SECTION 2 - CHAPTER 3
GEOGRAPHIC, CLIMATIC ENVIRONMENTAL AND NATURAL RESOURCE PROFILE

GENERAL

The Meramec Region is an eight-county, 5,133-square-mile area, located in the southeast central portion of the state. The smallest county is Maries, with 528 square miles while Washington County, the largest, has 760 square miles. The location of the region in the state is indicated in Figure 3-1. The Meramec Region is bound on the north by Franklin, Warren, Montgomery and Callaway counties; on the west by Miller, Cole, Camden, Laclede, and Texas counties; on the south by Shannon, Reynolds, and Iron counties; and on the east by St. Francois and Jefferson counties. The eight counties of the Meramec Region are Crawford, Dent, Gasconade, Maries, Osage, Phelps, Pulaski and Washington. The region has an average population density of 35.5 persons per mile. Maries County has the lowest population density with 16.9 people per square miles, while Pulaski has the greatest population density at 75.3 persons per square mile. The size and population density of each county within the region is indicated in Table 3-1.

CITIES

There are 35 incorporated places within the Meramec Region, two of which lie partially outside the region. They include: Bourbon, Cuba, Leasburg, Steelville, Sullivan and West Sullivan in Crawford County; Salem in Dent County; Bland, Gasconade, Hermann, Owensville, Morrison and Rosebud in Gasconade County; Belle and Vienna in Maries County; Argyle, Chamois, Freeburg, Linn, Meta and Westphalia in Osage County; Doolittle, Edgar Springs, Newburg, Rolla and St. James in Phelps County; Dixon, St. Robert, Richland, Crocker and Waynesville in Pulaski County; and Caledonia, Irondale, Mineral Point and Potosi in Washington County. The incorporated places of the region are listed by county in Table 3-2.

HISTORY

Crawford County — Crawford County was organized on Jan. 23, 1829, and was named after William H. Crawford of Georgia, who was a candidate for the presidency in 1824. Although the early records of the county court have been lost, it is believed that William Montgomery, Barney Lowe and John Duncan were the first justices of the court, commissioned on the same day the act organizing the county was approved.

The first courthouse, a two-story brick and stone structure, was ordered to be built in 1857 and was used until 1873, when it burned.

The outbreak of the civil war caused considerable excitement in the county, and lines between those favoring the Union and the Confederacy were sharply drawn. A meeting was held at Cuba by some of those favoring the Confederacy at which resolutions were passed in support of the Confederacy. The only dissenting voice at that meeting was that of E.W. Pinnell. Pinnell was the only one of 60 men present at the meeting to later enter the regular service of the Confederate States.

The first settler on the town site of Steelville, the county seat, was William Britton, who arrived in 1833. He was responsible for building a small log house and a grist mill. James Steel, for whom the town was later named, was the next settler in the area. Having purchased 40 acres of land from the government, he sold it to the county court for $50 in 1835. By this time, he had opened a small store, and a small settlement had sprung up in the area. The deed was recorded in December 1835 and the town was platted and lots sold soon afterward.

Other town sites in the county included Sullivan, Cuba, Leasburg, Bourbon and West Sullivan. Cuba was laid out and surveyed in December 1857 by M.W. Trask and W.H. Ferguson. At the time the town was surveyed, there were no houses within half a mile of the town site.

Leasburg is situated on the Burlington Northern Railroad approximately 82 miles west of St. Louis. The town was originally named Harrison Station for William Harrison. The name was changed in 1859 in honor of Samuel Lea, who built the first residence on the town site. Lea was also the first merchant to open a general store in the area and became the first postmaster.

Bourbon is also situated on the Burlington Northern Railroad about 75 miles west of St. Louis. The town was named for an old post office, which had existed in the vicinity some years before the town was founded. The post office had been named after bourbon whiskey, which was a new product being introduced in the area at that time.

The City of Sullivan is located on Old Highway 66 and the St. Louis and San Francisco Railroad, 68 miles southwest of St. Louis. It has long been known as the “Gateway to the Ozarks.” Sullivan was founded in the early 1800's by Stephen Sullivan who, with his wife, accompanied Daniel Boone on his return trip from Kentucky to get settlers to populate the territory around the Meramec River. When the railroad reached the small settlement in 1858, a town was laid out that the railroad company named

“Sullivan.” Only part of the incorporated area of Sullivan lies within the boundaries of the Meramec Region. The balance is in Franklin County.

Dent County — Organized on Feb. 10, 1851, Dent County was named in honor of Lewis Dent, who settled in the county in 1835 and was its first representative, elected in 1862. Dent County was organized from territory once belonging to Crawford and Shannon counties. The first county officers appointed were Justices G.C. Breckinridge, Samuel Hyer Jr. and Jotham Clark, with Joseph Milsaps as sheriff, and David Henderson as clerk.

It was not until 1853 that the present site of the county seat was designated in Salem. Previously the court meetings were held either at Mr. Bressie's or Mr. Wingfield's house near what later became Salem on Spring Creek. Salem was established in 1853, and a brick courthouse erected shortly thereafter. Perhaps when the founders named the town, they had in mind the ancient biblical city of Salem in Canaan, later identified with Jerusalem.

In 1855, the county was disorganized in the state legislature, and three days later reorganized under "An Act to Reorganize the County of Dent," approved on Dec. 4, 1855. In the process of reorganization, some things were done which were not technically legal, and it was found necessary to pass "An Act to Amend an Act Entitled 'An Act to Reorganize the County of Dent.'" The second act declared the proceedings valid and decided on one representative for the county. The county court business proceeded as usual until the Civil War closed operations in 1861, when the last term was held. The courthouse was used as a military headquarters until 1864. In October of that year, while federal troops were away from the area, two Dent County citizens—Simeon Richardson and James Jamison—burned the courthouse and jail. Because of the fire, the court was forced to meet in a store belonging to Judge W.P. Williams, when the court reconvened after the war.

It is uncertain whether remains of mounds, earthworks, pottery and other artifacts found in Dent County were left by the pre-historic people known as Mound Builders or by earlier races of Native Americans. It is known, however, that the Native Americans who roamed the region attributed these artifacts to people who had lived long before their time.

The Native Americans who followed these ancient people in the occupation of Dent County's territory were, it may be supposed, the same as those who wandered over Missouri and the Ozark uplands generally. Early records indicate that they made little trouble for the early settlers in the area. As late as 1838, Native Americans were passing through the county on the White River Trace.

There was no town in the county until Salem was founded as the county seat. The site was chosen by a commission appointed for the purpose of locating the county seat. The town grew to a population of between 600 and 800 people by the opening of the Civil War. After the close of the war, Salem recuperated slowly. The construction of the railway and the opening of the mines during 1872 caused a boom growth. By the time of the panic of 1873, the population had reached approximately 1,100.

Gasconade County — Organized in November 1820, Gasconade County was named for the Gasconade River. Gasconade City was elected as the first seat of the justice for the county. Gasconade City remained the county seat until 1825 when, because of a flood, it was deemed advisable to move the seat to Bartonville. Bartonville was located on the Gasconade River in what is now Osage County and remained the county seat until it, too, was flooded. The county seat was then moved a second time to Mount Sterling, located in a place known as Shockley's Bluff or Starky's Bluff. The county seat remained at Mount Sterling until 1842 when an election was held to determine if the seat should be moved to Hermann. Hermann had promised to render substantial financial assistance to the county if the county seat would be located there. As a result of the election held on March 14, 1842, the county seat moved to Hermann.

The history of the settlement of the city of Hermann is of particular interest. The selection of the location for the town site was originally made under the auspices of the Deutsche Ansiedlung Geschellschaft (German Settlement Society) of Philadelphia. In March 1837, the society sent a representative through Indiana, Michigan, Illinois, Wisconsin and Missouri to look for a suitable place for a proposed German settlement. By Oct. 5, 1837, the president of the society announced to the membership that a large piece of land had been purchased in Missouri. At the same meeting during which the announcement was made, the society resolved that the name of the new town would be Hermann. Mr. Bayer, who had investigated the town site, was made general agent of the society and agreed to accept the 80 acres of land in the new settlement and a salary of $600 per year. Every member of the society arriving in the new town was to have the privilege of choosing one lot for himself.

The first storekeeper in Hermann was H.W.D. Wiedersprecher. The railroad was built through the town in 1854, and from that time until the Civil War, the town prospered.

Also located in Gasconade County were the cities of Bland and Owensville. Located in the southwest portion of the county, Bland was named after Congressman R.P. Bland. A trading post was founded near a spring where William Haynes was the first settler in the Bland area in the 1850's. In 1864, General Price's army robbed the stores, took the livestock and destroyed what could not be taken. In 1900, the railroad was being built and the first station was a boxcar. In 1902 a station was built as well as the

Bland Commercial Bank. In 1904, the Bland Courier's first newspaper edition was published and was printed twice weekly with 500 subscribers.

Owensville was laid out in 1886 by the Owensville Improvement Company, consisting of Robert Robyn, Dr. G. Ettmueller, Michael Jordan, Dr. M.W. Hoge and George H. Buschmann. The first three were citizens of Hermann, while the other two founders were from the vicinity of Owensville. The company bought 280 acres of land and platted the town. According to legend, the town was named as a result of a game of horseshoes between store owner Francis Owen and blacksmith Edward Luster, with the understanding that the settlement would be named after the winner. Although Luster won the game, legend has that he decided to name the settlement after Owen because Owensville sounded better than Lusterville. Other Gasconade communities include Morrison, Rosebud and Gasconade.

Maries County—By the beginning of the 1850s, the population of the area now embraced by Maries County had grown large enough that agitation began for the formation of a separate county. A bill for the organization of the county was introduced into the legislature in December 1854 and was approved by the governor on March 2, 1855. The county was named for two streams, the Marie and the Little Marie.

When originally formed, Maries County extended farther south than it does at present, taking in the city of Rolla and barely missing Newburg, both now in Phelps County. This situation persisted only a short time, since Phelps County was formed shortly afterward. Maries County lost some territory to Phelps County, but gained almost as much from Crawford at the same time.

On July 20, 1855, title to the 70 acres of land on which Vienna, the county seat, now stands was acquired from William Shockley, who donated the tract in consideration of the county seat being located there. The construction of the first courthouse was completed, and the building occupied in October of 1856. The building was completely destroyed by fire on Nov. 6, 1868, and all court records were lost or destroyed. Work on a new building began in 1869 and was completed in 1870. This second courthouse was razed in 1939 to make way for the construction of the present courthouse. The first land entry within the present limits of Maries County was made on Jan. 11, 1826, at which time Charles Lane entered an 80-acre tract. In April of the following year, he entered the adjacent 80 acre tract giving him 160 acres of land known for a hundred years thereafter as the Old Pay Down Mills. Mill sites were in great demand by the early settlers, and Lane probably had such a use for the land in mind when he acquired it.

The trace known as Boone's Lick Road was the site of the first three post offices to be established in the county. The first of these was established on the farm of Lunsford L. Lane in Lane's Ford. Mr. Lane was the postmaster. The second post office, also located on the road, was established in July 1842, in William Hawkins' store and lasted until June 1864. The third post office, located near the crossing of the Boone's Lick and Springfield roads, was established in February 1851 and was located in the home of William Pinnell.

The first school district was organized in Maries County in 1843. Its boundaries were indefinitely described, but it included the northwestern portion of the present Maries County, and the southwestern part of the present Osage County. Davis Woody was the first president of the board of education of the new district.

The first newspaper within the area, 100 miles south of Jefferson City, made its appearance in Vienna on Oct. 20, 1858. It was called the *Central Missourian* and carried the name of C.F. Walker as editor and Henry Lick as publisher. The subscription rate was one dollar per year.

Osage County — The first settlers came into Osage County in the early 1800s and were predominantly French and second-generation Americans from the East. Starting in 1835, there was a large influx of German settlers, which continued for several decades. The county was formally organized in January 1841. It was named for the Osage River. For the first two years after the county's formal organization, county business, to include court business, was conducted in various homes throughout the county. In 1843, the county court requested bids to build a courthouse in the county seat of Linn. Completed in 1844, this building served the county until 1874 when it was sold to make way for a new courthouse. The new courthouse was damaged by fire in 1880, and then burned to the ground in 1922. In 1923, the building, which still serves as the county courthouse, was constructed along Route 50 in Linn.

The early economy of the area was based almost entirely upon agriculture. In 1898, exports from Osage County included cattle, hogs, wheat, corn, flour, sheep, clover seed, wine, poultry, eggs, butter, cross ties, hides and furs. The county is a part of the steep, hilly and rocky Missouri Ozarks and the soil is not conducive to crop production, thus, agriculture has always been strongest in livestock production. Agriculture in the county has always been primarily at the subsistence level. As agriculture became more and more mechanized following WWI, the economic viability of the small subsistence farm dwindled, resulting in great out-migration from the farms. Although the existence of four navigable rivers in or on the borders of the county were historically an asset for transportation of exports and imports, the location of the county prohibits it from becoming a major transportation or trade center. The only natural resources present have been timber and fire clay.

Phelps County — Phelps County was created by the legislature on November 13, 1857, from territory originally belonging to Crawford, Pulaski and Maries counties. The county was named for John Phelps of Green County, who was governor from 1877 to 1881. The County Seat Locating Commission designated the area now known as Rolla to be the county seat. When the locating commission made its report, considerable protest was voiced concerning the choice of sites. Approximately 600 citizens of the county signed a petition of protest, citing the fact that only two of the three commission members had met to consider the possible sites for the county seat. The matter went first to the Circuit Court and then to the Supreme Court. Before the high court could make a decision, however, the legislature took action on Jan. 14, 1860, confirming the location of the county seat in Rolla. Smarting under a considerable amount of criticism concerning the matter, all members of the county court resigned during April 1858, but later withdrew their resignations.

The town of Rolla did not exist as of Nov. 13, 1857, when the county was created. Only the J. Stever office and John Webber's home were located in the area. Early court business included the location and opening of roads from the county seat to various places within the state, including: St. Louis, Springfield, Jefferson City, Lake Spring and Salem. It is in this last road order, dated in July 1858 that the use of the name Rolla first appears in the court records. The name was used earlier, in May 1858, in a deed of railroad land to the county.

On April 26, 1859, the county court ordered the 50 acres donated by Mr. Bishop for the site of the county seat to be surveyed. The survey was conducted by A.E. Buchanan, a young railroad surveyor. Buchanan delivered his plat to the county court on May 31, 1859.

On Feb. 9, 1861, the day of Rolla's first town council meeting, a county-wide meeting was held to determine whether to join the Confederacy in secession. The consensus at that time was not to take any action until there were further developments. Further developments came in April of that year when Fort Sumpter was fired upon, and county residents decided to support the South. The May 10 Circuit Court session saw a heated debate of secession, which broke up the court. Circuit Court Judge James McBride departed to assume command as a Confederate general under Sterling Price. Outside the courthouse, a group of men drew down the United States Flag and raised a Confederate flag, which had been sewn by the women of Rolla. The group then moved to the newspaper office of Charles Walder, a Union supporter and editor of the *Rolla Express*, and forced him to close his shop. Southern sympathizers patrolled the town day and night, often ordering Union sympathizers to leave town. On June 14 of that year, General Franz Sigel arrived by train with his 3rd Missouri Infantry and took over the town. From that day until the close of the war, Rolla was in Union hands. The 13th Illinois Infantry Regiment, under Colonel John B. Wyman, was brought in to guard Rolla and the Pacific Railroad's terminal. It was this

regiment that did the basic planning and building of Fort Wyman, although other regiments undertook the task of finishing it. President Lincoln's personal order was that Rolla should be held at all costs. Being situated at the terminus of the railroad, military wagon trains went out from Rolla to all Union armies stationed southwest in Arkansas, Hartville and Springfield and northwest to the Linn Creek area, now known as the Lake of the Ozarks. After General Price's defeat at Pea Ridge in March 1862, several troops that were organized by Gov. Jackson returned home. Confederate sympathizers, unwilling to profess their loyalty and support to the Union after the battle, were treated harshly. One example is the shooting of former Presiding Justice Lewis F. Wright and four of his sons in 1864, after being taken from their homes for "questioning."
Other towns within the county included Newburg, incorporated in 1888, and St. James, incorporated in 1869. Arlington and Jerome were both incorporated in 1867, but neither is incorporated at this time. Doolittle, the last of Phelps County's towns to be formed, was incorporated on July 2, 1944. Other Phelps County communities include Edgar Springs that was incorporated during the 1970s.

Pulaski County—Pulaski County was organized in 1833. It was named for Revolutionary War General Polish Count Casimir Pulaski. The county was once roamed by Indians and French trappers, and is part of land ceded by the Osage Indians in 1808. Early settlers of the county were southern pioneers, drawn by the springs, woodlands, caves and Gasconade and Big Piney Rivers. The founders of the first settlement were Johnson, Cullen and Duffe, immigrants from Mississippi. They located near the Gasconade River at the "Nitre Cave," about five miles west of Waynesville. These gentlemen found a superior quality saltpeter and began to manufacture gun powder, selling it to trappers and hunters of the area. After the mysterious death of Mr. Cullen, Johnson and Duffe moved upriver to a large spring running into the Gasconade River. They built a large mill, later known as Bartlett Springs Mill.

On December 15, 1818, the Territorial Legislature created Pulaski County. The boundaries were not specified at that time, but were further defined in 1859. The first county court was held at the home of Jesse Ballew. In 1843, the Legislature passed an act to locate the county seat in Waynesville. A crude courthouse was built in early 1844. It was used until 1873, when a brick courthouse was built.

Waynesville was named for the Revolutionary War General "Mad" Anthony Wayne. The town was a stage stop on the St. Louis to Springfield Road, also called the "Old Wire Road," because it was the same route the telegraph traveled. As the Cherokee Indians were removed from Oklahoma in 1837 along the infamous "Trail of Tears," they camped in the area.

The towns of Dixon, Hancock, Crocker, Swedeborg and Richland all came into existence due to the Southern Pacific Railroad. The first railroad ran through south central Pulaski County, but was later abandoned due to rough terrain and routed to its current location.

In 1940, the U.S. Government announced plans to build a military base in Pulaski County. The Army acquired 65,000 acres. Construction began soon after, with an estimated 15,000 construction workers building the camp. The post was named Ft. Leonard Wood, and has since become the largest engineer training center in the U.S.

Washington County — Washington County was organized on Aug. 21, 1813, and was named after George Washington, the first president of the United States. The territory of which the county is composed was previously a part of Saint Genevieve County. Saint Genevieve County was one of the original five districts of which the Territory of Missouri had been composed at the time of its organization in 1812. As it was originally laid out, the county contained more territory than it does at the present time. By subsequent acts of the Legislature, the county had been reduced in size to its present limits.

The commissioners appointed to select a county seat site designated the village of Mine a Breton as the temporary seat of justice for the county. On Feb. 26, 1814, the permanent county seat was established on 40 acres of land donated by Moses Austin and 10 acres of land donated by John Rice Jones. The town was platted with a public square and 22 blocks with 147 lots. The new town was briefly names St. George, but was later renamed Potosi in honor of the Spanish silver mining town in Bolivia. Potosi and Mine a Breton remained separate villages until May 2, 1826, when they were incorporated under the single name of Potosi.

A large courthouse, suitable for a future state capital was planned for Potosi. It was to be financed by the sale of several of the city lots. In the Territorial Convention, Potosi lost in its bid for the site of the capital to Jefferson City and lost by only one vote to St. Charles as the temporary capital until the capitol building could be constructed in Jefferson City. Although Potosi was not successful in becoming the capital of the new state, the State Supreme Court met twice a year in Potosi between 1837 and 1843.

In May 1861, the citizens of Potosi went on record in favor of armed neutrality in the Civil War and organized a home guard to maintain their neutrality. Later that month, Union troops overran the town and arrested several southern sympathizers. In August, Colonel White and a Confederate Calvary detachment invaded Potosi, but left shortly thereafter. In September 1864, General Shelby and his troops invaded the town, only to be met by a resistance force that had barricaded itself in the courthouse.

The defenders were unsuccessful, and several of them were shot on the courthouse lawn following the engagement. After the Civil War, the surface lead deposits in the area were depleted, and barite mining became prominent.

GEOLOGIC HISTORY

There is a close relationship between the geological history of an area and its present natural resources of soils, minerals, topography and ground water. The quality, quantity and composition of the ground water, soils, minerals and topography are, to an extent, dependent upon historical events. For this reason, an understanding of the geologic past will help explain these features.

The oldest rocks in Missouri include those in Washington County, which were formed in the Precambrian age of geologic history (See Figure 3-2.) At one time, these rocks covered the entire state of Missouri. Ancient streams eroded these rocks to create a large plain, marked by occasional mountains and valleys. Later in geologic history, the entire state was covered by ancient seas into which streams deposited their sediments. This sediment was eventually hardened and became rock. Muds and clays became shale; sand became sandstone; gravel became conglomerate; and the remains of sea organisms contributed to the formation of limestone and dolomite. These sedimentary rocks were stratified, or formed in horizontal layers, the oldest layers at the bottom and the most recently deposited layers at the top. Later in geologic history, many of these sedimentary layers were uplifted by tremendous forces within the earth. The topography of the region is a result of the uneven uplifting or arching of the bedrock and the erosion and weathering of the various types of rocks exposed to the atmosphere.

As a result of the repeated uplifts and eroding, the topography of the region is marked by hills, deep valleys and plateaus. Much of the younger layers of rocks have been eroded away exposing the older rock formation. Springs and caves are common in the carbonate rocks of the region. Springs tend to form where solution has enlarged channels along bedding planes of the layered rocks. If underground channels are large, caves result. Where roofs of caves collapse, sinkholes are formed.

TOPOGRAPHY

Topography in the Meramec Region ranges from broad ridges and gentle slopes to steep slopes bluffs with corresponding variations in elevation. Generally, the topography of the Meramec Region slopes from the Salem Plateau toward the Missouri River. Figures 3-3 through 3-8 illustrate the generalized

topography of each county within the region. The following is a generalized topographic description of each county.

Crawford — Crawford County is divided by a ridge between the Bourbeuse Watershed to the north and the Meramec Watershed to the south. Interstate Highway 44 runs along this ridge. The Bourbeuse Watershed is characterized by gently rolling hills, with only a few steep slopes in the area. Most of Crawford County lies in the Meramec Basin. This area has rugged terrain with steep sloping hills and narrow valleys. The maximum relief in the county is approximately 800 feet, with the lowest point at the northeast corner of the county, and the highest point in the southeast corner.

Dent — Dent County is located principally on a plateau between the Meramec Watershed to the north and the Current River Watershed to the south. The plateau is centered around the City of Salem with a gently rolling topography. To the east of Salem, the terrain becomes more rugged, with steep, sloping hills. The Current River Watershed area is characterized by very rough terrain and extremely steep, sloping valleys. The maximum relief is about 500 feet, with the high point on a ridge south of Salem, and the low points near the north and south borders of the county.

Gasconade — The topography in Gasconade County can be divided into two areas: the area to the south within the Bourbeuse Watershed; and the area to the north, which drains into the Gasconade and Missouri rivers. In the Bourbeuse Watershed, the topography is fairly gentle with rolling hills. North of Highway 28 the topography becomes rough with steep sided valleys and narrow ridges. The maximum relief in the county is approximately 500 feet, with the highest area being at the north edge of the Bourbeuse River Valley, and the lowest at the Missouri River.

Maries — Maries County falls into two major topographic areas. The topography in the eastern portion of the county is typical of the Bourbeuse Watershed, with gently rolling hills and prairie-like terrain. West of the Bourbeuse Watershed the terrain grows rough and hilly. The most rugged terrain is in the western portion of the county in the Maries River Watershed. The maximum relief in the county is approximately 500 feet.

Osage — The topography of Osage County is nearly uniform, consisting of narrow ridges and steep sided valleys. Elevations rise from an average of about 600 feet along the stream valleys to near 1000 feet along the ridge crests. Generally, the land in the county slopes very gradually towards the Osage and Missouri Rivers.

Phelps — The topography in Phelps County east of Rolla is generally rolling hills with steeper hills near the Meramec River. West of Rolla, the terrain is considerably rougher with steep, sloping valleys. In the southern portion of the county, the topography flattens to form a small platform around Edgar Springs. The maximum relief in the county is approximately 500 feet.

Pulaski—Pulaski County is located primarily in the East Osage River Watershed. The basin lies entirely within the Salem Plateau section of the Ozark Plateau. Karst features such as sinkholes, springs and caves are locally prominent within the Salem Plateau. The topography is characterized by steep hills and deep valleys. Headwaters of the Gasconade River are near Waynesville.

Washington — The topography of Washington County is divided by a line coincident with Highway 21. The topography west of Highway 21 is very hilly. The ridges in this area are sharp and the hills are steep sloping. East of Highway 21, the topography is gentle with broad valleys and rounded ridges. The maximum relief in the county is approximately 700 feet.

SOILS

Soil is the thin covering of the earth's surface that is capable of supporting plant life. The physical and chemical properties of soils are due to the integrated effects of climate, parent materials, relief, time and biological activity. Soils are composed of weathered rock materials, mineral, organic matter, water and air in varying proportions.

Where man's activities are associated with land, the nature of soils often influences them either favorably or adversely. Soils determine, in part, the productiveness of the land. Soils and soil material affect the homeowner as well as the engineer in his designs for construction of the many forms of urban development.

Figure 3-9 graphically displays the major soils of the Meramec Region. The map contains limitations relative to its use and the interpretation of the information contained on it. Only a soil map developed by a detailed soil survey can provide the near precise information needed by those persons who desire specific knowledge pertaining to soils and their anticipated behavior under certain uses or conditions. However, in the absence of a detailed soil survey for the Meramec Region, the generalized soil map does provide a graphic description of the general range of soils that exist in the region.

The user must also keep in mind that any particular soil has a range in its characteristics. The data obtained from research in the laboratory and interpretive information developed from such data is based on the central or dominant concept of the range of characteristics of that particular soil. Therefore, the user of soil data presented in this volume should be aware of these limitations, and should use a certain amount of judgment in applying this data in the field.

The following is a generalized description of each of the major soil type associations found in the Meramec Region.

Lebanon - Nixa - Clarksville and Hobson - Clarksville — These are the forested, highly weathered soils that occupy a nearly level to gently rolling topography interspersed with steeply sloping areas bordering drainages and streams. This soil landscape is sometimes referred to as the "Ozark Highland." The soils have developed from cherty dolomite, limestone and sandstone. The nearly level ridgetops show evidence of a thin loess cap less than three feet thick.

The Lebanon soils are positioned on the ridgetops. They are moderately well drained, relatively chert free in the upper three feet and have at depths of 29 to 32 inches a dense impermeable fragipan layer that is underlain by red, cherty clay material. The fragipan limits tree root penetration; hence, only scrub oak strands of timber exist under natural conditions. When cleared, areas of Lebanon are used for pastures and forages, but they are droughty in late summer due to the low water holding capacity of the underlying materials.

The Hobson soils occupy similar positions and have a fragipan, but are developed from sandstone and are even more droughty than the Lebanon.

The Nixa soils have a less distinct fragipan than the Lebanon. They are positioned on more sloping topography and have cherty fragments in and above the fragipan.

The Clarksville soils are positioned on the steeper slopes. They have very cherty light colored surfaces, and red cherty clay subsoils at depths of two feet or more. The Clarksville soils are very droughty.

All of the soils in this association are low in fertility, but there is a potential in this for forage, pasture and woodland, as well as use of the area for recreational purposes.

Clarksville - Fullerton - Talbott — This soil association is the forested limestone-derived soil of the Ozarks that makes up a large part of the landscape along the steeply sloping portions of the Osage,

Gasconade, Meramec, Current and White River drainage basins. The soils differ mainly in chert content and depth to red, high clay subsoils. Clarksville soils are very cherty (stony) in the upper two feet and have red clay subsoils containing less chert than does the surface two feet. Fullerton soils have less chert in the surface and have red clay subsoils at shallower depths. Talbott soils have very little chert and usually have red clay subsoils at less than 10 inches depth. Depth to unweathered limestone or dolomite is variable, but is usually greatest in Clarksville areas, being 15 feet or more. The depth is least in Talbott areas where five feet is common.

All soils have low-to-moderate moisture storage capacities, with Clarksville being the most droughty. Forest and forage production are the main land uses for this soil association, with greatest acreage being in forest. Quality and quantity of production are normally better on the Talbott or Fullerton areas.

It is this soil association along with the spring fed streams in the valleys that gives the Ozarks its unique character. The potential for large forage, forest, wildlife or recreational areas are great.

Union - Fullerton - McGirk — This association of northeastern Ozark border soils is located on rolling to steep topography bordering streams. The soils have formed from thin loess deposited over weathered material from cherty limestones. The area was originally forested, and the soils are light colored.

The Union soils are the most extensive soils in this association. They are moderately well drained and rolling, and have a slight fragipan layer below the subsoil. Because of this fragipan and the underlying materials, the soil has moderately low water storage capacity.

The McGirk soils are gray, poorly drained soils, occupying the foot slopes and other low seepy areas.

The Fullerton soils occupy the steeper slopes. They have light-colored, cherty surfaces and red, cherty clay subsoils. They are well drained, but have limited water storage capacity because of chert content and underlying clay materials.

Other soils are found in bottom lands developed in alluvium. The Lindside soils, for example, are moderately to slowly drained, medium textured and medium in fertility, while the Huntington soils are brown, well drained, fertile and medium textured soils.

The Union and McGirk soils are used for pastures and forages, and the Fullerton soils for woodland and pasture.

Menfro - Winfield - Weldon — These light-colored, formerly forested soils are positioned on the narrow ridgetops and steep slopes in the river hill areas bordering the Missouri River from central Missouri to St. Louis, and in the Mississippi River hills north of St. Louis. The three soils occur in bands or zones, which parallel the river bluff line. The Menfro soils are in a zone on the bluff, and have the steepest slopes. Winfield soils are positioned farther from the river bluffs, and the Weldon soils still farther and on more gently sloping topography.

The silty loessial parent materials are 20 feet or more in thickness near the bluff in the Menfro area, but are 10 to 20 feet thick in Winfield areas and less than 10 feet thick in areas of Weldon. The Menfro soils are well drained and have high available moisture storage capacities. They are fertile and productive, but have severe limitations for agricultural crops because of steep slopes and gully erosion. Tree growth is excellent. The soil is noted for its permeability and its stability when used as road fill or for footings for buildings.

The Winfield soils are not as well drained and are slightly less fertile than Menfro, but they are similar in capabilities and limitations.

Weldon soils are better suited topographically for cultivation, but they are less fertile than either Menfro or Winfield, and are not as well drained, especially in spring months.

Steeper slopes in all areas may have stony soils with most of the stones being limestone or chert.

Ashe-Tilsit-Hagerstown and Tilsit-Hagerstown — Soils of these two associations are restricted to Iron County and adjacent counties where rounded hills under lain by igneous rocks are found with elevations 200 to 400 feet above intervening basins. The basins are underlain by acid sandstone and dolomites.

Ashe soils have formed on the hills or "knobs" from the igneous rocks, which are mainly granites, granite porphyries and felsites. Ashe soils are stony and often have large boulders at the surface. They are acid soils of low fertility and have low moisture storage capacities. Most areas are forested.

Tilsit soils have formed from the acid sandstone associated with the igneous rocks. They have low fertility and only moderate water storage capacities.

Hagerstown soils have formed from dolomites in the basins between the hills of Ashe soils. They are red soils with a low content of stone. They are well drained, but have moderate to high available

moisture storage capacities. They are responsive to soil amendments and are used for forage and grain crops.

The soil landscape, especially that part having both the hills or knobs and basins, has a unique beauty. Lakesites, wildlife and recreational areas are potential uses for much of the Ashe-Tilsit area.

Sarpy-Havnie-Onawa-Wabash — This is an association of alluvial soils found along the Missouri River Valley in northern Gasconade County. Soils of this association are usually composed of soil material eroded from the uplands, which has been deposited by flood waters. The soils are generally moderately clean to sandy clay with a fragipan 18 to 36 inches below the surface and are underlain by sandstone, shale and dolomite.
Sarpy is a light brown soil with a loamy sand subsoil. The soil is rapidly permeable with a moderate amount of surface runoff. The inherent fertility of the Sarpy soil is very high and is used predominantly for forage and cropland. Water storage capacity of this soil is moderate, with some lack of water during the summer period nearly every year.

Havnie is a dark gray brown soil of moderate permeability used mainly for crops. The inherent fertility of this soil is very high and has an excellent water storage capacity.

Onawa and Wabash soils are also used predominantly for crop land because of their high fertility and good to moderate permeability. Water storage capacity of these soils is moderate, being subject to intermittent problems with drought.

CLIMATE

Generalized — Missouri is an inland state, thus its climate is essentially continental. There are frequent changes in the weather both from day to day and from season to season. Missouri is in the path of cold air moving down out of Canada, warm moist air coming up from the Gulf of Mexico and the dry air from the West.

Precipitation — Annual precipitation in the Meramec Region ranges from about 37 1/2 inches at Hermann to about 42 inches in Salem. Snow occurs between November and April, both inclusive, but most of the snow falls in December, January and February. An average of about 13 inches of snow occurs annually in the Meramec Region. It is unusual for snow to stay on the ground for more than a week or two before it melts. Winter precipitation usually is in the form of rain, snow or both.

Conditions sometimes are border line between rain and snow, and in these situations freezing drizzle or freezing rain occurs. Spring, summer and early fall precipitation comes largely in the form of showers or thunderstorms. Thunderstorms are most frequent from April to July. Measurable precipitation occurs on the average of less than 100 days per year. About half of these will be days with thunderstorms.

Most of the precipitation is absorbed by the soil and plants; however, a portion of the precipitation forms runoff and is returned to streams and other bodies of water. Figure
3-10 indicates groundwater yields from bedrock and throughout the region.

Temperature — Because of its inland location, Missouri and the Meramec Region are subject to frequent changes in temperature. The average annual temperature is in the mid 60s with an average in January of about 30 degrees and an average in July of about 78 degrees. A low temperature of -28 degrees has been observed in Salem, and a high temperature of 113 degrees has been observed in Rolla.

While winters are cold and summers are hot, prolonged periods of very hot weather are unusual. Occasional periods of mild, above freezing temperatures are noted almost every winter. Conversely, during the peak of the summer season occasional periods of dry, cool weather break up stretches of hot, humid weather. About half of the days in July and August will have temperatures of 90 degrees or above, but it is not unusual for the temperature to drop into the 50s by the evening. In winter, there is an average of about 100 days with temperatures below 32 degrees. Temperatures below zero are infrequent with only about three days per year reaching this low temperature. The first frost occurs in mid-October, and the last frost occurs about mid-April.

Tornadoes — Tornadoes occur occasionally in Missouri, with an average of only 10 per year for the entire state. About 70 percent occur between March and June with May being the month of most frequent occurrence. Tornadoes occur most frequently in the afternoon between the hours of 4-6 p.m.

HYDROLOGY

WATERSHEDS

Physiographic features, such as watersheds, play an important role in the development of any given area. Practical planning and engineering methods take advantage of the topography in planning and designing sewer and water facilities. The individual watersheds should form the basis for sewer and water

districts, while several contiguous watersheds within the same drainage basin may be combined to form a sewer or water district.

Figure 3-11 outlines the 45 individual watersheds contained wholly or partially within Missouri. A drainage basin is the total area drained by a river and all of its tributaries. Within the Meramec Region, are found the following major water sheds: Lower Osage River Basin, Upper Gasconade River Basin, Big Piney River Basin, Lower Gasconade River Basin, Bourbeuse River Basin, Meramec River Basin, Big River Basin and the Current River Basin.

The Meramec Region is located predominately in three river basins: Gasconade, Meramec and Osage. The Gasconade River and its tributaries including the Big Piney River, Beaver Creek, Little Beaver Creek and Little Piney Creek drain parts of Gasconade, Maries, Phelps and Pulaski counties in the region. Included within this basin are 53 springs: 28 in Phelps County; four in Maries County; two in Gasconade County; and 18 in Pulaski County.
The Meramec River and its tributaries including Bourbeuse River, Dry Creek, Huzzah Creek, Courtois Creek, Hazel Creek, Big River and Mineral Fork drain parts of Maries, Gasconade and Phelps counties and all of Crawford and Washington counties. Included with this basin are 36 springs: three in Phelps County, three in Gasconade County, 23 in Crawford County and seven in Washington County.

The Osage River and its tributaries, including the Maries River, drain parts of Pulaski and Maries counties.

HYDROGEOLOGY

Groundwater yields from bedrock in the Meramec Region is depicted in Figure 3-11. The region is located within the Missouri River Valley and the Ozarks groundwater regions of Missouri. The northern edges of Gasconade and Osage counties are located in the Missouri River Valley. The water table in this river valley is near the surface. The water in this region is hard with a high iron content, but the overall quality of the groundwater is good.

Most of the region is Missippian limestones, Ordovician and Cambrian dolmites and sandstone. Yield is 15-500 gpm, depending on depth and producing formations. Yields locally exceed 1000 gpm in some areas, including Rolla. Parts of Washington and Dent counties are Cambrian and pre-cambrian rock, yielding 15-50 gpm.

The Ozarks groundwater region has good to excellent groundwater quality. The bedrock aquifers include the Roubidoux Formation, the Gasconade Formation, the Gunter member and the Potosi Formation. The normal and range of well yields for these aquifers is summarized in the following chart:

Aquifer	Normal Yield (Gallons per minute)	Range (Gallons per minute)
Roubidoux	20	10-30
Gasconade	15	10-20
Gunter	40	10-75
Potosi	400	250-600

The Roubidoux Formation is the most reliable shallow aquifer for farm wells in the Ozarks groundwater region. In most of the area, the Potosi is the most reliable aquifer for municipal and industrial water supplies.

ENVIRONMENTALLY SENSITIVE AREAS

The location and characteristics of natural areas need to be considered when adjacent land use activity is to be developed. The areas listed in Table 3-3 include state parks and forests, natural history areas, wildlife areas, national forests and natural areas.

KARST AREAS

Environmentally sensitive areas exist in the Meramec Region because of the region's geological characteristics, primarily karst terrain and seismic zones. Figures 3-12 show these areas. Karst can best be described as a land area lying on soluble rock through which a tangible amount of water moves through naturally occurring cracks and crevices. The most significant natural process occurring in karst areas is the solutional weathering of the soluble rock. This process takes place when rainwater combines with carbon dioxide in the soil or atmosphere and forms a carbonic acid, a weak acidic solution that breaks down limestone. The dissolved limestone washes away leaving cracks and crevices in the rock. These fissures in the stone formation act as conduits from surface water to groundwater.

Because of the porous nature of the underlying rock, a large amount of the rainfall in karst areas moves quickly and directly into the groundwater system. Water moves rapidly through karst and does not undergo the purification it would receive if seeping through soil and less permeable rock formations.

Karst area groundwater is very susceptible to contamination, thus making it extremely difficult, if not impossible, to site landfills in karst areas under Subtitle D regulations. The state, when compared to the nation as a whole, is at a distinct disadvantage.

NEW MADRID FAULT AREA

Areas that are susceptible to seismic disturbances also present unique problems. Figure 3-12 shows the major fault lines within Missouri. The New Madrid Fault in southeast Missouri is significant enough to influence solid waste decisions in the Ozark Rivers Solid Waste District. Approximately two-thirds of Crawford and Dent counties and all of Washington County lie within an area this considered a seismic impact zone. There is a 10 percent or greater probability of maximum ground acceleration in hard rock exceeding 1.10 g in 250 years. The map in Figure 3-12 also shows the seismic impact zones within the state with the outermost boundary bisecting Crawford and Dent counties. Washington County is divided between the 10 percent and 20 percent probability zones. The probability percentages increase relative to the proximity to the New Madrid Fault.

AGRICULTURE

GENERAL

The Meramec Region has 821 more farms now than it did in 1987. According to Census of Agriculture information from 1987, 1992, 1997 and 2002, the region had 5,575 farms in 1987 and 6,396 in 2002. From 1997 to 2002, the number of farms in the region declined by 229—a 3.5 percent drop. This is in line with the state and national trends that show a 3.8 and 3.9 percent decrease respectively. Two counties in the region showed an increase in the number of farms from 1997 to 2002—Gasconade and Washington counties. Dent County had the largest decrease with 128 fewer farms, or a 15.6 percent decrease, followed by Phelps County with a decrease of 43 farms. Details on the number of farms and the percentage of change from 1987 to 2002 are found on Table 3-4.

SIZE

Table 3-5 provides data on the number of farms over 1,000 acres and percentage of change between 1987 and 2002. Large farms, 1,000 acres and over, have increased in the Meramec Region by 23.4 percent between 1997 and 2002. This change is greater than the increase in Missouri and the U.S., at 3.8 percent and 3.1 percent, respectively. Large farms in the Meramec Region, 1,000 acres and over, have

shown a net increase from 1987 to 2002 (55), in contrast to the decline in total number of farms as described in Table 3-4 (-821). It is likely that larger landowners are buying smaller, neighboring farms to add to their existing holdings.

The average size of farms in the Meramec Region has decreased by 8 acres—from 269 to 261—between 1987 and 2002. From 1987 to 2002, two Meramec counties saw increases in average farm size, while 4 had decreases. In 2002, the counties in the Meramec Region had an average size between 230 acres and 303 acres with the region average at 261 acres. The 2002 Missouri average size was 280 acres and the national average size was 441. These figures are shown in Table 3-6.

Table 3-7 provides data on the number of acres each county in Meramec Region has in Conservation Reserves. This is an accumulated acreage from 1986 to 2002. Gasconade County leads the region in reserves with 2,437 acres. Total reserve acreage for the region is 6,993; a 35.3 percent decrease from 1997-2002.

FORESTRY

GENERAL

The Ozarks region of Missouri is the focal point of several converging ranges of plant associations. Eastern hardwoods, southern pines and western prairies and the wildlife each supports, all reach the outward limits of their range in this area. As a result, various types of forest lands and animal habitats co-exist within a limited area

PHYSIOGRAPHY

Topography ranges from broad ridges and gentle slopes to steep slopes and bluffs with corresponding variations in elevation. For the most part, the soils of the forest areas are formed on the cherty dolomite and sandstone residuum derived from the Jefferson City and Roubidoux geological formations. The soils are generally droughty and somewhat low in inherent fertility. Droughtiness is due primarily to high chert content, extensive subsurface drainage, and shallow fragipans.

The climate is characterized by a range of temperatures with extremes occurring only occasionally. The frost-free period extends from about April 20 through October 15, and the growing season averages 180 days. Precipitation, most of which is rainfall, averages 42 inches per year. About 30 inches of that

average occurs during the spring months. Heavy rains result in excess run-off with occasional flash floods. Sleet and glaze storms occur annually and result in damage to timber. Tornadoes occur at infrequent intervals. Droughts of short duration occur annually during the late summer months, while more severe droughts occur infrequently.

Permeable soils with subterranean drainage, lack of sufficient rainfall during the growing season, and high evapo-transpiration rates during the summer months affect the volume of growing stock that can be managed on forest lands. Soil moisture depletion occurs early in the growing season during normal years, causing moisture to be a limiting factor of native tree species in the Meramec Region.

DEFINITIONS

The following are definitions of terms used in the text and tables of this chapter.

All live – All trees greater than 1.0 inch in diameter.

Commercial Forest Land - Forest land that is producing, or capable of producing crops of industrial wood, and has not been withdrawn from timber utilization by statute or administration regulation.

Forest Land - Includes areas of at least 10 percent stocked with trees capable of producing timber or other wood products, as well as land from which trees have been removed, so long as the land has not been developed for other purposes.

Forest Type - Classification by forest type is based on the species forming a plurality of stocking based on gross cubic volume of timber. Non-stocked forest land is classified with the forest type best suited to the soil.

Growing stock trees – Live trees of commercial species that are 5.0 inches or larger that meet (now or in the future) regional merchantability requirements in terms of sawlog length grade and cull defductions. It excludes rough and rotten trees.

Non-commercial Forest Land - Forest land which otherwise qualifies as commercial forest which has been withdrawn from utilization by statute, ordinance, or administrative order, or forest land incapable of yielding a stand averaging at least one 13 foot saw log per tree.

Non-stocked - Areas failing to meet any of the preceding criteria except that for commercial forest land.

Poletimber - Stands failing to meet specifications for sawtimber, but at least 10 percent stocked with trees of five inches in diameter at breast height (D.B.H.) or larger and having at least half of the minimum stocking in poletimber - size trees.

Sawtimber – Any commercial tree species greater than 11 inches.

Seeding and Sapling - Stands failing to meet requirements as either sawtimber or poletimber, but at least 10 percent stocked with trees of commercial species, and at least 5 percent stocked with seedlings and saplings.

Timberland – Forestland that is capable of growing at least 20 cubic feet of wood per acre per year.

FOREST AREA

As shown on Table 3-8, there were 2,268,686,059 cubic feet of all live trees on timberland in the Meramec Region in 2002-06 sample years. Washington County has the largest amount of all live trees on timberland in the area, 421,819,910 cubic feet. Maries is on the low end of the scale with 153,985,229 cubic feet of all live trees on timberland.

According to Table 3-9, the region has 2,040,325,359 cubic feet of growing-stock on timberland (91.6 percent hardwoods). About 89 percent of the live trees on timberland are growing stock. Annual growth of the growing-stock (Table 3-12) averages over 60 million cubic feet. An average of 19,944,611 cubic feet of growing stock is lost annually (Table 3-10).

NATIONAL FOREST

The headquarters for the Mark Twain National Forest is located in Rolla. The forest area includes 13 ranger districts. The responsibilities of the National Forest include the following:

1. Coordinate timber management activities with the use of other resources.
2. Achieve a better balance of size classes throughout the forest, based on a rotation period of 80 years for pine and 90 years for hardwood.
3. Market the programmed annual cut and promote the marketing of the allowable cut.
4. Assist industries, communities, and area development agencies to expand wood using industries.
5. Assure adequate stocking of all regeneration areas.

MINERAL RESOURCES

The mineral resources of the region have been an important factor in the local economy, but several problems face the mining industry. The location of mining areas presents problems in the removal of mining wastes, pollution of local water supplies and the reduction in the market for mineral resources in the region. This chapter will give a summary of the mining industry in the region and the impact on the economy. It will not be as complete as one would like since it has become extremely difficult to acquire data from the mining industry. Some data and information will be included from previous planning documents to provide an overall view of the resources and their location.

Table 3-12 lists the mining and quarry companies and their location. Figure 3-13 shows where the different mineral resources are located in Missouri. Resources in the region include fire clay, crushed stone, construction sand and gravel, dimension sandstone, perlite, iron oxide pigments, and iron. Mineral resources close to the region include silver, copper, lead and zinc. Mining/quarry industries are discussed in Section I, Chapter 5: The Meramec Region Economy.