

SECTION 4
GROUNDWATER

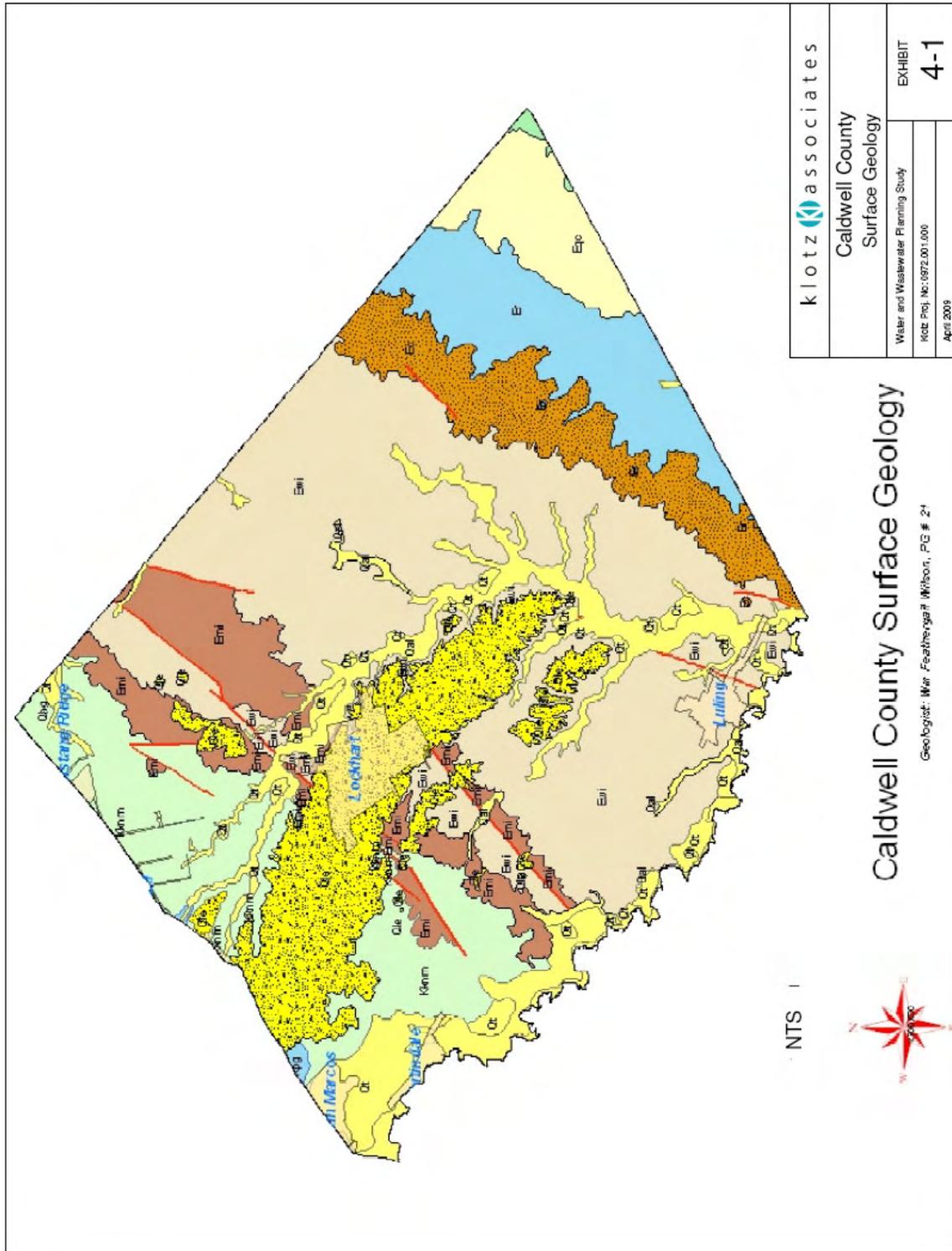
4.1 Groundwater Sources

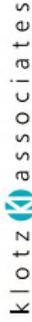
Groundwater in Caldwell County remains the primary source of potable water. Most water utilities have wells that pump water from local aquifers. Groundwater in the region is produced by aquifer formations that include the Leona, Carrizo, and Wilcox Aquifers. The formations vary from the Cretaceous to Quaternary time period as listed in *Table 4-1*. The table and *Exhibit 4-1* were provided by Feathergail Wilson, Professional Geologist. Mr. Wilson also provided valuable details and information regarding the groundwater resources in the region.

TABLE 4-1				
Caldwell County Stratigraphy				
PERIOD	EPOCH	FORMATION/GROUP	MAP SYMBOL	LITHOLOGY
Quaternary	Holocene	Undesignated	Qal, Qt	alluvium sand, silt, clay
	Pleistocene	Leona	Qle	gravel
Paleogene	Eocene	Weches	Ew	glaucconitic fossiliferous clay
		Queen City	Eqc	sand and clay
		Reklaw	Er	clay and sand
		Carrizo	Ec	sand
		Wilcox	Ewi	sand and clay
	Paleocene	Midway	Emi	clay
Cretaceous	Late	Navarro	Kknm	expanding clay
		Pecan Gap	kpg	chalk

4.1.1 Leona Formation

The Leona Formation is an alluvial outcrop formation that extends from Kyle to about 10 miles southeast of Lockhart. It is primarily gravel stratified with some sands, clay and silt. “In some locations the gravel is so well cemented that the end result is a hard compact conglomerate resembling concrete.” (Follet, 1966) Lockhart’s water supply was completely provided for by the Leona Formation



	
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before 1953. Deterioration in water quality from the Leona Formation has made this source of water unsuitable for potable water use unless the water is treated. The extensive use of chemicals in agricultural production is a likely reason for high nitrate levels in the Leona Formation. The water from this shallow formation is used primarily used for irrigation.

The Leona aquifer has an approximate thickness of about 40 feet and can yield small to large quantities of water. It has a gradient that averages 10 feet per mile. The hydraulic conductivity, which describes the movement of water through pores spaces, is expected to range from 10^0 to 10^{-7} centimeters per second (cm/sec). Flow is generally to the southeast and is believed to recharge the underlying Wilcox.

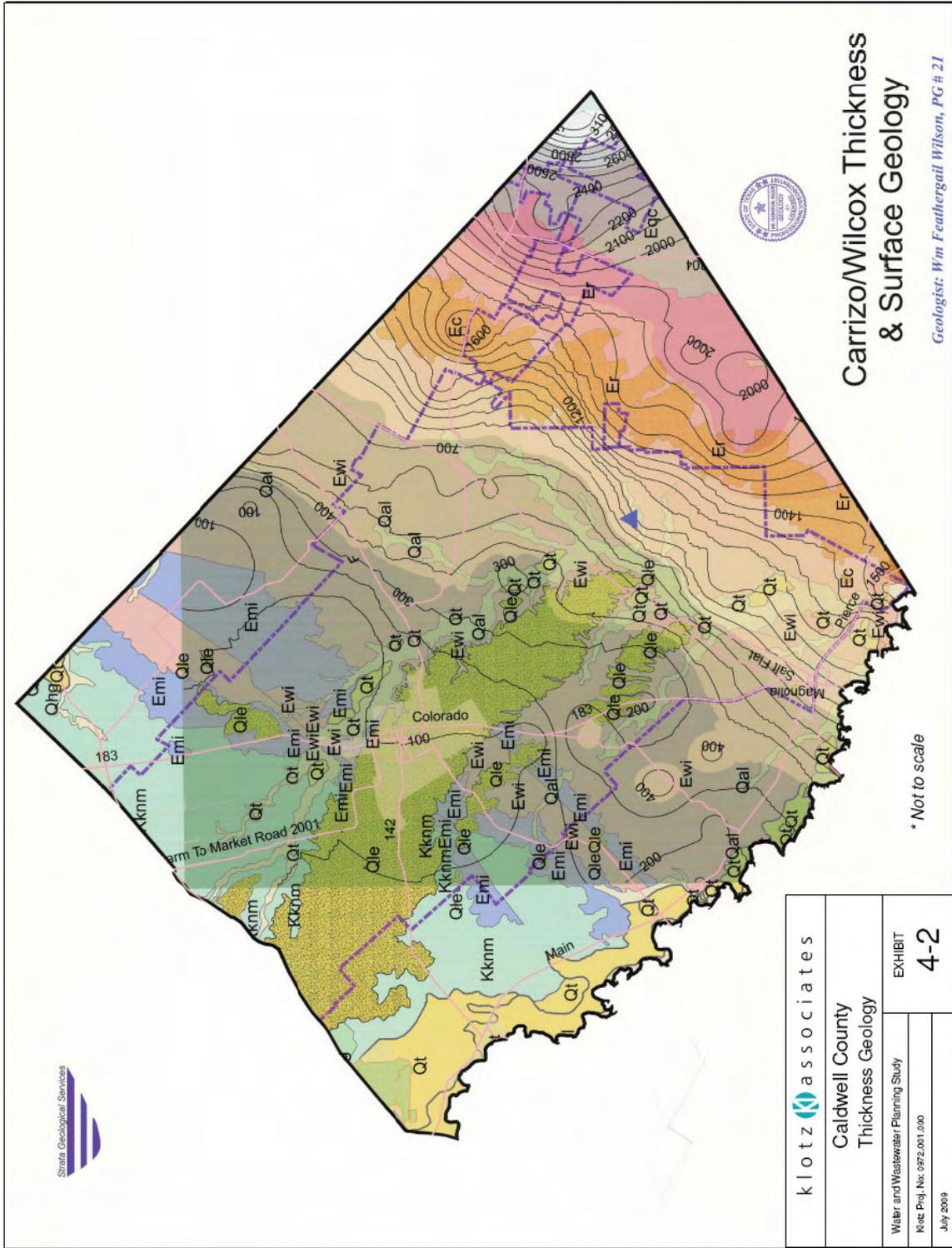
4.1.2 Wilcox Formation

The Wilcox Formation is another water bearing unit in Caldwell County. The formation outcrops in the central part of the county, as shown in the Caldwell County Surface Geology Map, *Exhibit 4-1*. The Wilcox Group, from youngest to oldest formations, includes the Hooper, Simsboro, and Calvert Bluff. The geological label for the Wilcox outcrop label, Ewi, is shown in *Table 4-1*.

The outcrop width range is approximately 8 to 10 miles. It then slopes steeply downward at about 150 feet per mile. The thickness of the formation increases as the depth increases and is mostly composed of sand and clay. Maximum thickness in the study area is approximately 2,000 feet and occurs in the southeastern portion of the county as shown in *Exhibit 4-2*. Fresh to saline water can be found at depths of 50 feet to 2,800 feet in the southeastern area.

4.1.3 Carrizo Formation

The overlying formation on the Wilcox Formation is the Carrizo Formation. In Caldwell County, the Carrizo Formation is generally white, coarser-grained and



loose sand. The sand tends to be free of finer clays. The Carrizo outcrop is located in the southeastern part of the county. The cement-like characteristics of the Carrizo at the outcrop cause a rise in elevation. The stratum of the Carrizo dips downward from the outcrop at about 140 feet per mile with a general thickness of about 400 feet. The overlying sands have a higher hydraulic conductivity than the Wilcox. In some parts of the county a clay liner acts as a seal to separate the two water-bearing units.

4.1.4 Recklaw Formation

The Recklaw Formation overlays the Carrizo and crops out at the southeast corner of the county. It is about 2 to 3 miles wide and with a maximum thickness at approximately 400 feet. It dips downward at about 140 feet every mile. Sand and silt define the lower portion of the formation and clay with thin beds of sandstone classifies the upper portion.

4.1.5 Queen City Sands Outcrop

The Queen City Sands outcrop is approximately 3 to 4 miles in width. The formation dips southeast at about 120 feet per mile. The thickness increases to approximately 500 feet. The formation includes fine to medium sands and clay.

The water in this formation was reported to have total dissolved solids that ranged from about 500 parts per million (ppm) near Bastrop and Fayette Counties to 3,000 ppm near the Gonzales county line.

4.2 Groundwater Quality

The water quality of the region varies depending on the aquifer and the depth at which it is found. The chemical constituents in ground water originate primarily from the soil and rocks it seeps through. As depth increases so does the chemical

and sodium content while hardness decreases. The suitability of the water depends largely on the chemical quality.

Chemical constituents found in water are compared to water quality standards developed by states. The state standards have to be approved by the Environmental Protection Agency (EPA) for implementation. Current drinking water standards for Texas are listed in the Texas Administrative Code (TAC) 209 Subchapter F. A list of the water quality standards has been placed in **Appendix C**. Various requirements have been imposed to regulate maximum contaminant levels in drinking water. Some of the most common contaminants include total dissolved solids (TDS), chloride (Cl), fluoride (F), iron (Fe), manganese (Mn), nitrate (NO₃), and sulfate (SO₄).

A Water Quality Publication Report prepared by the TWDB lists wells and the water quality testing results in Caldwell County. A page of the report has been included in **Appendix D** for review. The report list the constituents found and their respective contaminant levels.

Due to the high quality of groundwater in the Wilcox-Carrizo formation, it is the most desired source for developing wells. TDS in the southeast and southwest corner of the county are less than 500 ppm. However, TDS increase significantly in between these corners. Well monitoring and observations indicate an arch in the formation which degrades the water quality in this area.

There are few areas in the Wilcox-Carrizo formation near Caldwell County that exceed the sulfate and chloride drinking water standards of 300 ppm. In the southeast corner of the county sulfate was found to exceed 300 ppm in areas where total dissolved solids were under 1000 ppm. Chloride constituents were not reported to exceed the standards.

4.3 Groundwater Conservation Districts

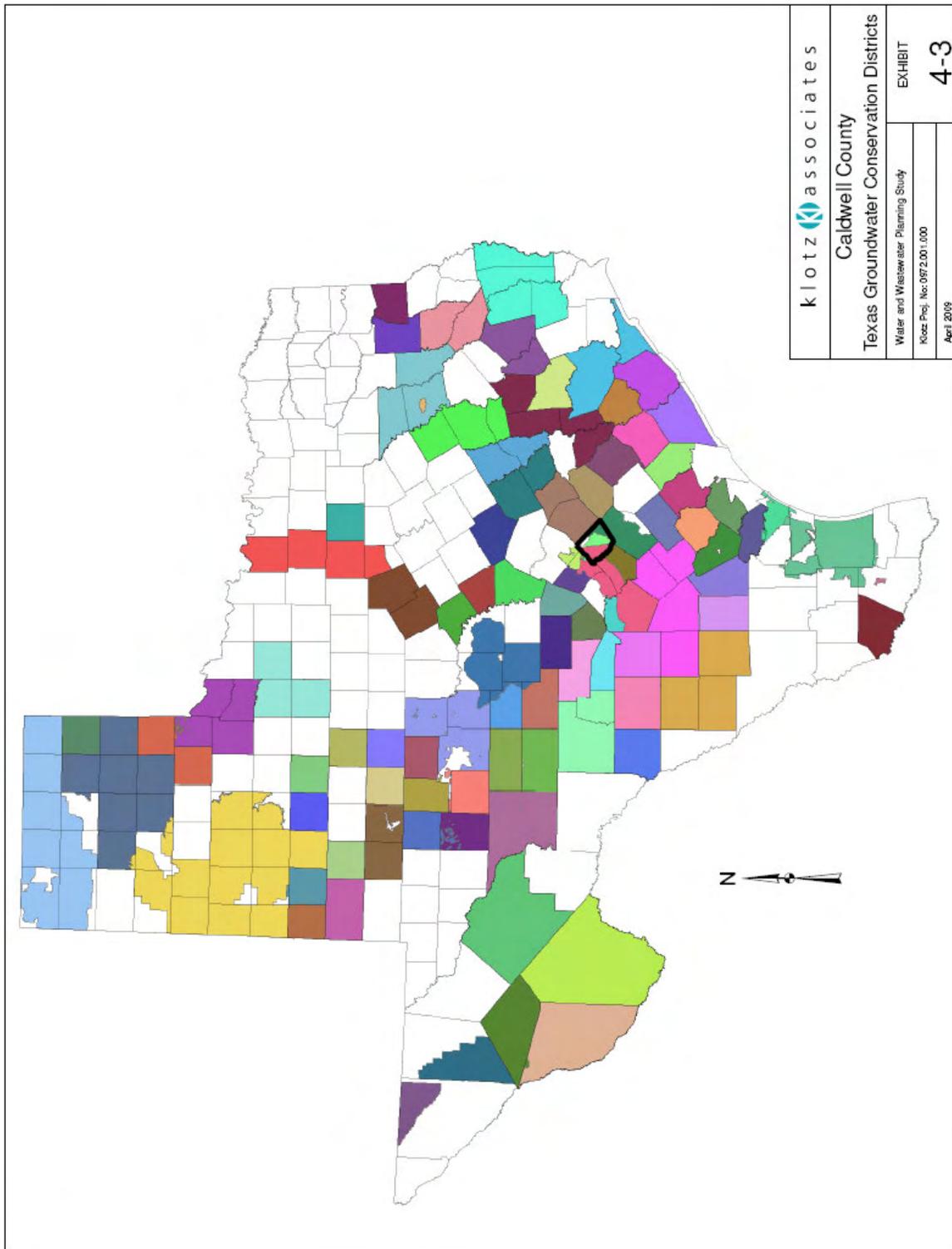
Groundwater conservation districts (GCD) were first created by the Texas Legislature in 1949. They are charged with developing and implementing comprehensive management plans that conserve and protect groundwater resources. *Exhibit 4-3* illustrates the GCD that have been established in Texas. The districts plan for the future, work to collect data, educate consumers about water conservation, and prevent waste of water. A board of directors oversees the districts with guidance from the TWDB.

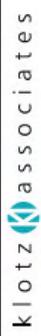
In Caldwell County the management districts are the Plum Creek Conservation District (PCCD), the Gonzales County Underground Water Conservation District (GCUWCD), and the Edwards Aquifer Authority (EAA). These boundaries of these districts are illustrated in *Exhibit 4-4*. The PCCD and the GCUWCD currently have some overlapping areas that have created uncertainty about the rules that apply for the land owners in the overlapping area.

Rules for developing wells and issuing permits by the PCCD and the GCUWCD are similar at times but generally defined and managed differently. In general, the approach to manage groundwater are established in Management Plans and Rules established by each district.

4.3.1 Plum Creek Conservation District

PCCD is currently working with other districts within groundwater management area (GMA) 13 develop and adopt a desired future condition (DFC) for the aquifers within the management area. Once adopted, the DFC of the aquifers will establish quantified conditions of available groundwater resources based on hydrological studies and modeling. Due to the current status of the DFC not being established, PCCD has potentially issued more permits for groundwater than is currently available. Current laws require GCD to permit to the extent possible of



	
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the managed available groundwater. The groundwater permits that have been approved by PCCD are shown in *Table 4-2*. In addition to the listed permits in Table 4-2, PCCD received an application from the Plum Creek Group (prepared by Murfee Engineering Company) requesting 15,000 acre feet per year from the 4,384 acres that PCCD annexed on March 25, 2008 in the Southeastern part of Caldwell County.

TABLE 4-2				
Plum Creek Conservation District Groundwater Permits				
Type of Permit	Name	Number of Wells	Quantity (acft/year)	Date Permitted
Agriculture- Irrigation Permits	Joe Smith	2	400	2/21/06
Agriculture- Irrigation Permits	Brenda Horton	1	43	6/21/07
Agriculture- Irrigation Permits	Ben Tidwell	1	168	12/18/07
Agriculture- Irrigation Permits	Giacomel	1	22	9/12/07
Agriculture- Irrigation Permits	Joe Wells	1	31	6/2004
Agriculture- Irrigation Permits	Martin Pratka	1	43	9/12/06
Agriculture- Irrigation Permits	A.E. Nicholson	4	4,000	2/17/09
Public Supply Permits	City of Lockhart	7	5,475	7/15/08
Public Supply Permits	Dale WSC	1	269	6/17/08
Public Supply Permits	Polonia WSC	5	2,283	6/17/08
*Public Supply Permits	Polonia WSC	1	1,343	-
*Public Supply Permits	Hazelette	1	200	-
Public Supply Permits	Luling	4	1,612	8/19/08
Public Supply Permits	Aqua Water	3	625	11/20/07
Total			16,514	

PCCD has established a Groundwater Management Plan & Protection Rules (adopted December 16, 2003) in effort to protect, preserve, enhance, and insure the beneficial resources within its jurisdiction. A Groundwater Management Plan, which is a separate document, has also been prepared and was adopted in 2007 to

support the efforts of PCCD. The district rules attempt to regulate groundwater by means of well spacing based on production rates. **Table 4-3** provides a list of the spacing production provisions.

TABLE 4-3 PCCD Classification, Spacing, and Production Provisions		
Actual Pumping Capacity of Proposed Well (GPM)	Classification of Proposed Well	Minimum Distance from Newest Existing Well on Authorized Well Site
Less than 25 GPM	Domestic	None
25 - 100	A	600 Feet
101 - 250	B	1,500 Feet
251 - 500	C	3,000 Feet
501 - 1,000	D	6,000 Feet
1,001 GPM and over	E	12,000 Feet

Note:

Wells drilled after December 31, 2003 shall either perform a hydrologic study approved by the District designed to demonstrate the impact of the permitted well on wells located within a one-half mile radius, or comply with the District's spacing requirements. Wells are classified according to actual pumping capacity in gallons per minute (GPM) under normal operating conditions.

4.3.2 Gonzales County Underground Water Conservation District

The GCUWCD was created on an order of the Texas Natural Resource conservation Commission number 101692-Do4 and is charged specifically with managing the Sparta, Queen City, and the Carrizo-Wilcox aquifers in Gonzales County. The goals of the Management Plan and Rules established by the district are to conserve, preserve, protect and prevent waste for the future of Gonzales County.

The goals of the district are carried out through the GCUWCD Rules and Management Plan. The plan defines spacing requirements and pumping production limitation to manage the groundwater. Although the DFC has not been

developed, a drawdown of 100 feet in the Carrizo will curtail pumping. A list of tables and rules from the PCCD and the GCUWCD has been included in **Appendix E**.

The GCUWCD is also working with other districts in GMA 13 to develop DFC which will revise the current Management Plan to reflect the managed available groundwater (MAG). The GCUWCD is in the same situation as PCCD with possible over permitting of the Carrizo-Wilcox Aquifer.

In February 2009, the GCUWCD stated that the only permitted public transporter was the Schertz-Seguin Local Government Corporation (SSLGC) for 12,900 acre-feet per year. The length of the transport permit is 30 years. The SSLGC supplies water to the cities of Schertz and Seguin. Permits under review were submitted by CRWA and SAWS. Aqua WSC also has wells that were established before the creation of the GCUWCD and have been grandfathered on the east side of Gonzales County. Those existing wells remain operational under the grandfather provision and do not need to adhere to the current rules of the district.