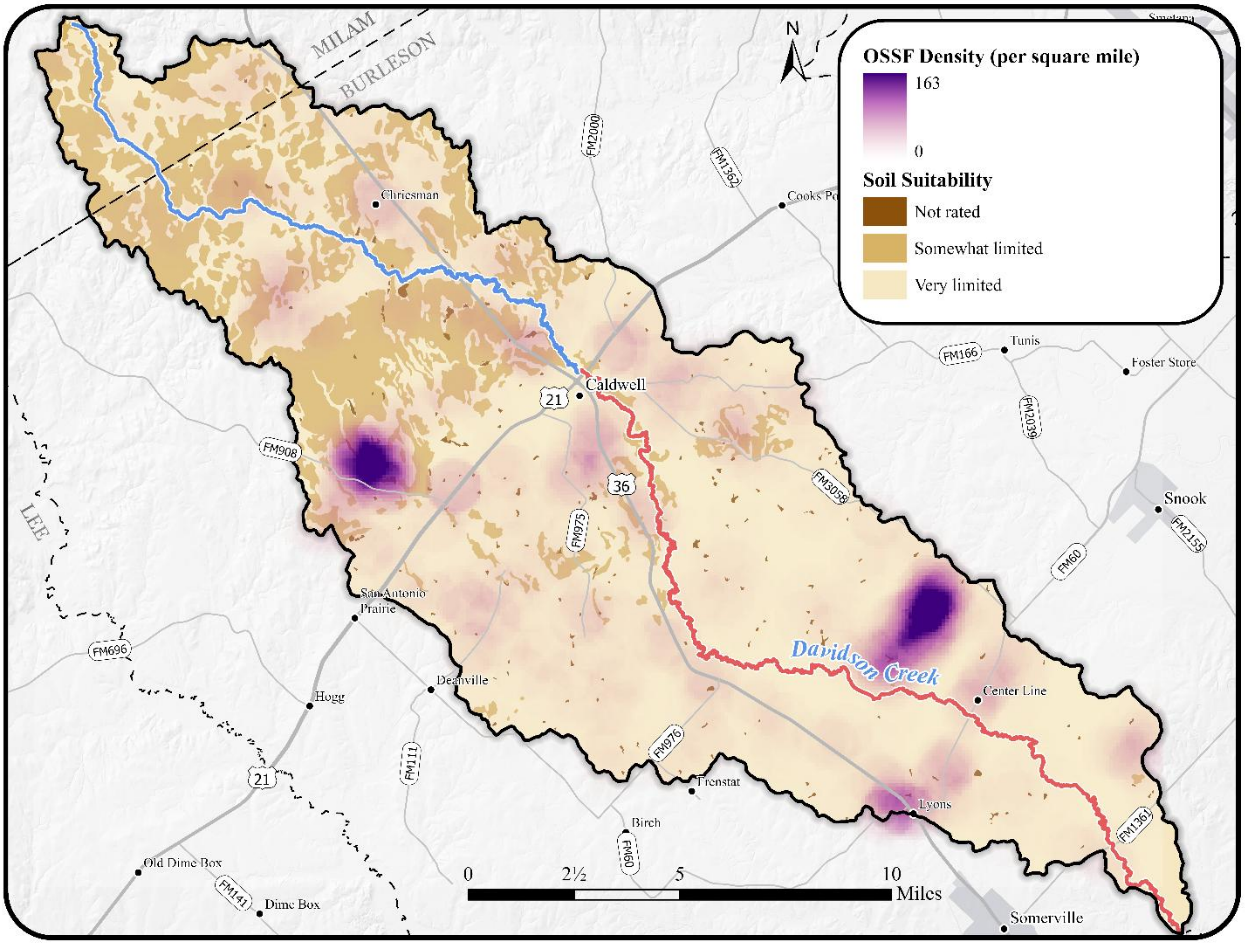

Figure 4- 2. Soil suitability ratings from the USDA NRCS and estimated OSSF density in the Davidson Creek watershed.

Permitted Discharges

Permitted discharges originate from sources that require authorization to release water or wastewater into the environment. In Texas, they are regulated by the TCEQ under the Texas Pollutant Discharge Elimination System (TPDES) program. Common examples of permitted discharges include effluent from wastewater treatment facilities (WWTF), stormwater runoff from industrial and construction sites, and discharges from municipal separate storm sewer systems (MS4). TPDES permits contain limits on the concentration, timing, and loading of pollutants that can be discharged, including bacteria and some nutrients. Facilities are required to monitor and report on the quality of their effluent, including those that exceed or violate their permit conditions.

Wastewater Treatment Facilities

WWTFs are designed to clean or treat municipal wastewater before discharging treated effluent into the environment. Wastewater treatment is a complex process, and a variety of factors may cause occasional exceedances in permit limits, such as excessive rainfall runoff entering the collection system, grease and other collection system blockages, mechanical failures, deferred maintenance, or illicit substances entering the collection system. In some cases, facilities may require infrastructure or process improvements to meet their regulatory requirements or to accommodate growth and inflows to their collection system.

Most WWTFs in the Davidson Creek watershed meet their permit limits with few periodic exceptions. However, because human waste is associated with a variety of pathogens, identifying permit exceedances for indicator bacteria, such as *E. coli*, is important in understanding overall impacts to water bodies. While wastewater treatment can be highly effective at removing bacteria and pathogens, it is less effective in nutrient removal and advanced treatment may be needed for discharges to sensitive waterbodies or drinking water supplies.

The TCEQ online database of wastewater permits was searched to determine the number of WWTFs in the watershed and their permit limits (Table 4- 5). The EPA Environmental Compliance History Online (ECHO) database (USEPA, 2025) was used to identify reported exceedances of permit limits during the January 2022 to June 2025 timeframe, for parameters of concern to the Davidson Creek watershed. As of June 2025, records indicated the Davidson Creek watershed had two WWTFs (Figure 4- 3). The city of Caldwell WWTF discharges directly into the impaired Davidson Creek segment. Records show the Burleson County WWTF, while never constructed, permits discharges into a tributary of Davidson Creek. However, this permit expired in May 2019 and county officials indicate that there is no current interest in renewing the permit.

The city of Caldwell WWTF had two instances of non-compliance between January 1st, 2022, through June 1st, 2025 (USEPA, 2025). Discharge is measured in millions of gallons per day (MGD).

Table 4- 5. Daily average flow and pollutant concentrations from WWTF between January of 2022 and June 2025.

Facility Name (TPDES Permit No.)	Receiving Stream	Flow (MGD)		Bacteria (MPN/100mL)		Events of Discharge Limit Exceedance
		Final Permitted	Reported (3-yr average)	Permitted (Daily Average)	Reported (3-yr average)	
City of Caldwell WWTF (WQ0010813-001)	Davidson Creek	0.711	0.39778	126	7.039	2 (*E. coli* daily average, Ammonia daily average)

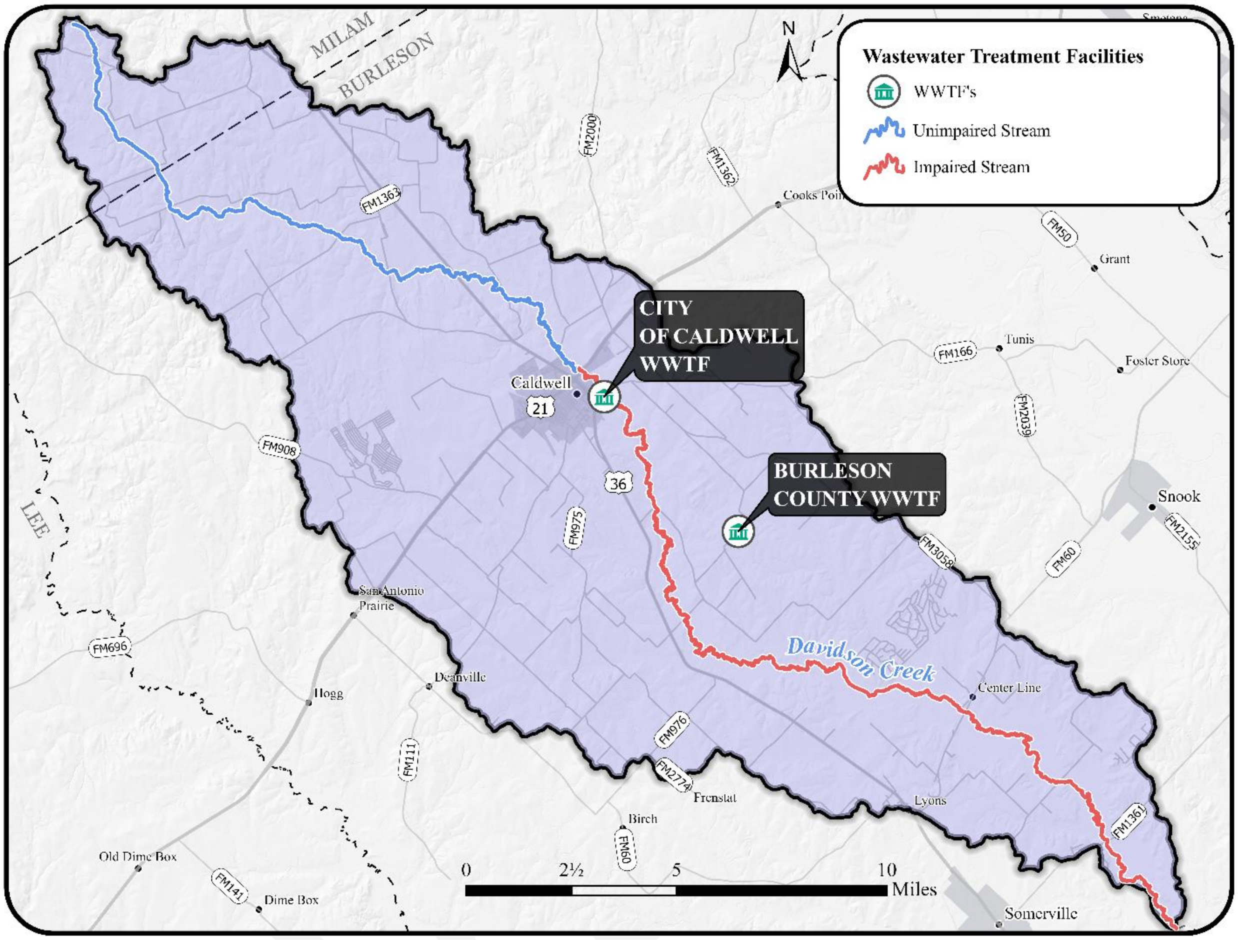

Figure 4- 3. Locations of active WWTFs in the Davidson Creek watershed.

Sanitary Sewer Overflow

Sanitary sewer systems collect and transport wastewater to WWTFs. When sewer lines lose functionality due to age, lack of maintenance, inappropriate connections, or overload during storm events, SSOs of raw sewage may occur. Inflow and infiltration (I&I) are typical causes of SSOs under wet weather conditions when stormwater enters the WWTF collection system. Blockages in the line could also exacerbate the I&I problem. Other causes, such as a collapsed sewer line, may occur under any condition.

SSOs are unauthorized discharges that should be addressed by the party responsible, either the TPDES permittee or the owner of the collection system that is connected to a permitted system. Other than self-reported SSO events, no compliance or pollutant loading data associated with SSOs are publicly available. Pollutant loads associated with individual SSO events are variable based on the amount and makeup of the discharge.

The TCEQ Region 9 office maintains a database of SSO data reported by municipalities in the area. These SSO data typically contain estimates of the total gallons spilled, the responsible entity, and a general location of the spill. Wastewater permit holders are required by TCEQ to report known overflows that occur in their system. According to the TCEQ, between December 2015 and March

2025, there was one SSO incident reported by the City of Caldwell WWTF (TCEQ, 2025d) (**Error! Reference source not found.**6).

Table 4- 6. Sanitary Sewer Overflow events from 2015-12-01 to 2025-03-01.

Facility	Date	Gallons	Cause
City of Caldwell	2021-11-19	200	Line blockage (non-grease)

Permitted Stormwater

While stormwater is considered a nonpoint source, it can be regulated if polluted runoff originates from a Municipal Separate Storm Sewer System (MS4) or if it is associated with industrial and/or construction activities.

MS4 permits refer to the permitting of municipal stormwater systems that are separate from sanitary sewer systems. Systems are broken down into "large" Phase I and "small" Phase II permits based on population. As of June 2025, records indicated there were no MS4s in the Davidson Creek watershed (TCEQ, 2025c). Based on the 2024 NLCD data, only a small fraction of the watershed was urbanized (8.43%). However, urban areas in the watershed may increasingly contribute to local stormwater pollution in their subwatersheds as populations grow and impervious surfaces increase.

TPDES General permits regulate stormwater discharges from Phase II urbanized areas, industrial facilities, and construction sites larger than one acre. Runoff from these developed and industrial areas can carry elevated levels of bacteria and nutrients, as it washes accumulated pollutants from roads, parking lots, buildings, parks, and other impervious surfaces. Stormwater best management practices (BMPs) can be implemented to minimize these impacts. These include structural and non-structural practices such as detention ponds, riparian buffers, pervious pavement, and low-impact development (LID) techniques. As of June 2025, records indicated there are eight active construction permits, one active concrete production permit, and one aggregate production permit in the watershed (TCEQ, 2025c).

Pet Waste

Pet waste, especially dogs waste, can contribute to bacteria loads in watersheds through runoff from lawns, parks, and other open spaces. This type of nonpoint source pollution is reduced when dog owners properly dispose of pet waste in a trash receptacle.

The American Veterinary Medical Association (AVMA) estimates that approximately 45.5 percent of U.S. households own dogs and of those homes there are around 1.5 dogs per household (AVMA, 2024). To estimate the number of dogs in the Davidson Creek watershed, the AVMA information can be applied to the number of households in the watershed (Table 4- 7).

Stakeholders recommended supplementing 2020 census data with the Burleson and Milam County 911 Address Database to estimate the number of households within the watershed (USCB, 2020; Personal Communication Central Texas Council of Governments GIS Manager, 9-3-2025; Personal Communication Burleson County 911 Addressing Coordinator, 9-2-2025). This brought the total number of households for both counties to 5,761 in the watershed (Table 4- 7). Additionally, during public planning meetings, many stakeholders brought up the issue of stray/feral dogs and cats in this watershed. While the total population of feral animals cannot be estimated using publicly available data, it's important to recognize this issue in future implementation efforts. In rural areas many pets spend most of their time outdoors, making proper waste disposal impractical more challenging.

Table 4- 7. Estimated dog populations in the Davidson Creek watershed.

Estimated Number of Households	Estimated Number of Dogs
5,761	3,932

Illegal Dumping

Improper waste or garbage disposal can also contribute to water quality issues. Areas that are frequently littered tend to become dumping areas for others as well. Although most items dumped may not in themselves be major sources of bacteria and nutrient pollution, items like animal carcasses and household chemical containers can contribute additional bacteria, nutrients, and hazardous waste to creeks and rivers. Human and animal health concerns due to injury may also arise from illegal dumping.

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