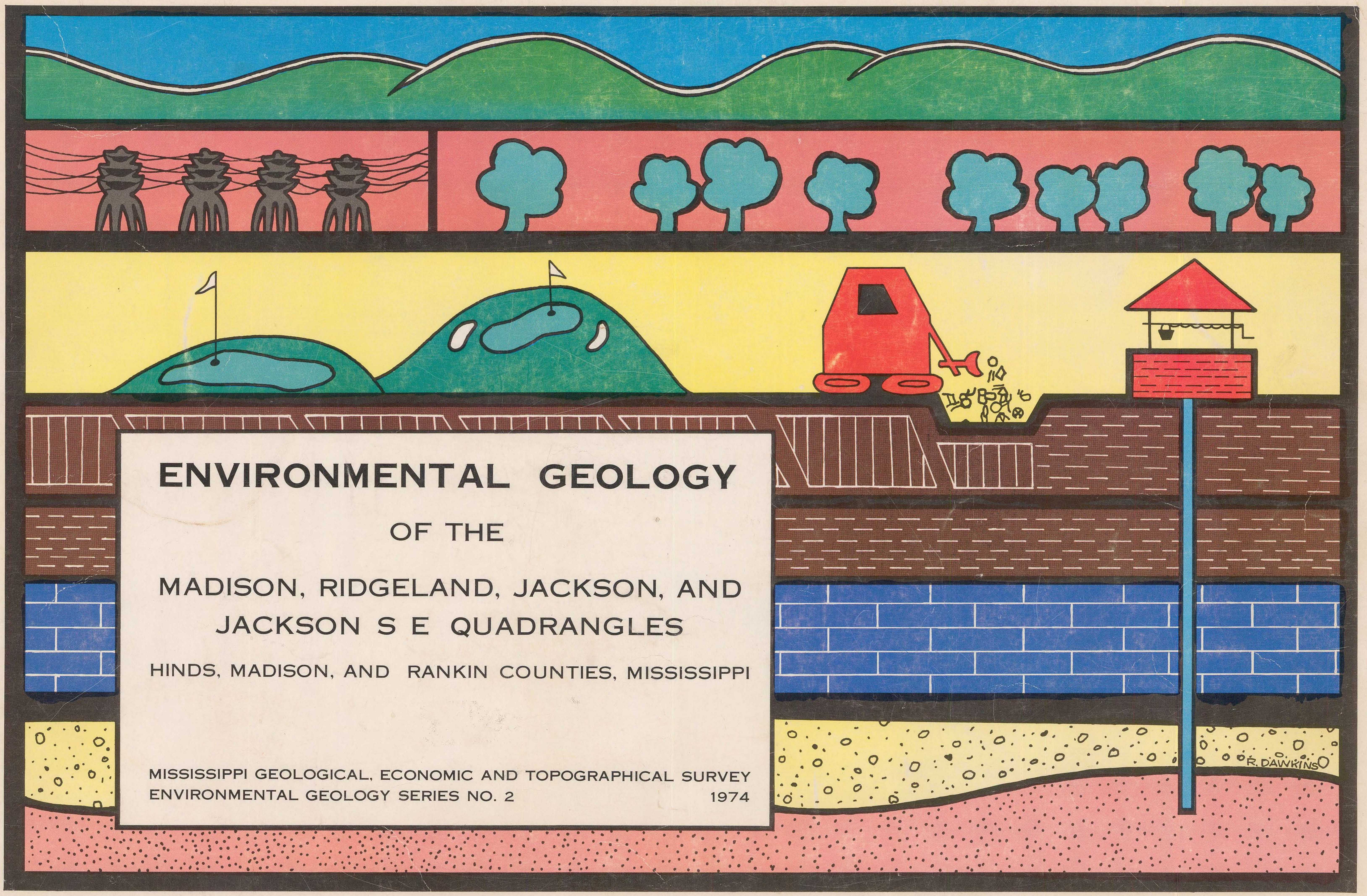
ENVIRONMENTAL GEOLOGY

OF THE

MADISON, RIDGELAND, JACKSON, AND
JACKSON S E QUADRANGLES

HINDS, MADISON, AND RANKIN COUNTIES, MISSISSIPPI

MISSISSIPPI GEOLOGICAL, ECONOMIC AND TOPOGRAPHICAL SURVEY
ENVIRONMENTAL GEOLOGY SERIES NO. 2 1974



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MADISON, RIDGELAND, JACKSON, AND JACKSON S E QUADRANGLES

HINDS, MADISON, AND RANKIN COUNTIES, MISSISSIPPI

BY

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DIRECTOR & STATE GEOLOGIST

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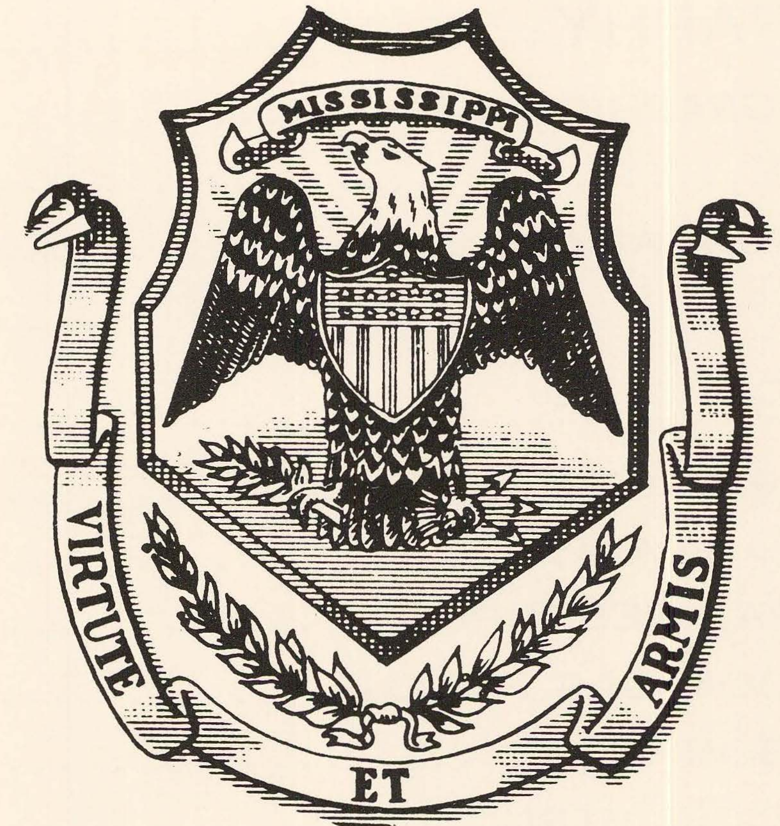

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INTRODUCTION

Environmental geology bridges the hiatus between the pure science of geology and the problems related to man's cognation with the Earth. Environmental geology is defined as the collection, analysis, and application of geologic data and principles to problems created by human occupancy and use of the physical environment. It comprises the maximization of a rapidly shrinking living area and resource base to the needs of mankind, and the minimization of the deleterious effects of man's interaction with the Earth. It pertains to the problems that society has in using the Earth and the response of the Earth to that use. Environmental geology includes the study of hydrogeology, topography, engineering geology, and economic geology. These studies are applied to the safe disposal of waste products, development and management of natural resources, construction, and the planning and development for the most advantageous utilization of the land.

As America continues to grow and attempts to maintain or improve mankind's standard of living, additional demands will be made for construction materials, ample water supplies, petroleum resources, and other mineral products. A fixed quantity of these natural resources is available for man's consumption, and if these supplies are exhausted before synthetic substitutes can be developed, then society as we know it will deteriorate. Proper conservation of natural resources and forethought with regard to how available land is to be used will avert, or at least lessen, the ominous effects prophesied by the environmental extremists.

Geologists are suited by nature of the profession to recognize and help solve problems associated with mineral resources and natural hazards relating to certain land uses. Geology is the science of the Earth. This science is involved with Earth history, Earth processes, Earth materials, the geometry of the Earth's crust, and the configuration of the Earth's surface. Therefore, it would seem that geologic information should be considered before any plans are made which concern the land. If geologic data is not considered, all pertinent information will not be analyzed, and chances of success for any particular land use will be reduced.

Mississippi's relatively slow economic development over the years may to some extent seem to be a disadvantage which turned out to be good. With a few exceptions, this State has not experienced the degree of environmental problems that have beleaguered many other States. This is not to imply that Mississippi is free of pollution. It does indicate that the State is relatively clean. Mississippi can continue its economic growth without endangering the health and opportunities of its future generations by means of proper land-use planning. The people of this State have the opportunity to learn from the mistakes made in other parts of the Country.

This publication is offered as an aid to the planning and development efforts of one localized area. The old Jackson 15-minute quadrangle located in Hinds, Madison, and Rankin Counties was selected for this study because of the population and commercial growths which are presently occurring. This quadrangle was first surveyed in 1903, but was resurveyed by the United States Geological Survey in 1963 into four 7 1/2-minute quadrangles. These have been designated as the Ridgeland, Madison, Jackson, and Jackson SE sheets. The topographic maps of these four quadrangles were photo-revised in 1971. The location of these quadrangles is shown on the map on this page. This study area is bounded on the east by the meridian 90° west longitude and on the west by 90°15' west longitude. The northern boundary is 32°30' north latitude, while the southern limit is 32°15' north latitude. The area encompasses approximately 240 square miles.

This study area is predominately urban and suburban and has some rural-agricultural areas in the Madison, Ridgeland, and Jackson SE quadrangles. The population is steadily increasing and planners and developers are concerned with modern complex problems such as water supplies, landslides, waste disposal, and varied engineering-construction problems associated with the presence of some hazardous geologic conditions.

With this book, the authors will attempt to show how geology relates directly to the needs of the people of a particular area. It is hoped that the information in this publication will be applied in a responsible way toward the achievement of the development goals.

The colorful atlas-type report is considered to be a satisfactory means of presenting this type of information in a manner that may be easily understood to readers outside the science of geology. The quadrangle maps presented in "Environmental Geology of the Madison, Ridgeland, Jackson, and Jackson SE Quadrangles, Hinds, Madison, and Rankin Counties, Mississippi" are to the scale 1:48,000. This scale is one-half that of the 7 1/2-minute quadrangles published by the United States Geological Survey.

Only one quadrangle map is shown on each page of this report. This is to avoid reproducing these maps at a size too small to be easily read, or to avoid using sheets of paper so large as to make the publication cumbersome. Consequently, only one legend is presented for the set of maps covering each topic. Many of the definitions found in the text and in the glossary of terms were adapted from the "Glossary of Geology" published by the American Geological Institute in 1972.

The authors wish to express their appreciation to several agencies and individuals for their aid in making this publication possible. Certain personnel of the Mississippi State Highway Department helped interpret engineering data. Aerial photography was obtained from the Earth Resources Laboratory of the National Aeronautics and Space Administration. Appreciation is expressed to the staff of the Mississippi Geological Survey for their advice while this work was in progress and for editing the manuscript. Special acknowledgement is extended to Rebecca H. Dawkins for the art contribution to this book. We wish to express our gratitude to Mercury Maps, Inc., for their assistance in the preparation of this publication.

This publication was made possible solely from budget funding of the Mississippi Geological, Economic, and Topographical Survey.

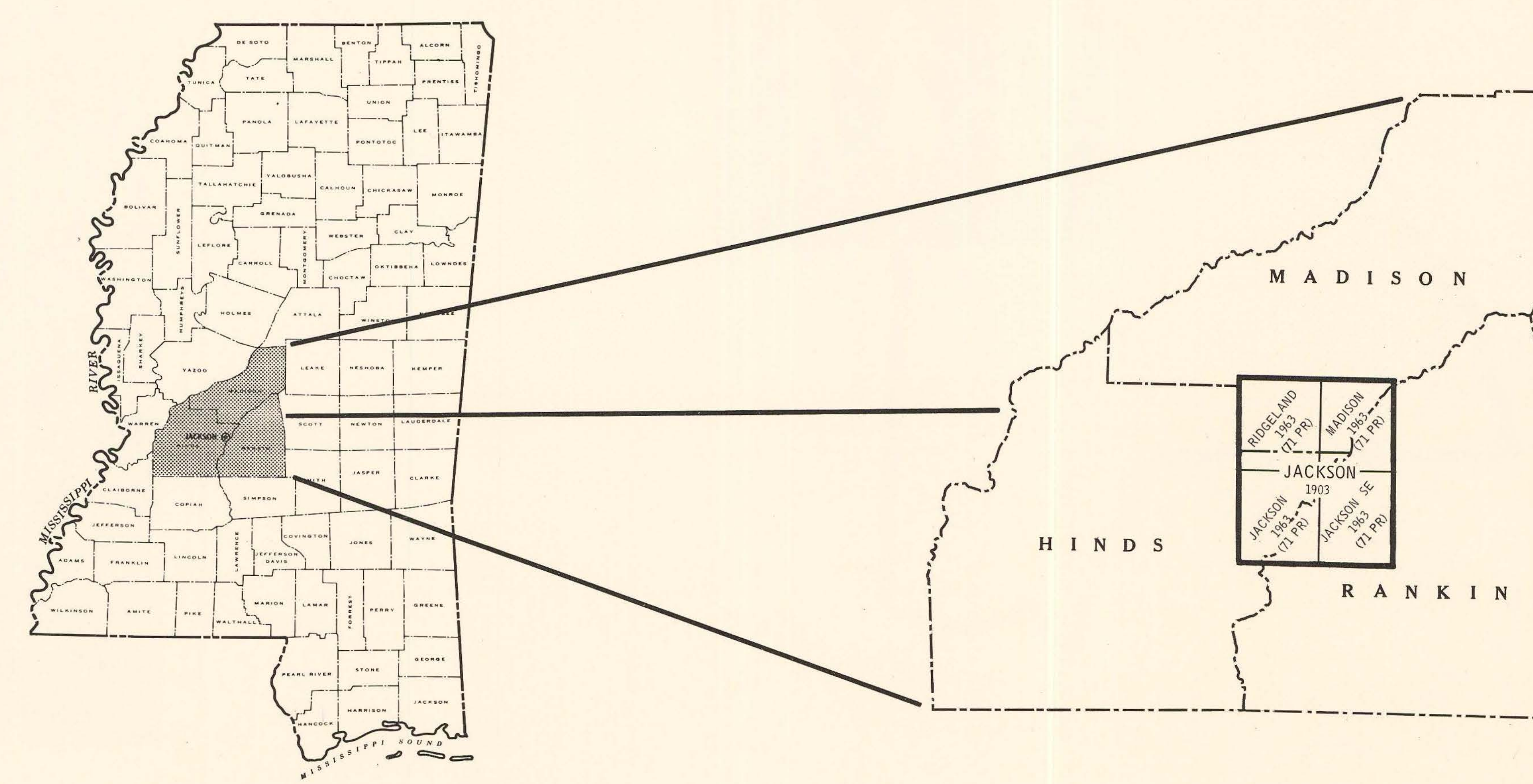
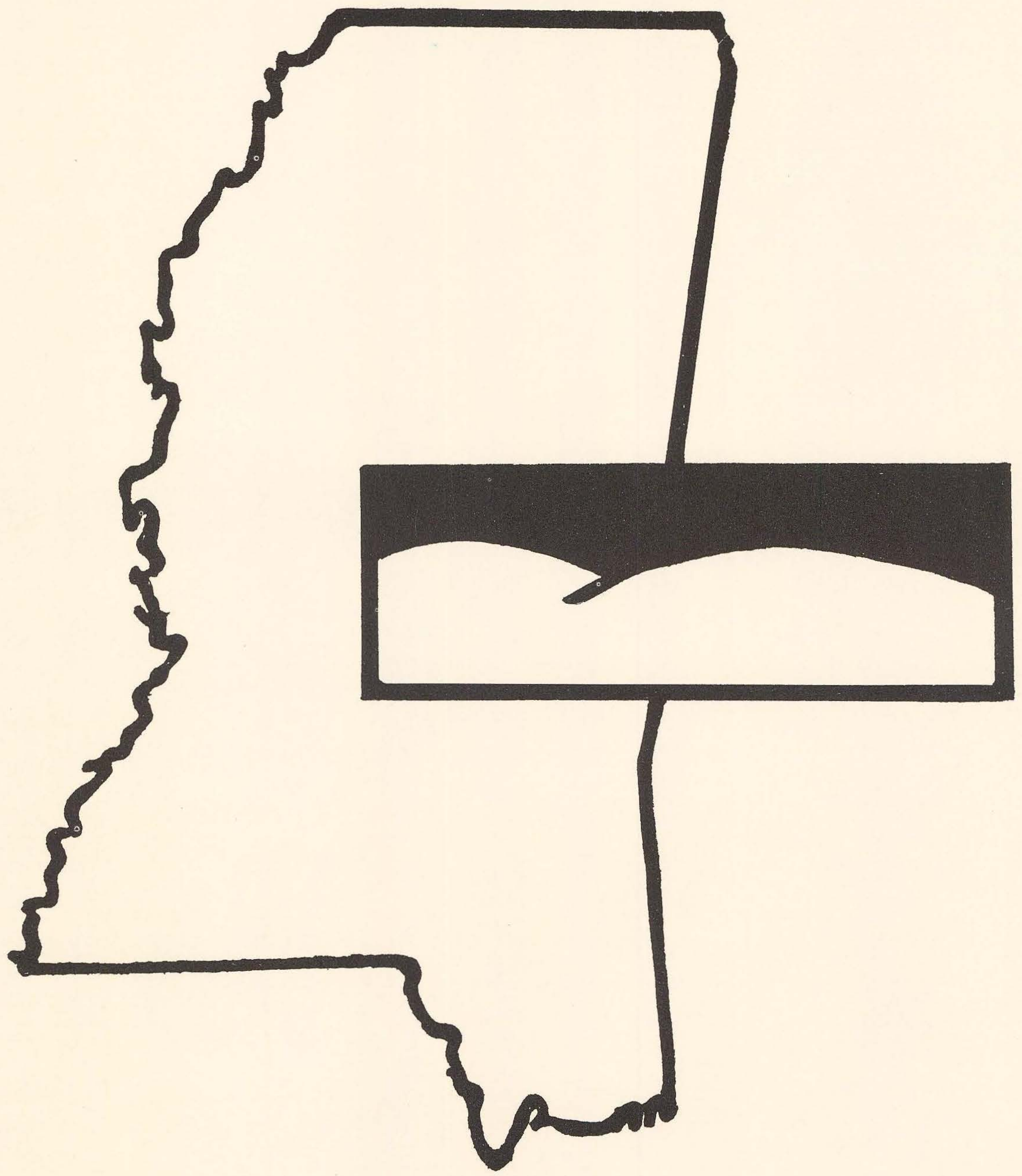


Figure 1. - Map showing location of study area.

TOPOGRAPHY



TOPOGRAPHIC MAPS

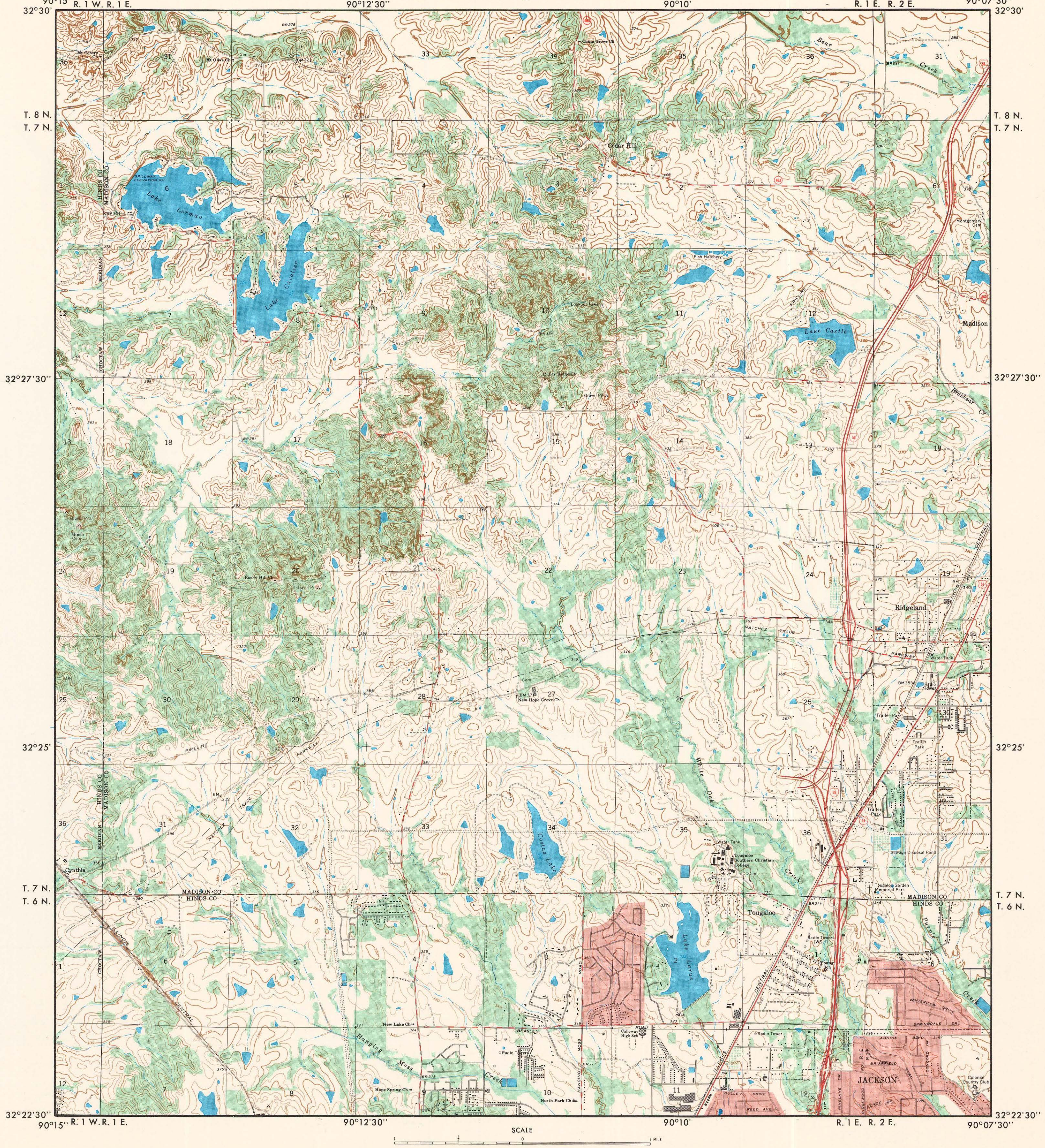
Topography has been defined as the configuration of a land surface, including its relief and the position of its natural and more prominent man-made features. A topographic map, therefore, is a graphic representation of natural and selected man-made features of a part of the Earth's surface plotted to a particular scale. Topographic maps convey to the user in readable form the physical characteristics of a certain area as determined by accurate measurements made by engineers and land surveyors. These maps show the location, shape, and pattern of hills, valleys, plains, lakes, and streams, as well as principal works of man such as railroads, highways, airports, power transmission lines, buildings, material pits, and political boundaries.

On the topographic maps prepared by the United States Geological Survey, features are portrayed by a variety of symbols and colors. Relief is shown by brown contour lines. To possibly better understand the contour symbol, it may be thought of as an imaginary line on the ground which takes any shape necessary to maintain a constant elevation above sea level. Contour lines have proven to be an effective mechanism for depicting a three-dimensional figure on a flat piece of paper. Symbols for water features are printed in blue. Man-made features are shown in black, with the exception of major highways, which are shown in red. Forested areas are exhibited in green.

The scale of the majority of the more recent topographic maps of this region published by the United States Geological Survey is 1:24,000. These maps are established on the basis of 7 1/2 minutes of latitude and longitude and cover an area of approximately 60 square miles. Many of these more recent 7 1/2-minute quadrangle maps are revisions of much older maps that were based on 15 minutes of latitude and longitude and covered an area of approximately 240 square miles. The 15-minute series of maps were printed at a scale of 1:62,500; therefore, it is quite apparent that a greater amount of detail is available on the newer series.

In most areas of the Country, topography is controlled to some extent by geologic features. Fault traces may show up as cliffs or anomalous stream patterns. Resistant rock formations may be expressed as hills or ridges. Uplifted or otherwise structured rock formations may also form hills, ridges, or even mountains and valleys. For the most part, however, the topography in this study area seems to be controlled by erosion.

RIDGELAND QUADRANGLE



MADISON QUADRANGLE

TOPOGRAPHIC MAP SYMBOLS

Hard surface, heavy-duty road

Hard surface, medium-duty road

Improved light-duty road

Unimproved dirt road

Trail

Railroad: single track

Railroad: multiple track

Bridge

Drawbridge

Tunnel

Footbridge

Overpass—Underpass

Power transmission line with located tower

Landmark line (labeled as to type) TELEPHONE

Dam with lock

Canal with lock

Large dam

Small dam: masonry — earth

Buildings (dwelling, place of employment, etc.)

School—Church—Cemeteries Cem

Buildings (barn, warehouse, etc.)

Tanks; oil, water, etc. (labeled only if water) Water Tank

Wells other than water (labeled as to type) Oil Gas

U.S. mineral or location monument — Prospect

Quarry — Gravel pit

Mine shaft—Tunnel or cave entrance

Campsite — Picnic area

Located or landmark object—Windmill

Exposed wreck

Rock or coral reef

Foreshore flat

Rock: bare or awash

Horizontal control station

Vertical control station BM ×671 ×672

Road fork — Section corner with elevation 429 58

Checked spot elevation × 5970

Unchecked spot elevation × 5970

(Continued On Page 6)

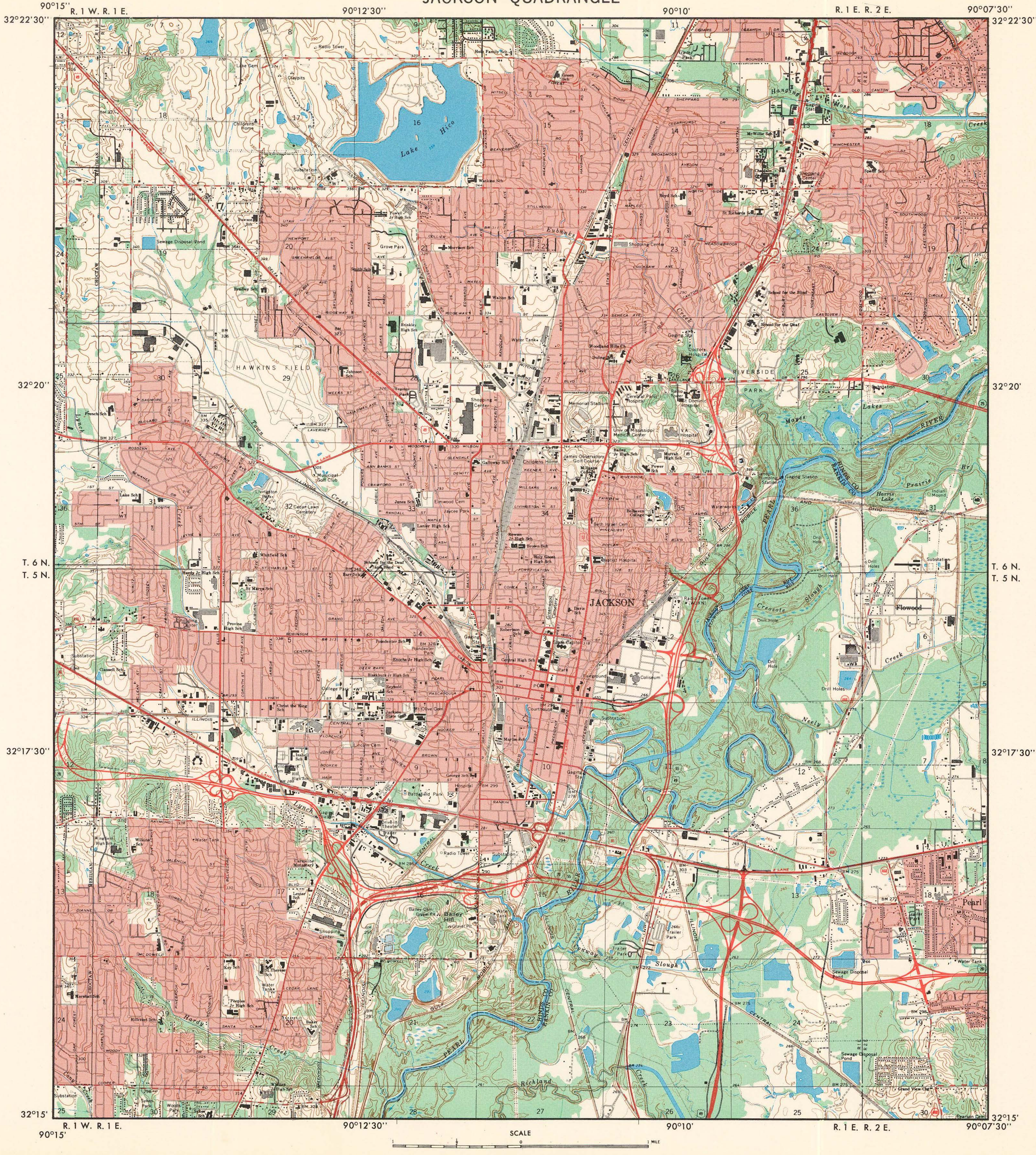
Boundary: national
State
county, parish, municipio
civil township, precinct, town, barrio
incorporated city, village, town, hamlet
reservation, national or state
small park, cemetery, airport, etc.
land grant
Township or range line, U.S. land survey
Section line, U.S. land survey
Township line, not U.S. land survey
Section line, not U.S. land survey
Fence line or field line
Section corner: found—indicated
Boundary monument: land grant—other

Index contour
Intermediate contour
Supplementary cont.
Depression contours
Cut — Fill
Levee
Mine dump
Large wash
Dune area
Tailings pond
Sand area
Distorted surface
Tailings
Gravel beach

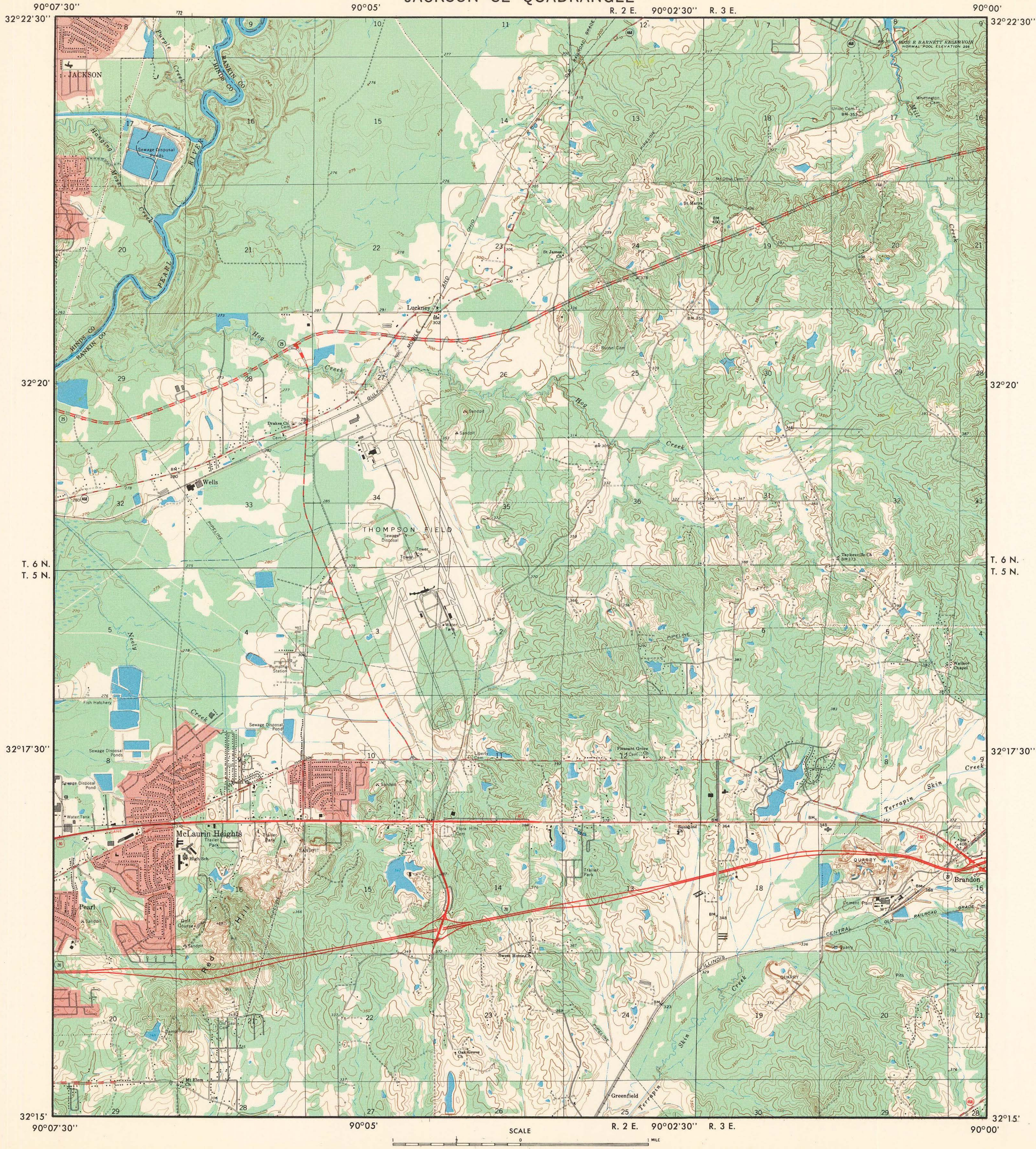
Glacier
Intermittent streams
Perennial streams
Aqueduct tunnel
Water well—Spring
Falls
Rapids
Intermittent lake
Channel
Small wash
Sounding—Depth curve
Marsh (swamp)
Dry lake bed
Inundated area

Woodland
Mangrove
Submerged marsh
Scrub
Orchard
Wooded marsh
Vineyard
Bldg. omission area

JACKSON QUADRANGLE



JACKSON SE QUADRANGLE



The most prominent topographic feature in this study area is the Pearl River flood plain which is three to five miles in width. The river flows southwesterly across the Madison, Jackson SE, and Jackson quadrangles. The flood plain occupies the southeastern one-half of the area covered by the Madison sheet, the northwestern one-third of the Jackson SE quadrangle, and the southeastern one-third of the Jackson sheet.

A line of terrace-capped ridges is on the southeastern side of the flood plain and trends roughly parallel to the plain in the Jackson SE quadrangle. Elevations on the crests of some of these ridges are in excess of 460 feet above sea level, thus resulting in approximately 200 feet of local relief.

The northwestern one-third of the Ridgeland quadrangle is composed of a fairly rugged upland with elevations in excess of 450 feet. This area is underlain by limestones, marls, and silts of the Vicksburg Group. This topographic feature represents an erosional remnant of rocks that apparently encircled the Jackson area because of a structural uplift. This is an example of a topographic expression implying a geologic structure.

Complete and current information concerning topographic mapping, not only of this study area, but of the entire State, is readily available at the Mississippi Geological, Economic and Topographical Survey office.

SLOPE

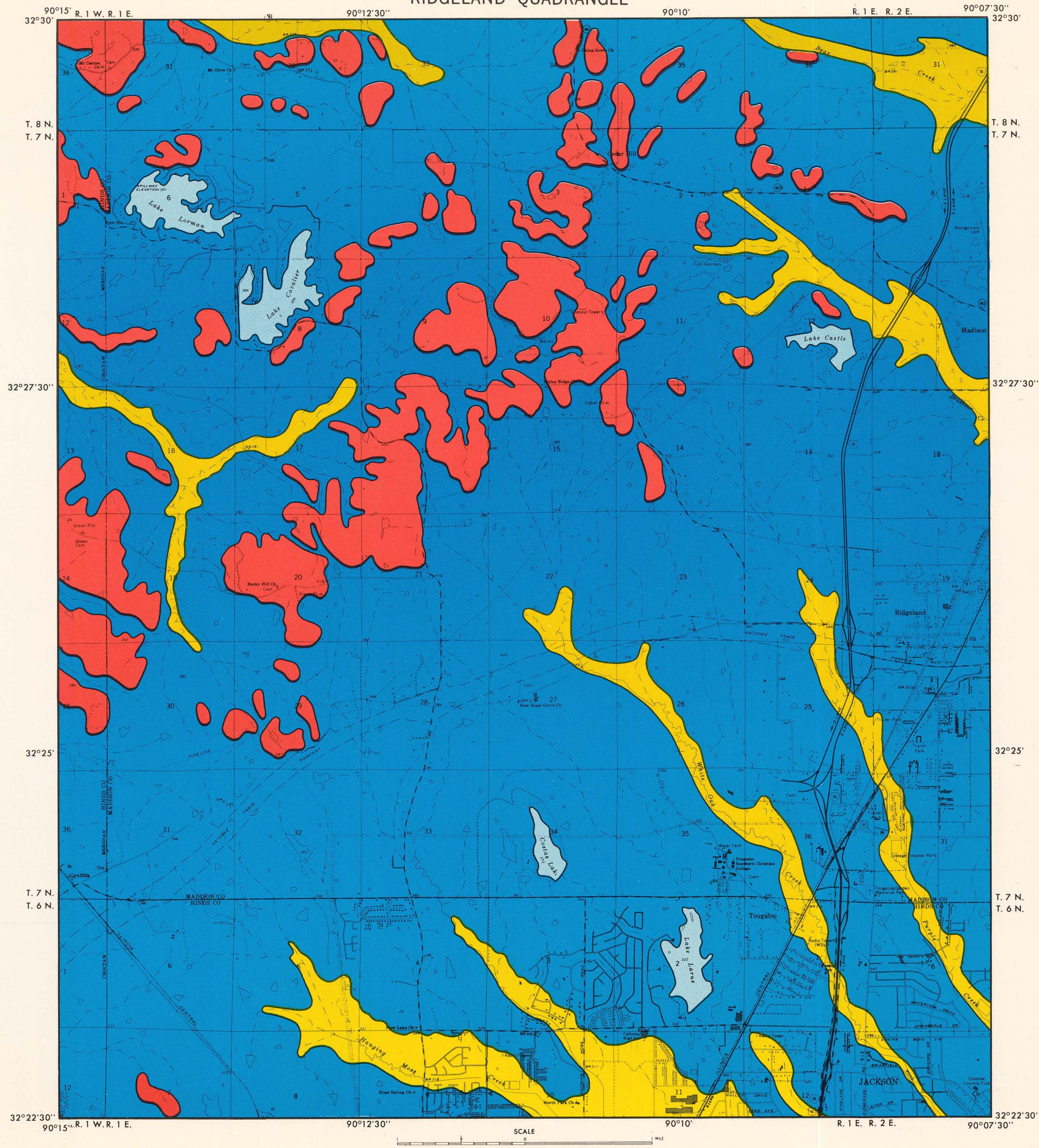
The general slope of the land in any area can be a criterion in the development of that area. In fact, in some parts of the Country, such as southeastern Louisiana and certain sections of the Rockies, the lay of the land is as much a factor as the climate, available financial resources, or work force. The general slope is not extreme in this study area and, consequently, it is not the detrimental factor to development that it is in other areas of the Country.

Topographic maps and slope maps should be basic tools for the planner and developer. Generalized slope maps may be drawn from the topographic maps of an area simply by comparing the vertical elevation to the horizontal distance and expressing the result as a percentage or ratio.

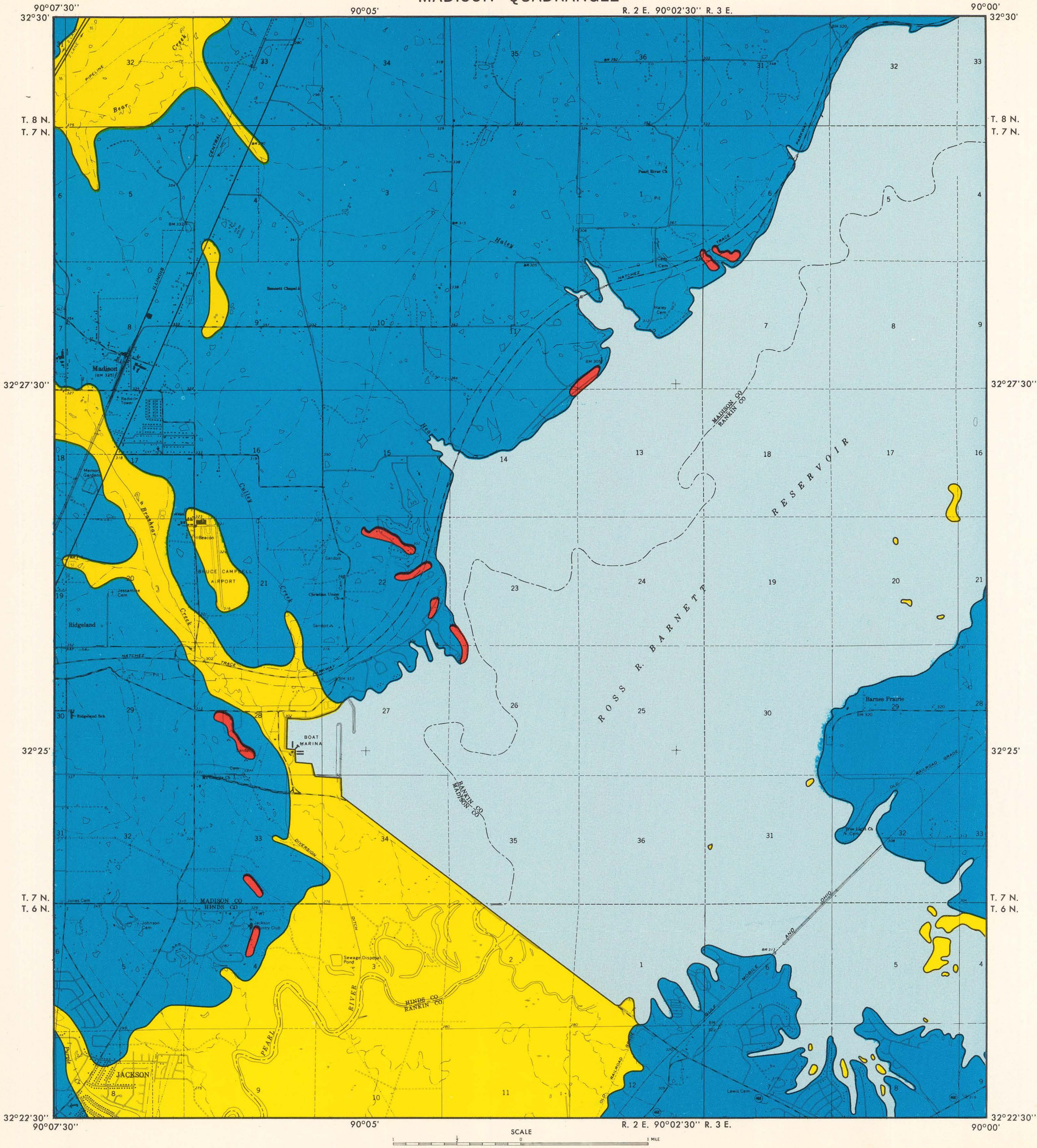
As is stated above, the general slope in this study area is not so critical as to form a deterrent to most development. A situation does exist in the area, however, that can be critical unless adequate planning and design measures are taken. Much of the study area is underlain by an expansive-clay stratum, the Yazoo Formation. The topography along the Yazoo outcrop belt is gently rolling terrain. One reason for the lack of incised streams and steep slopes in this material is the fact that it is unstable on slopes greater than 20 to 25 percent. If such a slope is created in this clay, either by work of man or by stream erosion, natural forces will attempt to restore the gradient equilibrium by means of landslides or soil creep. This results in the land surface being "smoothed out." Planners need to consider this fact when designing slopes for highways and landscapes for residential development or building complexes. This is a primary reason for much of the slumping that occurs along the bluff on the western side of the Pearl River floodplain in the area of Jackson.

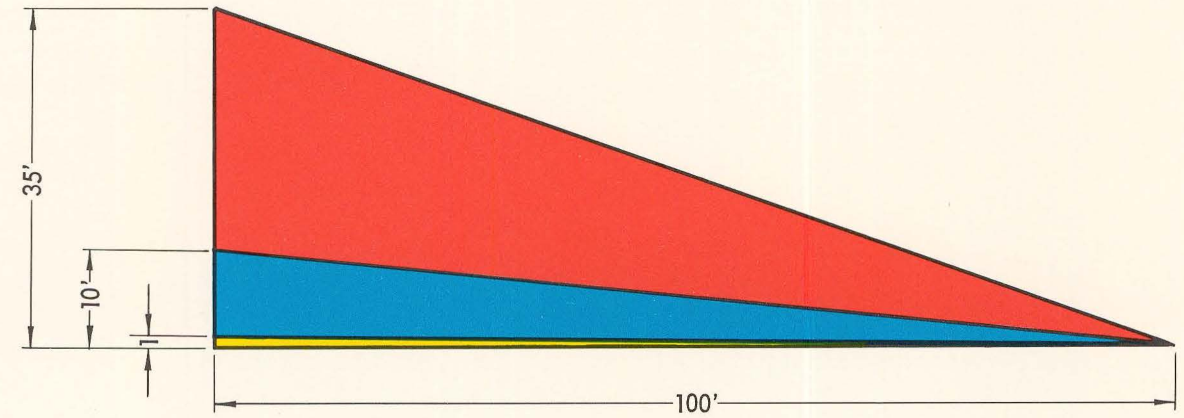
A slope of one percent has a gradient drop of one foot in elevation for every 100 feet of horizontal distance. For the purposes of this publication, slopes of one degree or less are considered to be flat. Areas shown in yellow on the maps in this section are areas having predominantly flat slopes. A glance at these maps leaves the reader with the impression that approximately one-half of the surface of the Madison, Jackson, and Jackson SE quadrangles is relatively flat. This is because of the fact that the broad flood plain of the Pearl River occupies a great deal of the surface of the area. Flooding occurs in the rainy season in a great portion of this flat area. Land uses should be restrained, therefore, because of the factors of public safety, economic loss to individuals, and cost to the taxpayers in disaster relief as a result of floods. Only a small percentage of the land in the Ridgeland quadrangle is flat, and this is found only in the creek valleys.

RIDGELAND QUADRANGLE



MADISON QUADRANGLE





LEGEND

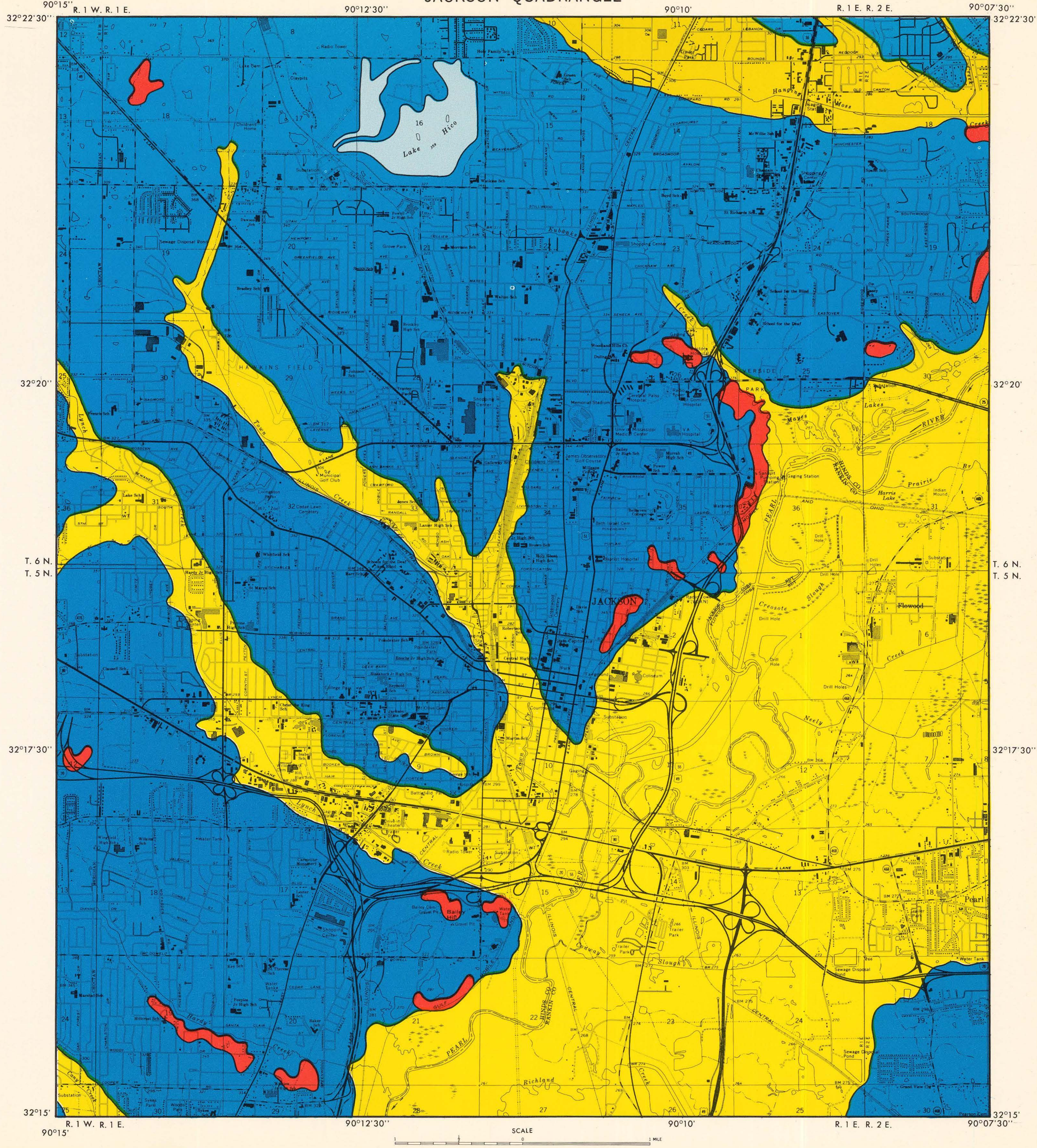
(For all four Slope Maps)

- STEEP SLOPE- Areas of slope greater than 10%.
- GENTLE SLOPE- Areas of slope less than or equal to 10% and greater than 1%.
- FLAT SLOPE- Areas of slope less than or equal to 1%.

Figure 2. - Residences built on flat slope.

Figure 3. - Residences built on gentle slope.

JACKSON QUADRANGLE



JACKSON SE QUADRANGLE

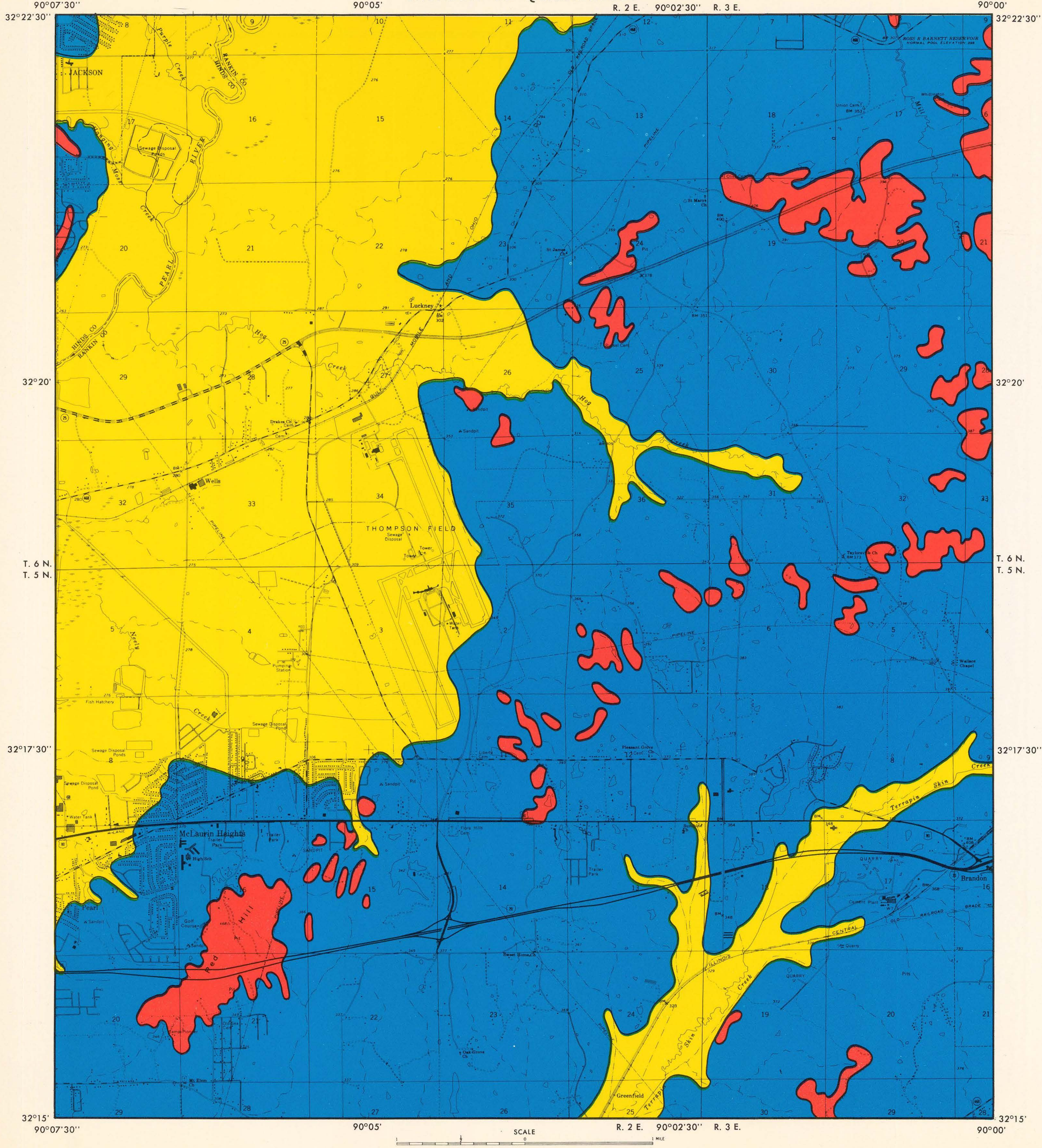


Figure 4. - Residences built on steep slope. Note leaning and broken wall and trees leaning because of soil creep.

A gentle slope is considered to be greater than one percent and less than or equal to 10 percent. The areas having predominantly gentle slopes are designated in blue on the accompanying maps. One-half to slightly less than one-half of the land area in the Madison, Jackson, and Jackson SE quadrangles has gentle slope. By far, the majority of the land area in the Ridgeland quadrangle is designated gentle. Fewer restrictions, if any, are generally placed on land uses and developments in areas of gentle topography such as this. Man-made steep slopes, however, can cause serious slumping problems in the portions of this area underlain by the Yazoo Formation.

Slopes having a gradient drop of 10 or more feet for every 100 feet of horizontal distance are designated as steep and are shown on the maps in red. A very small percentage of the land area of the Madison and Jackson quadrangles is shown to be steep and these slopes, for the most part, are found along the western bluff line of the Pearl River flood plain. These areas are underlain by the Yazoo Formation, and slumping problems are not uncommon. Approximately 10 percent of the Jackson SE land area is shown in red. These steeper areas are concentrated along terrace-capped ridges forming minor drainage divides along the eastern side of the Pearl River flood plain. About 15 percent of the land surface in the Ridgeland quadrangle is designated as steep. Virtually all of the steep slope is found in the northern and northwestern portion of the quadrangle which is underlain by more erosion-resistant materials of the Vicksburg Group. A part of this relatively rugged upland forms a portion of the major drainage divide between the Big Black and Pearl River systems. Very little development is found in these more extensive areas of steep slope.

PHYSIOGRAPHY

The State of Mississippi lies within the Gulf Coastal Plain physiographic province of the United States. This province has subsequently been divided into 12 physiographic units in Mississippi by R. R. Priddy. These units are shown on the map on this page. The study area is shown on this map to lie predominantly in the Jackson Prairie belt, with a small portion of the Ridgeland and Jackson SE quadrangles found in the Vicksburg Hills section.

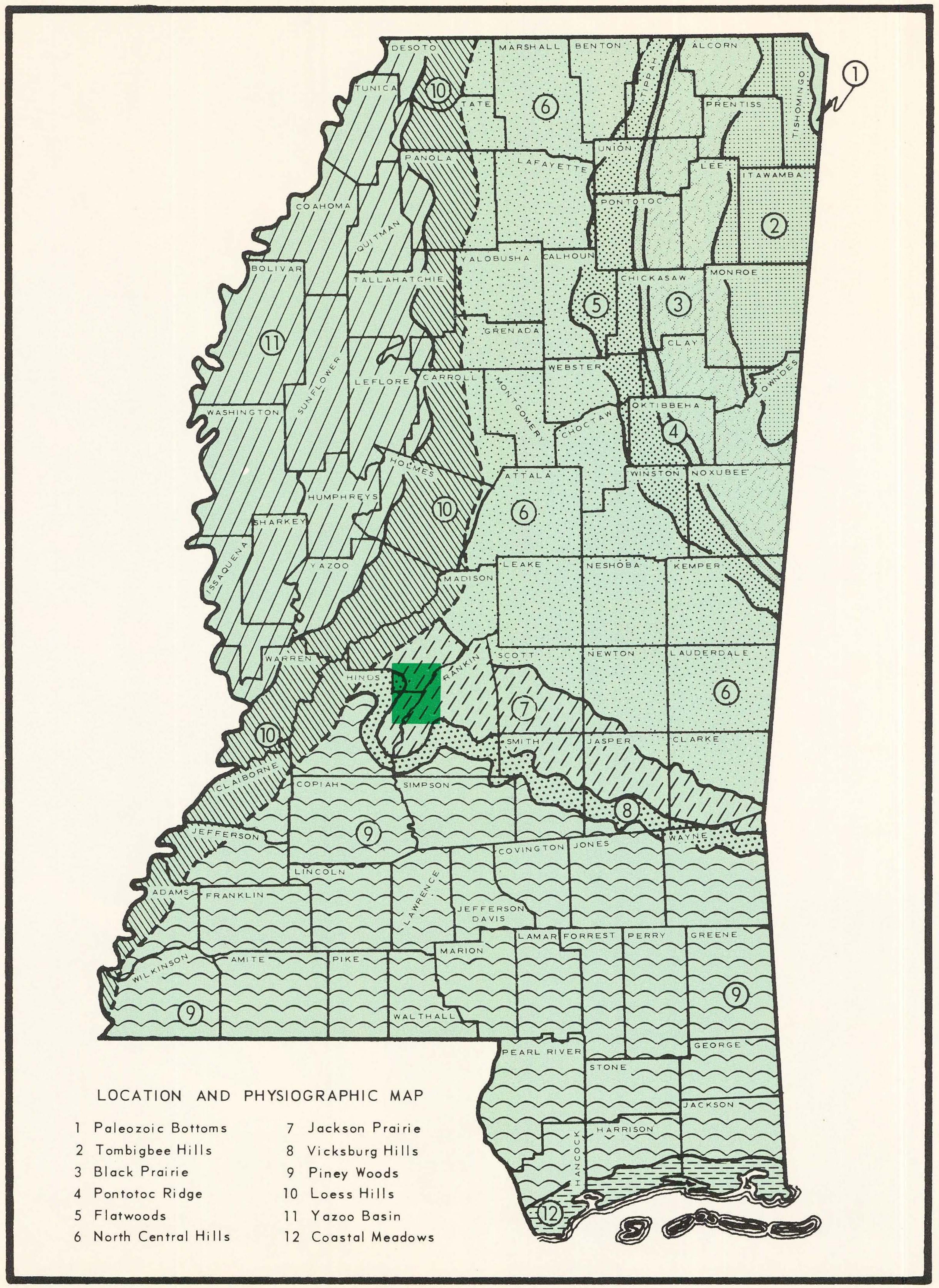
The Jackson Prairie is developed primarily on the outcrop of the massive clay of the Yazoo Formation. This belt is characterized by gently rolling terrain with terrace sands capping some of the hills bordering the Pearl River flood plain. Many of the hills, especially on the western side of the river, are capped by a thin layer of silty clay loam. This material is probably reworked loess, extensive deposits of which are found to the west of the study area. These terrace and loessal deposits are remnants of material that, at one time, covered much larger areas.

This prairie has been formed as a result of the slow-eroding action of fairly slow-moving streams. The clay is relatively impervious and homogeneous, which means a great percentage of the precipitation will run off instead of being absorbed. Water running off a homogeneous and impervious surface would not create deeply incised channels and rugged terrain such as found in areas where these conditions are not prevalent. The clay of the Yazoo Formation will not remain stable on steep slopes, as was pointed out in the previous section on slope. If a relatively steep slope is created by erosional processes in this formation, the material will slump naturally. This also tends to smooth the landscape. Similar prairie topography is found in the Flatwoods, underlain primarily by the impervious clay of the Porters Creek Formation, and in the Black Prairie belt, which is underlain primarily by impervious chalk of the Selma Group.

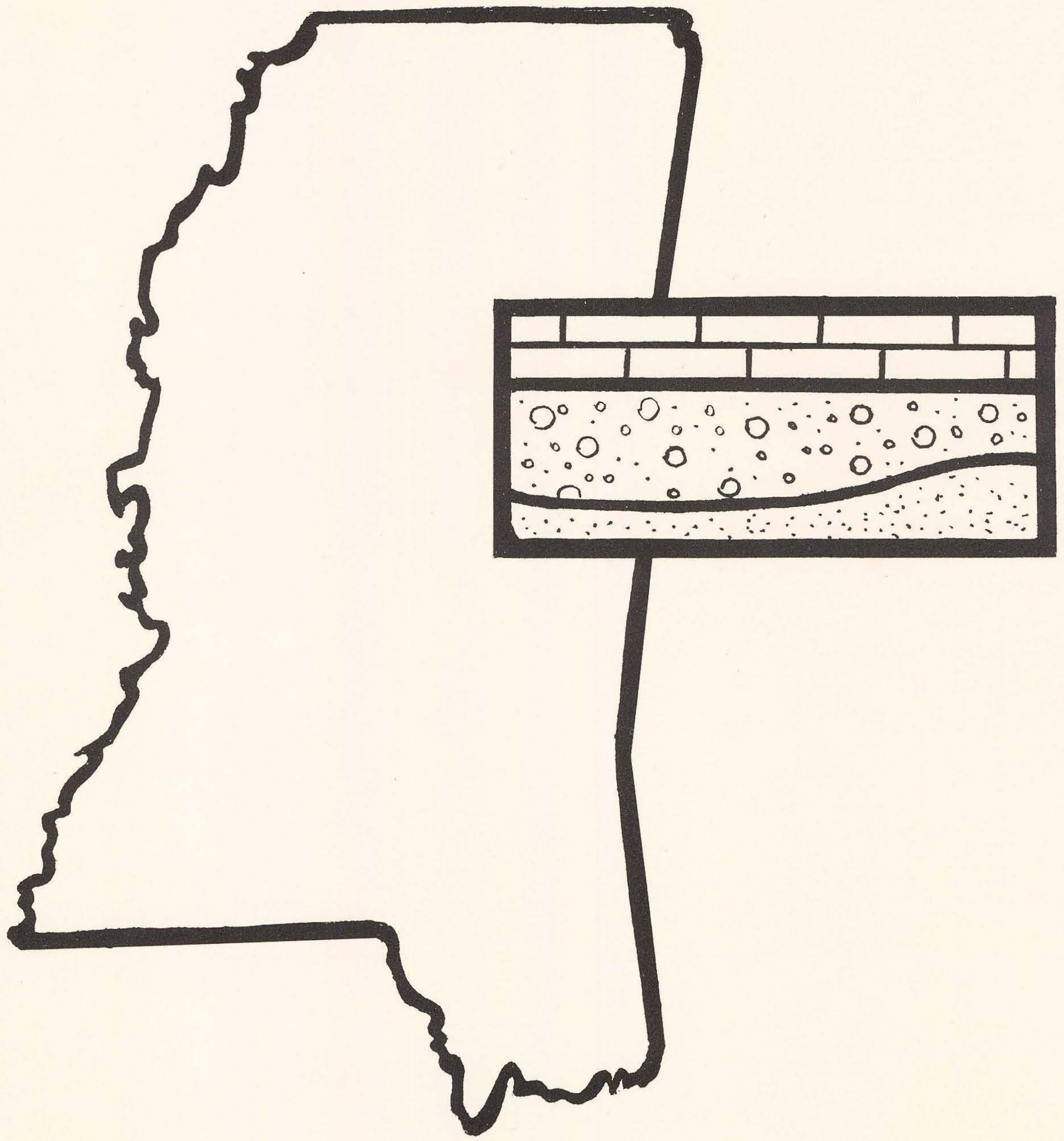
Surface elevations of the Jackson Prairie in this study area vary generally from 300 to 375 feet. The elevations in the Pearl River flood plain, of course, are lower than those found on the prairie itself.

The Vicksburg Hills form a belt of gently rolling to somewhat rugged uplands. This belt is underlain by the silts and clays of the Forest Hill Formation, marl of the Mint Spring Formation, and limestone and marl of the Glendon Formation. This variety of lithologic units, with their varying degrees of resistance to erosion, is responsible for the relative ruggedness of the area. Elevations in excess of 450 feet are found in the Vicksburg Hills and are as low as 270 feet in some of the major creek bottoms.

The Vicksburg Hills, at one time, apparently encircled the Jackson area as a result of a structural uplift. The Pearl River drainage system has breached this belt northeast of Jackson.



GEOLOGY



GENERAL GEOLOGY

Regionally this study area is located on the eastern flank of the Mississippi Embayment geosyncline. The axis of the geosyncline trends north-south and is located in the vicinity of the Warren-Hinds County line. Beds found in the general area are normally dipping approximately 25 feet per mile to the west and southwest. This regional dip is toward the axis of this structural trough.

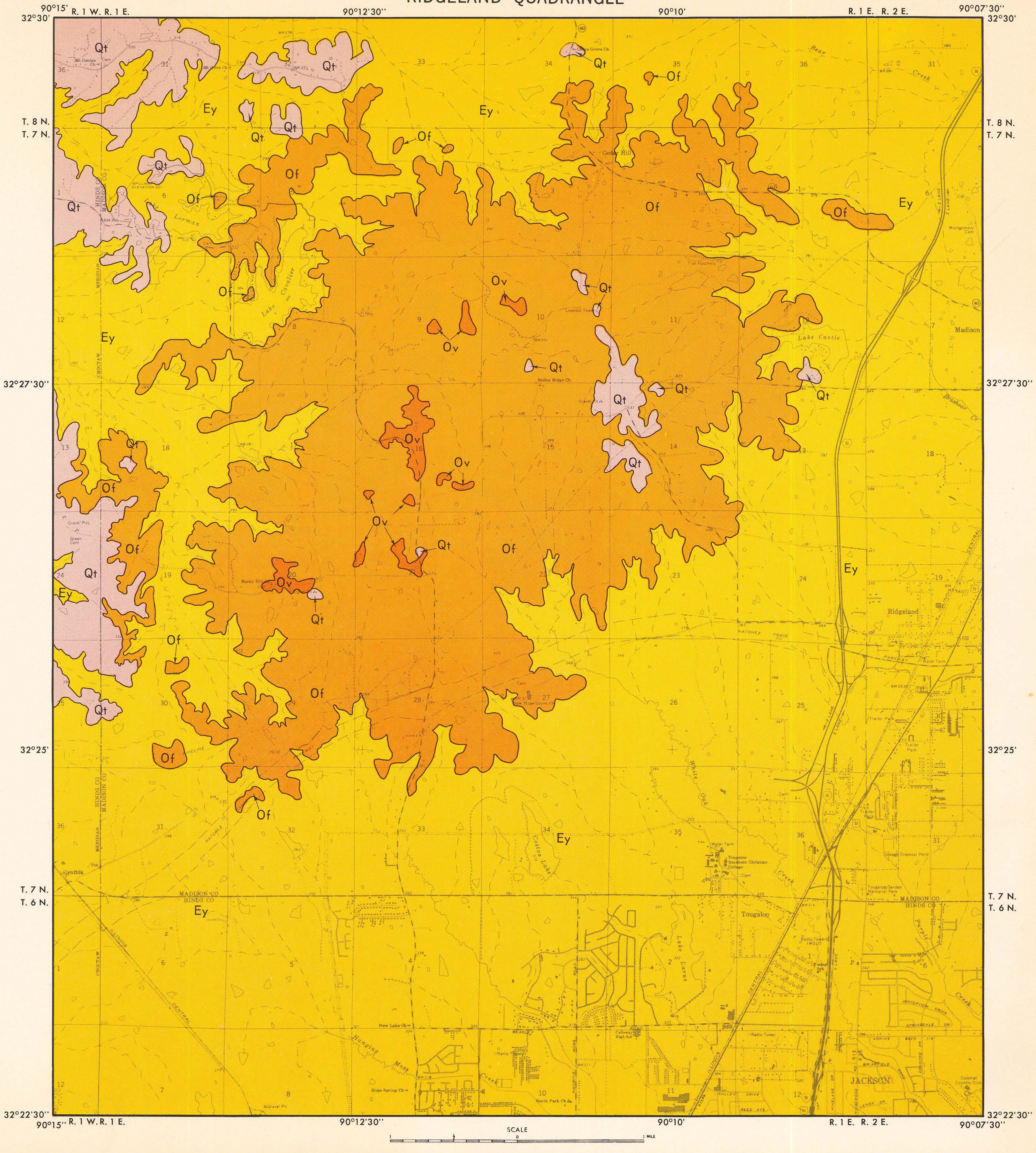
The regional dip is greatly altered in this area of study by a structural uplift at Jackson. This uplift, the Jackson Dome, causes all of the beds to dip away from its crest, which is located between east Jackson and the community of Flowood on the Jackson quadrangle.

All of the rocks exposed in the area are of sedimentary origin. These sediments are of the Eocene, Oligocene, and Miocene Series of the Tertiary System, and the Pleistocene Series of the Quaternary System. The outcrop areas of the major formations found in these units are shown on the quadrangle maps in this section. Since most of these formations are covered by soil, stream alluvium, colluvium, or water, the maps were prepared as if these surficial deposits and water bodies had been removed. Consequently, if a person goes to the field with these maps, he will not always see the formation the map indicates should be present. The most probable places to see these formations are in roadcuts and along some of the stream banks.

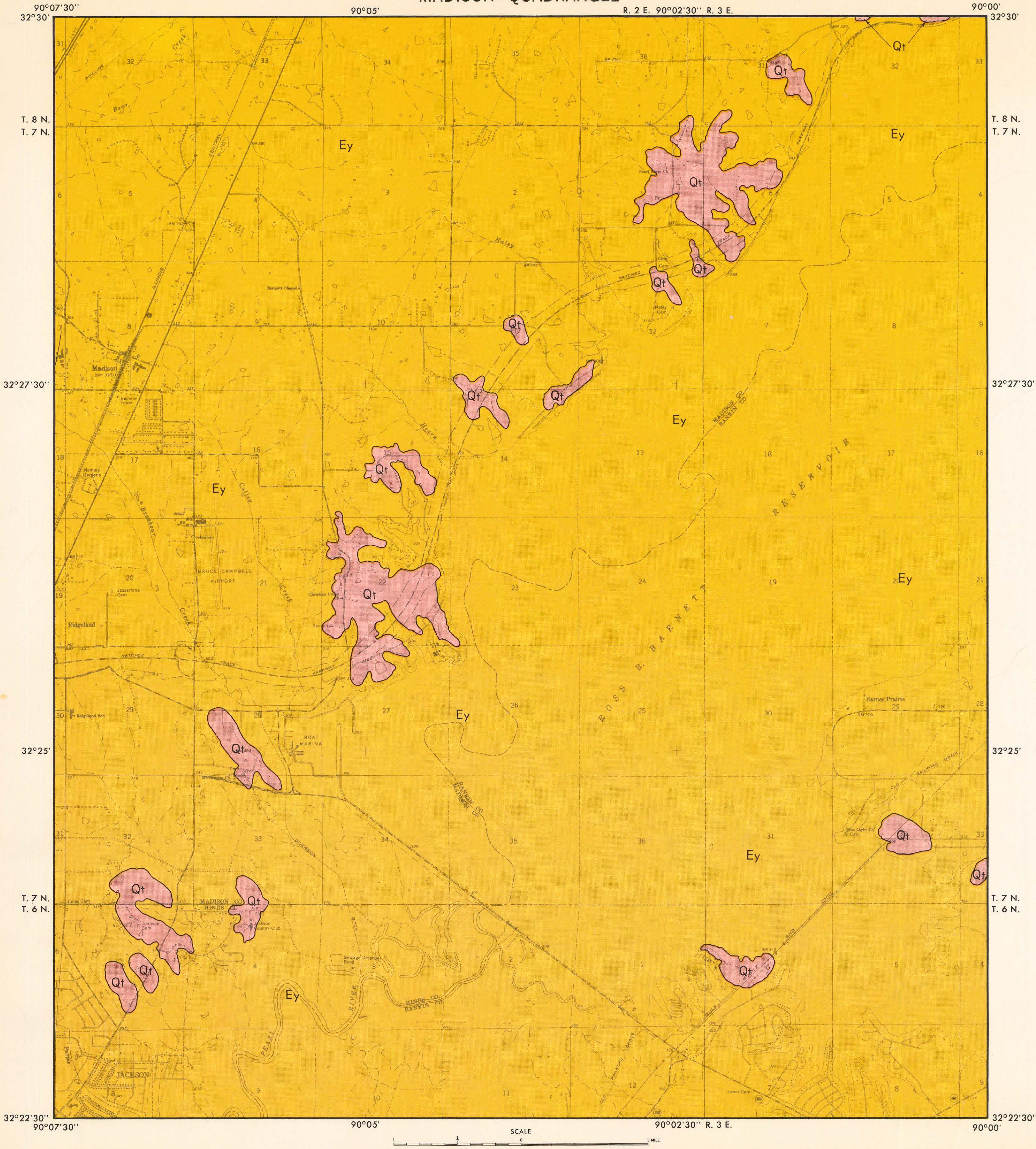
The oldest formation exposed in the study area is the Cockfield of Eocene age. The Cockfield is found in an elliptical pattern under the Pearl River flood plain on the eastern side of Jackson. The Cockfield would normally have been expected to be about five hundred feet beneath the surface at Jackson, but it has been structurally uplifted by the Jackson Dome. The Cockfield is about 225 feet thick over the crest of the dome and thickens considerably downdip. This formation consists of gray, silty, carbonaceous, micaceous clays, and fine-grained, silty sands. Thin beds of lignite are also found in the formation. The Cockfield will usually weather to a brown color. The Cockfield sands are utilized as an aquifer in the study area where it dips away from the crest of the Jackson Dome. It is commonly believed, therefore, to be receiving some recharge from the Pearl River.

The Cockfield is overlain by the Moodys Branch Formation of upper Eocene age. The Moodys Branch outcrop forms a narrow belt which encircles the outcrop of the Cockfield. In this study area the Moodys Branch is found exposed in several creek bottoms on the Hinds County side of the Pearl River, as well as along the western bluff of the flood plain. In the flood plain, however, it is buried under the alluvium. On the outcrop the Moodys Branch is a very limy, fossiliferous, clayey, glauconitic sand, and is usually a tan or yellowish color. The color is green to gray-green when the material is fresh. The Moodys Branch is about 15 feet thick near the crest of the Jackson Dome, but it attains thicknesses in excess of 30 feet in the surrounding area.

RIDGELAND QUADRANGLE



MADISON QUADRANGLE



Overlying the Moodys Branch is the massive Yazoo Formation. The Yazoo Formation (popularly referred to as "Yazoo Clay" by local residents), when fresh, is blue-gray, limy, fossiliferous, hard clay. This material weathers to a tan color and usually will be altered to a depth of 25 or 30 feet. The outcrop of the Yazoo occupied a large portion of the study area. In the weathered state, this material has the detrimental characteristic of being highly expansive. This characteristic can cause serious construction problems unless proper design methods are utilized. The Yazoo Formation's thickness is in excess of 450 feet in the area surrounding the Jackson Dome, but it is considerably thinner near the crest.

The Forest Hill Formation of Oligocene age overlies the Yazoo Formation. An erosional outlier of the Forest Hill is found in the Ridgeland quadrangle area, and a belt trending northeast-southwest is found in the Jackson SE quadrangle area. The Forest Hill is composed primarily of fine-grained, silty, micaceous sands, and silty, carbonaceous clays with a few thin seams of lignite. The formation is thinly bedded and on the outcrop presents a laminated appearance. Generally, the thickness of the Forest Hill is variable in the subsurface around the Jackson Dome, but in the study area it is found to be between 70 and 100 feet in the borings examined for this work. Sands in the Forest Hill are supplying fresh water to wells to the southwest, south, and southeast of the city of Jackson. The aquifers are believed, therefore, to be receiving some recharge in the Jackson SE quadrangle. Most of this recharge is probably being derived from streams flowing over the outcrop area.

LEGEND

(For all four Geologic Maps)

QUATERNARY	PLEISTOCENE	Qt	Pre-Loess Terrace – fine-to coarse-grained sand with clay lenses; some fine gravel.
TERTIARY	MIOCENE	Mc	Catahoula Formation – sandy, silty clays; silts and siltstones; fine-grained sands and sandstones.
	OLIGOCENE	Ov	Vicksburg Group – includes in descending order: Bucatunna dark-brown clay; Byram clayey marl; Glendon limestone and marl; Mint Spring sandy marl and limy sands.
		Of	Forest Hill Formation – fine-grained, silty sands; silty, carbonaceous clays; lignite.
	EOCENE	Ey	Yazoo Formation – blue-green, limy clay; weathers tan to yellow; slumps badly.
		Emb	Moodys Branch Formation – fine-to medium-grained, limy sands; sandy marl.
		Ec	Cockfield Formation – silty clays; fine-grained, silty sands; lignite.

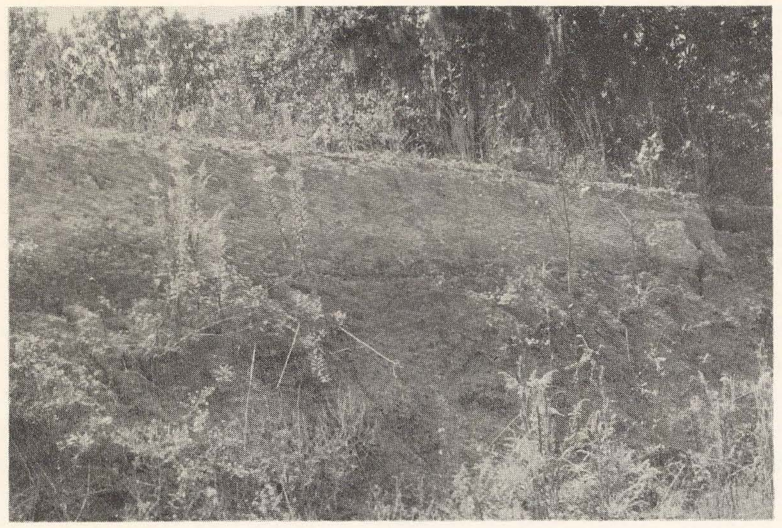


Figure 5. - Marl of Mint Spring Formation overlying clayey silts of the Forest Hill Formation. NW/4 of Sec. 16, T.7 N., R.1 E., Madison County.

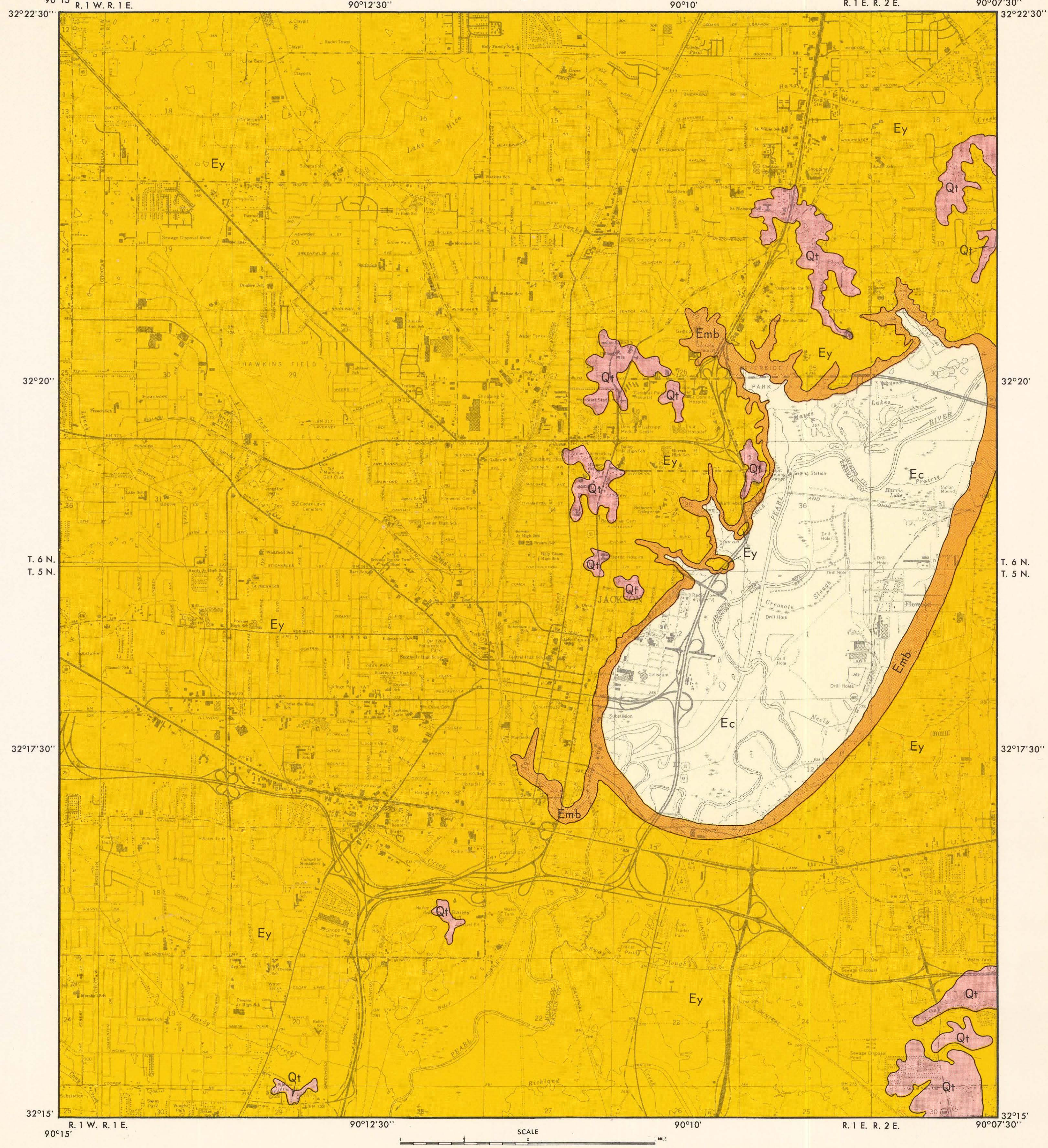
The Vicksburg Group of Oligocene age appears as one stratigraphic unit on these geologic maps. Actually, the Vicksburg is composed of four marine units. In ascending order these are the Mint Spring, the Glendon, the Byram, and the Bucatunna Formations. The Vicksburg is mapped as one unit because there are some questions concerning contacts between the various units. Resolving these problems within the Vicksburg was not considered within the scope of this study.

The Mint Spring consists of gray-green, sandy, fossiliferous marl, and averages about twenty feet in thickness. The Glendon is composed of alternating beds of gray, fossiliferous, slightly sandy limestone and gray-green, sandy, fossiliferous marl. The number, thickness, and stratigraphic position of these limestone beds are not constant, and this constitutes one of the problems in trying to map the unit in this area. The thickness of the Glendon averages between 30 to 40 feet. The Byram overlies the Glendon and consists of gray-green, fossiliferous, clayey marl and limy clay. It varies in thickness from 10 to 20 feet in this study area. The Bucatunna is the youngest unit included in the Vicksburg Group. It is a dark-gray to black clay with silt laminae. The Bucatunna is totally absent in some places in this area, while in other localities it achieves thicknesses approaching 25 feet.

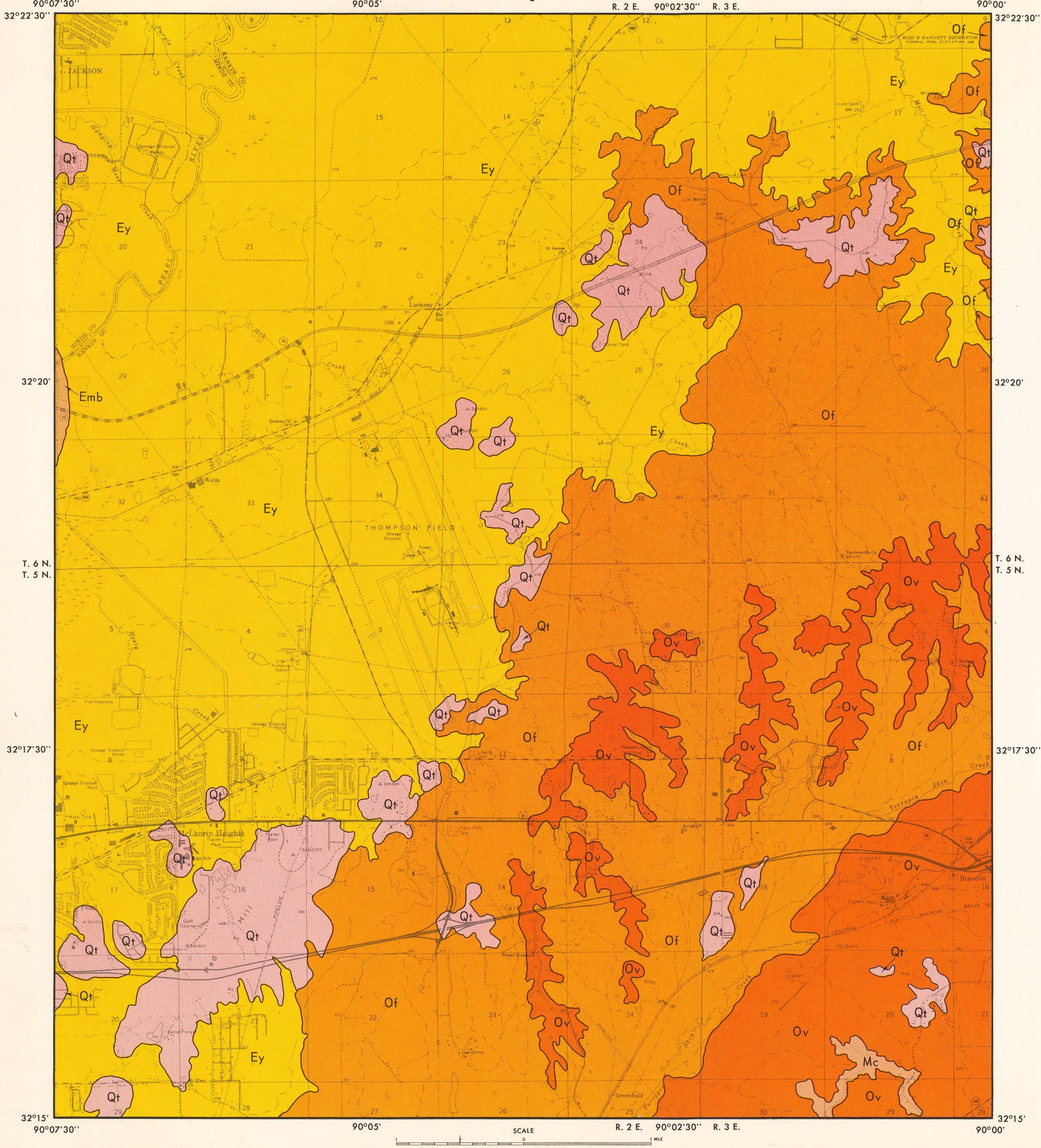
Beds of the Catahoula Formation overlie the Vicksburg, and, are found only in the southeastern corner of the Jackson SE quadrangle. The Catahoula of Miocene age consists of gray to white, fine to coarse-grained sands, and gray to white silts and clays. The silts are locally indurated to form layers of siltstone. The observed thickness of the Catahoula in the study area was about 20 feet, but in the subsurface immediately to the south of the area it is over 250 feet thick.

Terrace deposits are found capping many of the higher hills in the study area as well as some of the lower hills adjacent to the Pearl River flood plain. They possibly represent the remnants of deposits which at one time may have covered most of the area. These deposits are composed of fine- to coarse-grained sands with occasional clay lenses. A few thin gravel lenses also were observed in some of these terrace deposits.

JACKSON QUADRANGLE



JACKSON SE QUADRANGLE



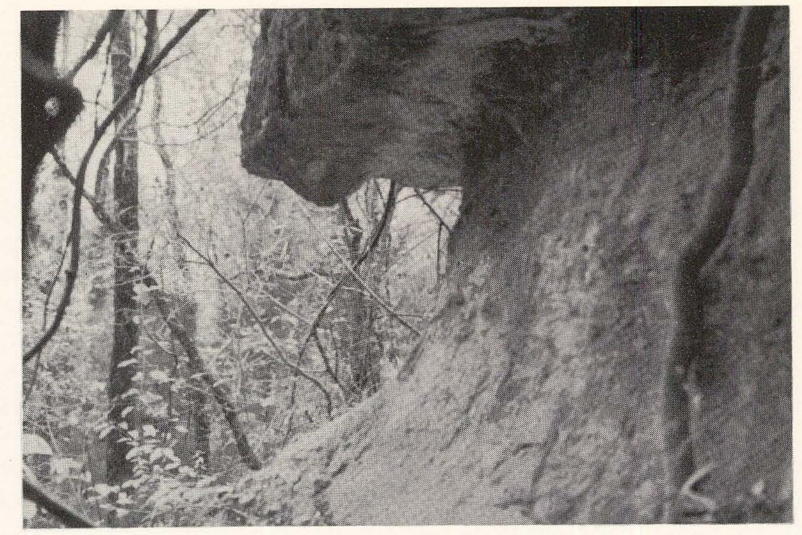


Figure 6. - Glendon Formation limestone ledge overlying Mint Spring Formation. SW/4 of Sec. 9, T.7 N., R.1 E., Madison County.

Figure 7. - Slump in clay of Yazoo Formation causing slight displacement of county road. Sec. 24, T.7 N., R.1 E., Madison County.

FLOOD PLAINS

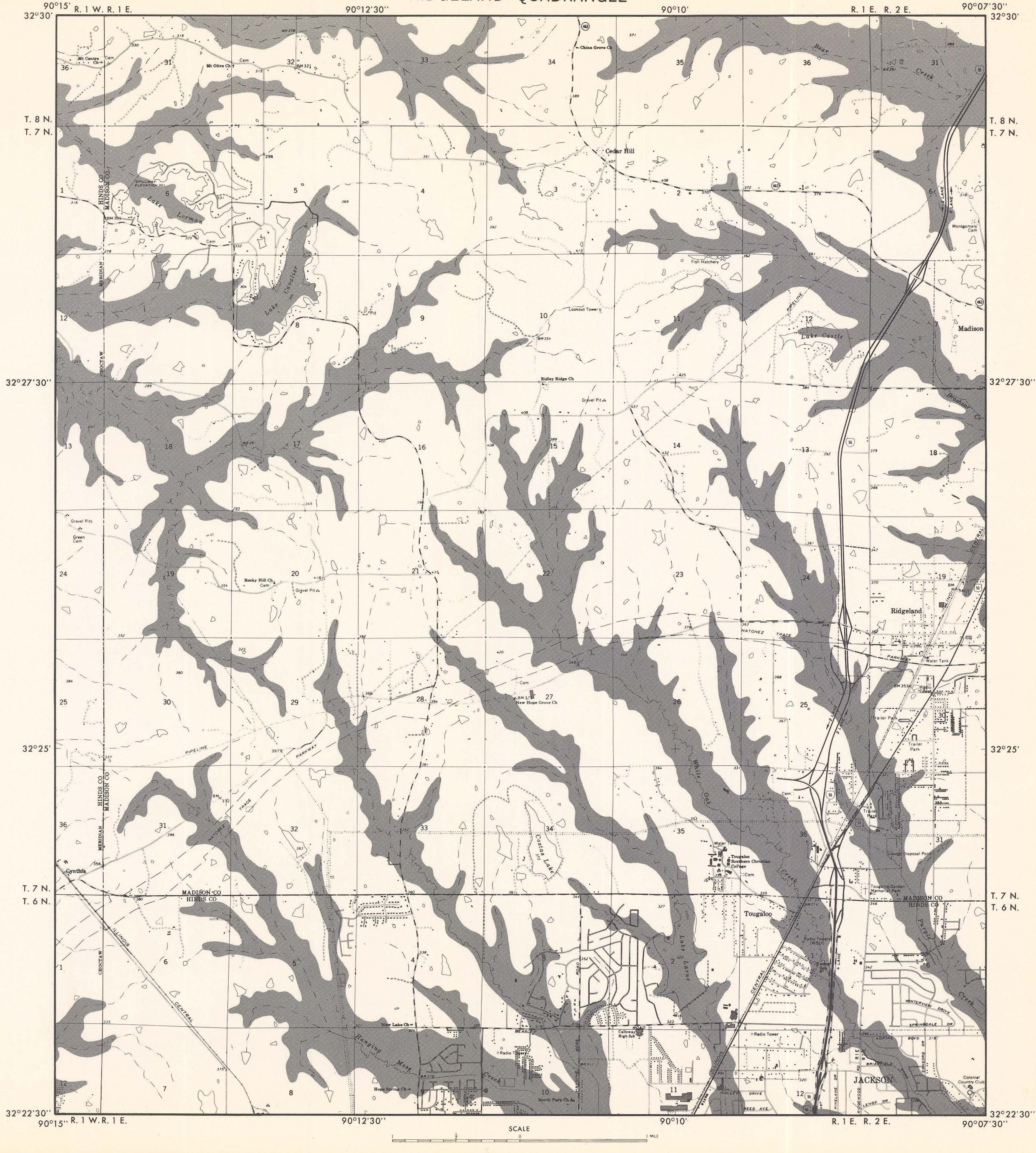
Flood plains, by general definition, are low, flat areas that are subject to periodic flooding by near-by streams. The flood plain is actually formed by, and is a part of, the stream system itself. It is a natural function of streams to overflow their banks and inundate the adjoining flood plains during seasons of heavy precipitation. At these times, the streams carry a greater amount of sediment than usual because of the increase in the velocity of the water and the increased erosion of the land upstream. After the flood crests, the velocity of the water will decrease, and the sediment load will be deposited. This is how flood plain, natural levee, sand bar, and channel fill deposits are formed. Collectively, this material is called alluvium. The areas shown in gray on the maps in this section portray the deposits of alluvium in the study area. These maps are not intended to delineate flood-prone areas, but merely to indicate the location of materials deposited by natural stream processes in the past few thousand years. Certain areas that are subject to flooding today, however, can be found within the boundaries of these deposits of alluvium.

The primary areas in the limits of this study that are subject to flooding are located in the lowlands along the Pearl River. Minor local flooding resulting from downpours, of course, is possible along most of the creeks of the area. The Ross R. Barnett Dam and Reservoir shown on the Madison quadrangle do not control the flooding situation downstream on the Pearl River simply because the structure was not designed for flood control.

The repetitive inundation of the flood plain of a stream is a normal event in the natural history of that stream. Consequently, from a geologist's point of view, these are not catastrophic events. The "catastrophe" angle comes when these floods destroy or damage the works of man that were built on the flood plain. Some of the photographs in this section show scenes of the major flooding which occurred in the lower Yazoo River basin in the spring and fall of 1973. This flood was catastrophic because of extensive damage to residential and commercial structures as well as by delaying the planting of crops which are vital to the economy of that particular area. Photographs of flooding along the Pearl River during the spring of 1974 are also shown. Damage here was not nearly as extensive as it was in the lower Yazoo basin.

Proper land-use zoning for flood plains is a community's best defense against tragic and economic losses caused by flooding. Regulating land use in flood plains should insure that they are used only for agriculture, parks, playgrounds, or other uses that do not require much in the way of expensive and permanent structures. The dollar value of damage resulting from floods increases each year. The primary reasons are increased property values and increases in the amount of development in these flood-prone areas.

RIDGELAND QUADRANGLE



MADISON QUADRANGLE

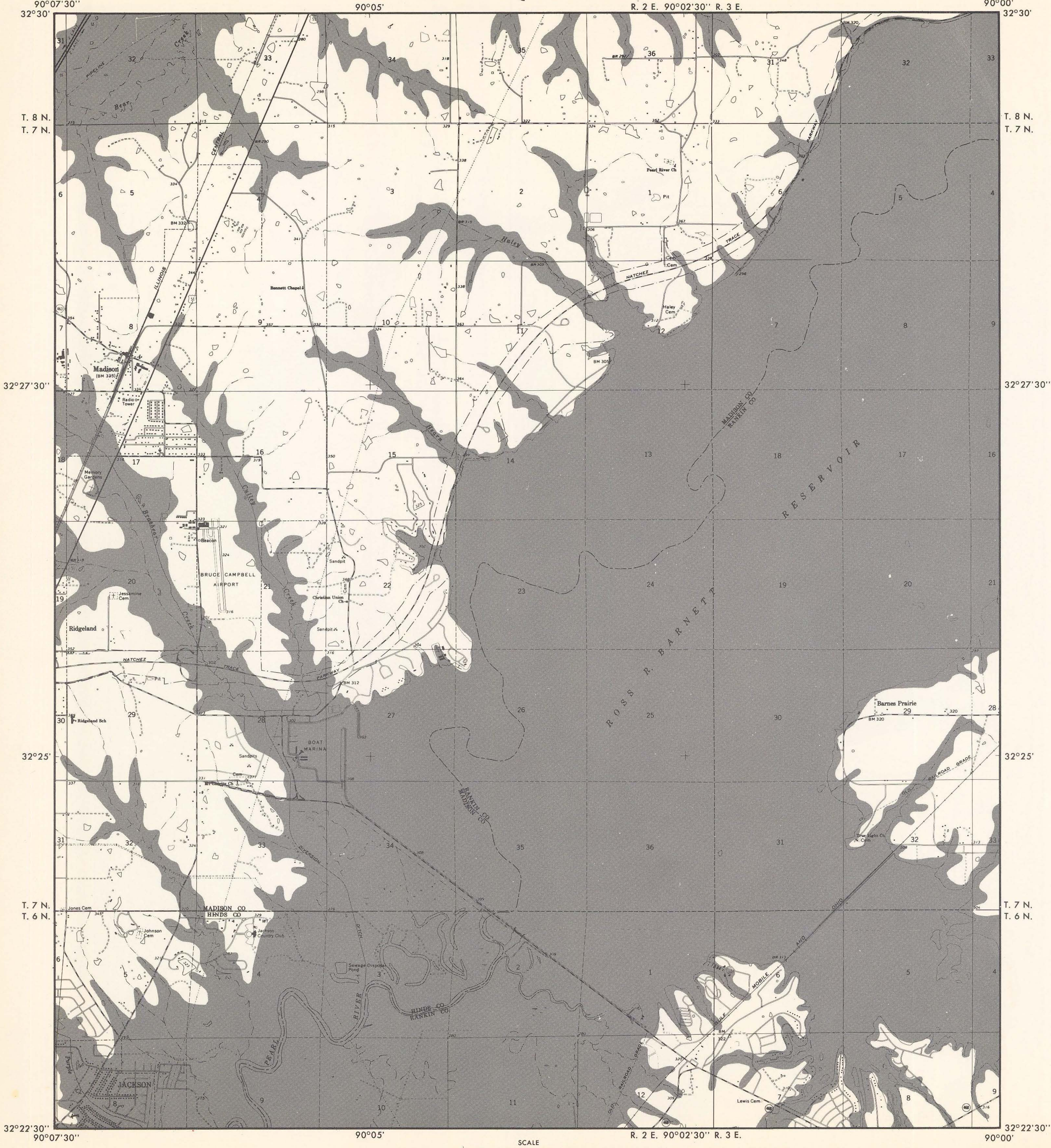
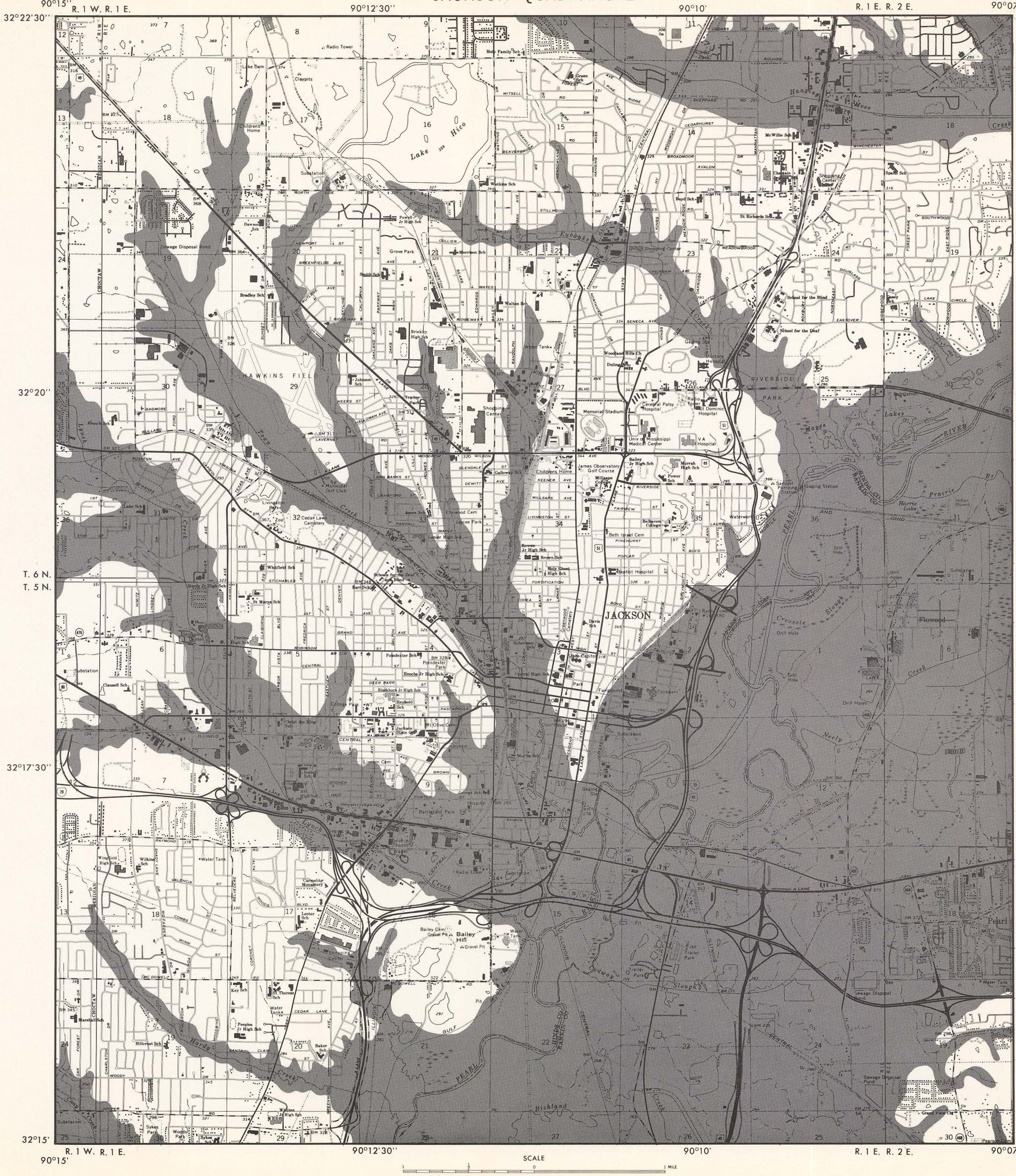


Figure 8. - Major flooding in lower Yazoo basin in the spring and fall of 1973 caused great damage to both commercial and residential property.

Much of the problem may be solved by regulating land uses in the flood plains, but the situation can become somewhat complicated in a metropolitan area. Urbanization affects the hydrologic regimen of a local area. The amount of runoff increases as a result of urbanization because plants that formerly assisted in holding moisture in the soil are removed to make way for streets, parking lots, and buildings. These impervious surfaces prevent rain water from entering the soil and replenishing ground-water supplies. The stream, therefore, is compelled to carry more water after urbanization than before. Flood crests are higher as a result. These crests come sooner after a heavy rainfall, and their frequency is increased because the normal capacity of the stream will be exceeded more often. Since the ground-water quantities are not so readily replenished, the flow of the stream in the dry season is reduced still further because there isn't enough ground water to feed the stream sufficiently. A stream, consequently, can be turned into a foul-smelling trickle at these times of low flow.

Figure 9. - Major flooding in lower Yazoo basin in fall of 1973.

JACKSON QUADRANGLE



It should be remembered that a stream in its natural state is controlled by complex geologic, hydrologic, and topographic factors. Man must be careful when he modifies the configuration of a stream. Levees may be beneficial and important to a certain locale but may cause the magnitude of a flood to increase as it moves downstream. When a river is prevented by levees from spreading over its flood plain, the water level in the constricted channel must rise, resulting in a much worse flood downstream than usual. Channelization can also cause problems such as increasing the gradient of the stream, thus worsening flood conditions below the channelized section, and increasing the erosion of the banks of the stream and its tributaries. The works of man can, therefore, upset a delicate balance if proper care is not taken.

JACKSON SE QUADRANGLE

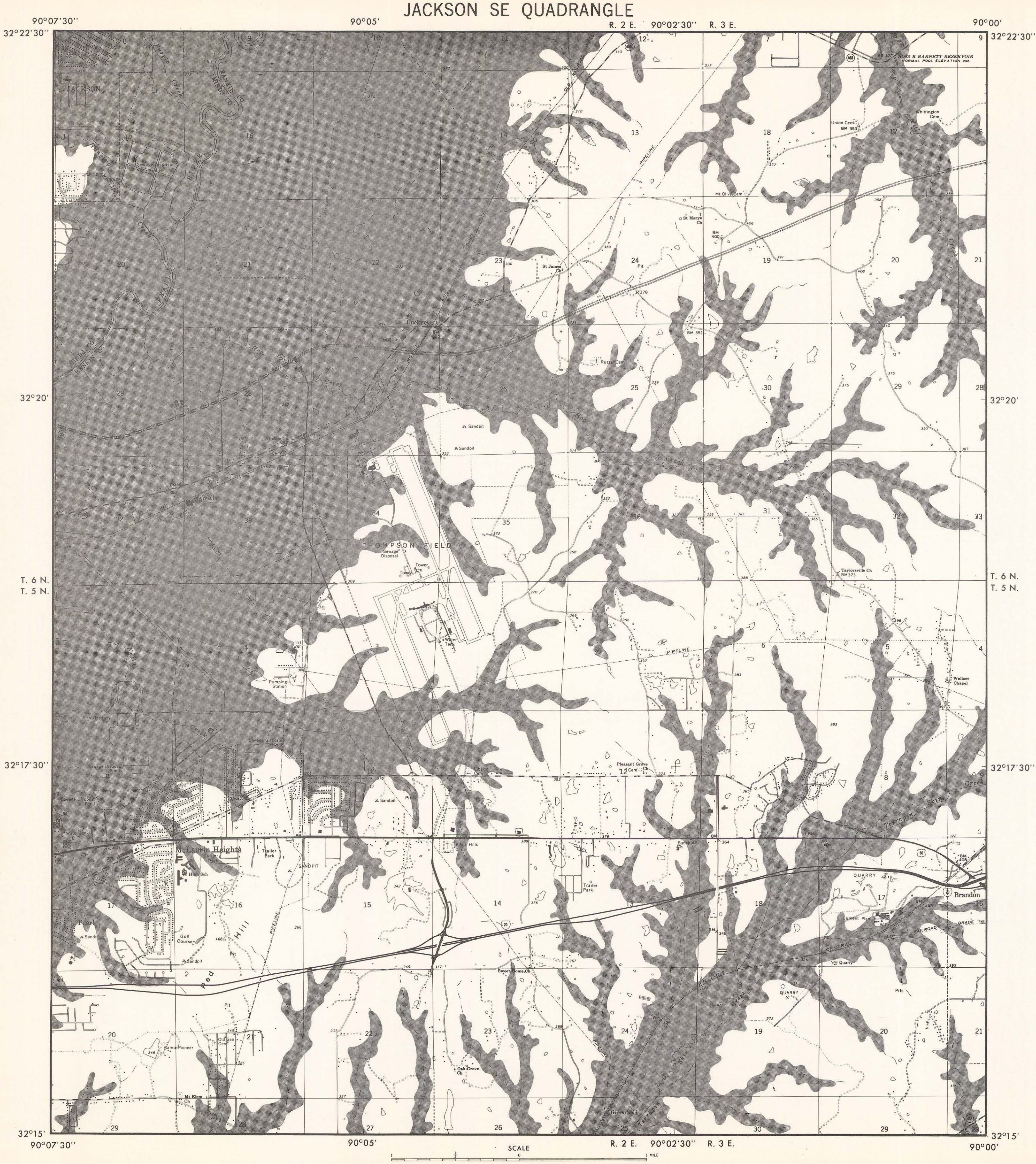


Figure 10. - Flooding in a part of northeast Jackson in the spring of 1974.

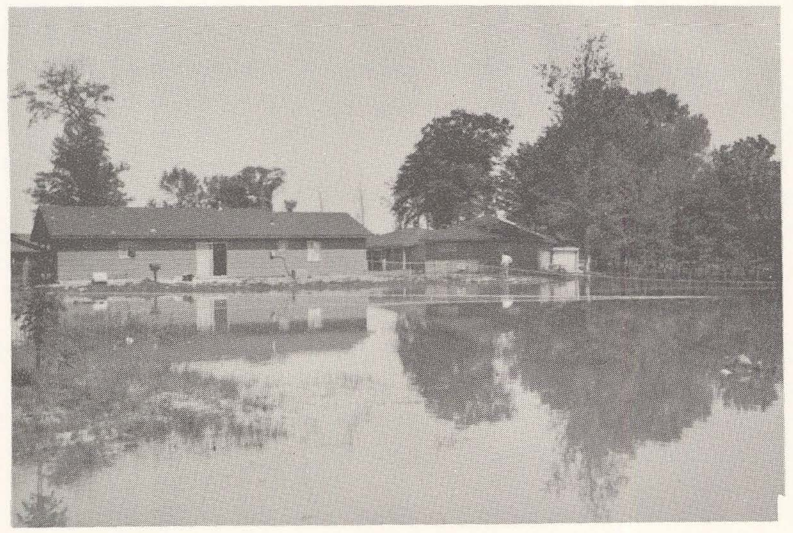


Figure 11. - Developers being allowed to build residences in floodplains usually cause economic problems to individual homeowners as well as taxpayers in general.

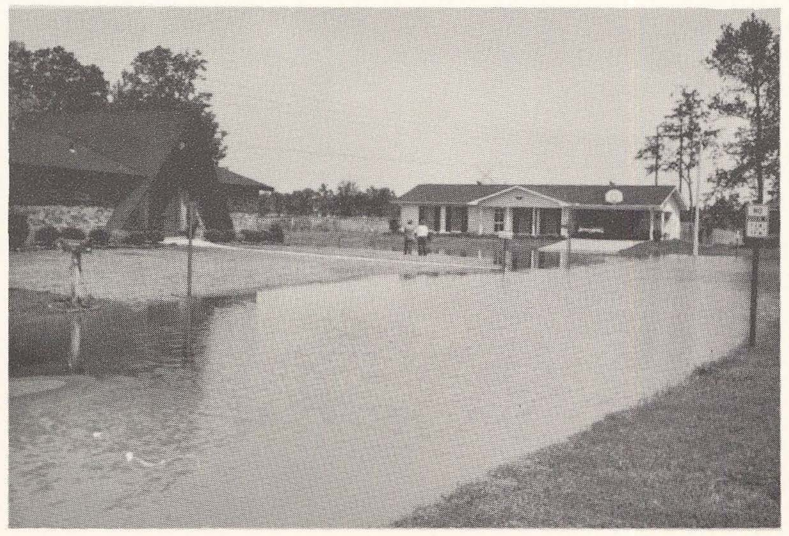


Figure 12. - Northeast Jackson residential area flooding in spring of 1974.

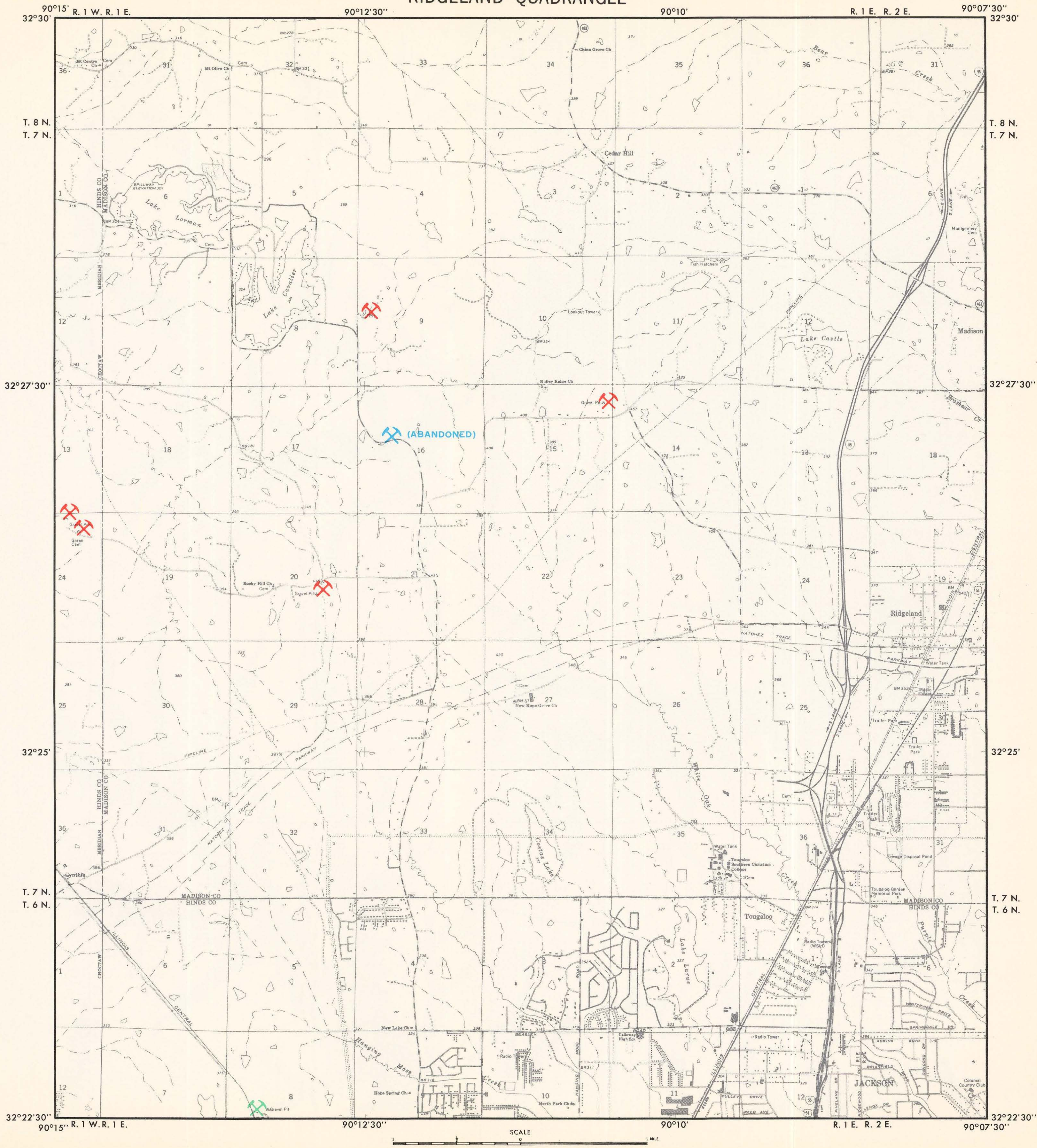
MINERAL RESOURCES

Mississippi mineral production does not include such exotics as gold, silver, platinum, or diamonds. Nevertheless, there is significant mineral production taking place within the State. The total value of Mississippi's mineral production in 1972 was in excess of 260 million dollars. Crude oil and natural gas accounted for approximately 85 percent of this figure, but sand, gravel, stone (primarily limestone), and assorted clays contributed significantly to the economy of the State. These basic materials are essential for the maintenance of our standard of living. They are primary ingredients in the production of various fuels and certain construction materials. As a result of the energy shortage the Nation is presently experiencing, exploration for petroleum has been stepped up, and the evaluation of the State's lignite deposits has begun. Mississippi's mineral production may increase as a result.

Hinds, Rankin, and Madison Counties contributed approximately 10.5 million dollars (about 4 percent) to the value of the State's mineral production in 1972. The majority of this value, approximately 7.2 million dollars, was supplied by Rankin County alone.

The mining of limestone for the purpose of manufacturing portland cement is currently the primary contributor to the value of mineral production in Rankin County. The locations of limestone quarries are shown on the map near the southeastern corner of the Jackson SE quadrangle. Petroleum is also a major source of mineral revenue in the county, but there are no oil or gas fields located in this study area. Minor amounts of sandstone and siltstone from the Catahoula Formation have been utilized as building stone in Rankin County. A study of the clay deposits in the county has revealed that material is available which is suitable for the manufacture of brick, tile, lightweight aggregate, and pottery. These deposits have not been developed to date, however. This study area is one of the fastest growing sections of Mississippi, and as a result, there is a great deal of construction taking place. The extensive Citronelle sand and gravel deposits lie to the south of the area, unfortunately; thus most of these construction materials have to be transported into the Jackson vicinity. There are numerous terrace and flood-plain sand deposits in the Rankin County portion of the study area that are utilized by the county and communities for street and road construction.

RIDGELAND QUADRANGLE



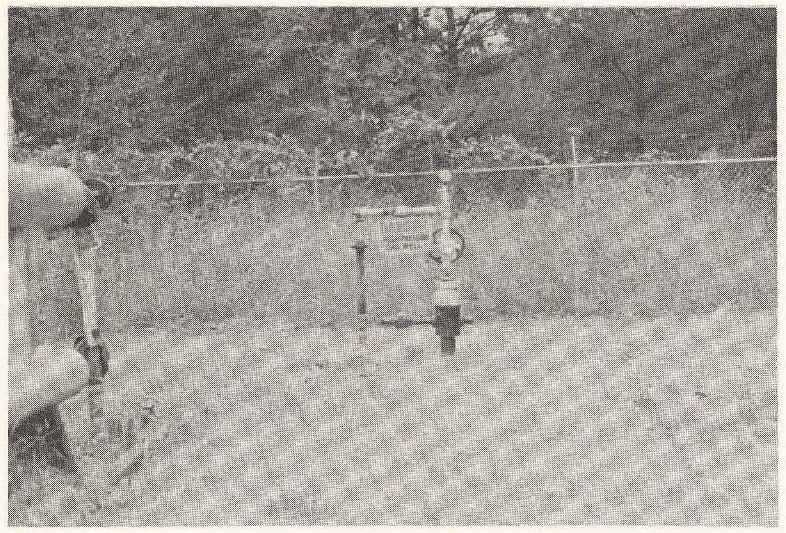
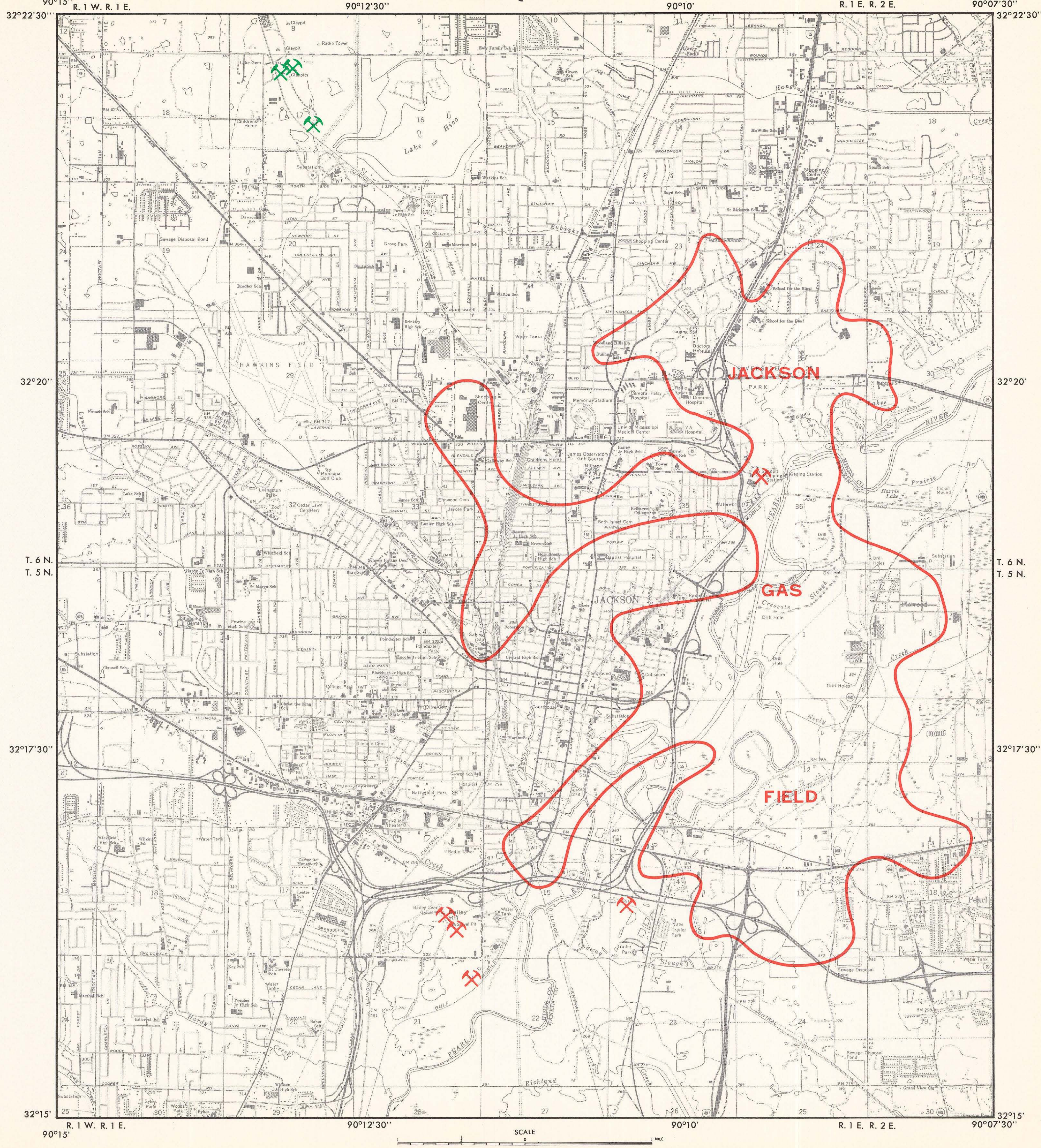


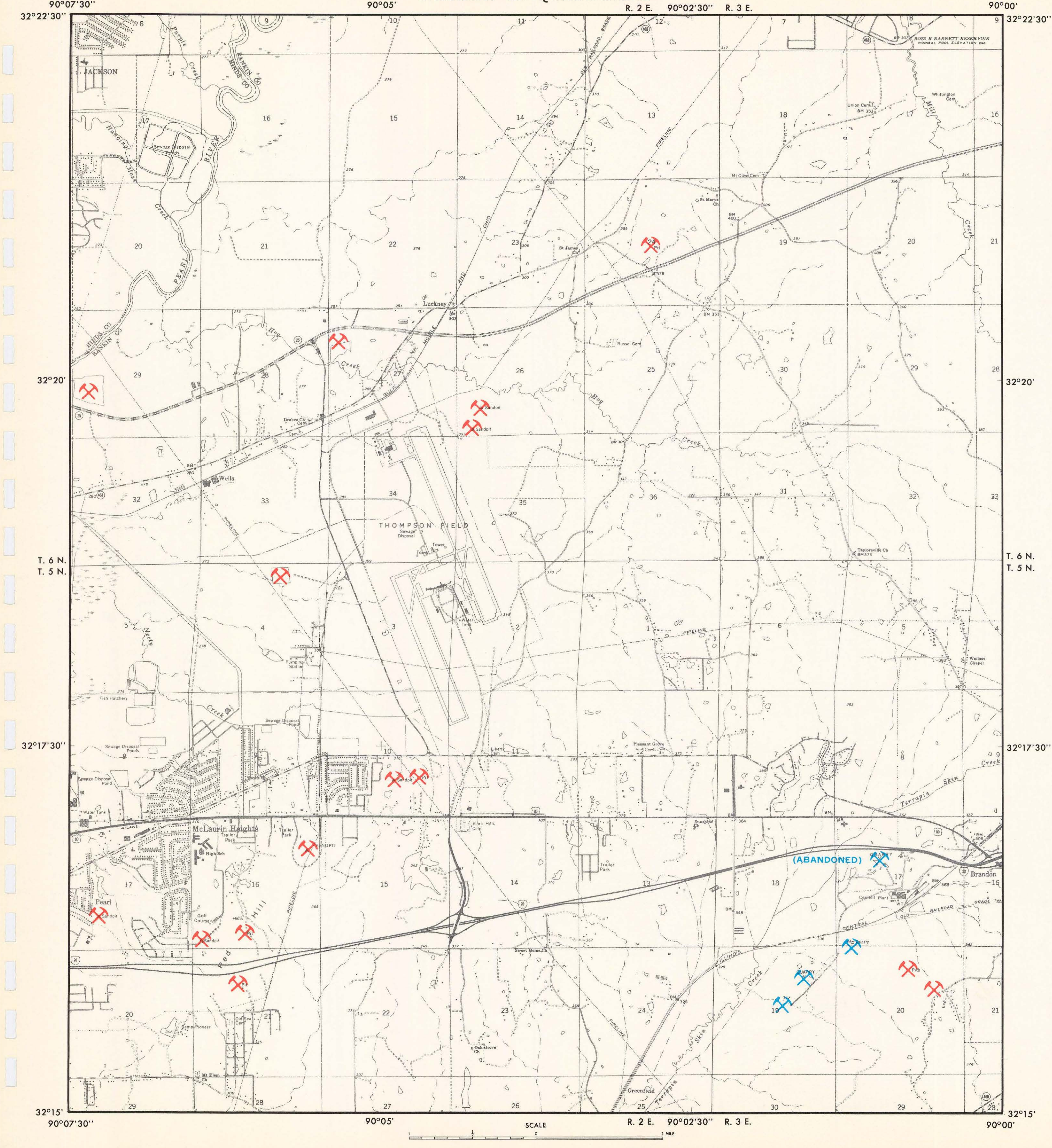
Figure 13. - Well presently producing gas in Jackson Gas Field.

Figure 14. - Jackson Gas Field well, drilled in 1932, still furnishing gas to a local college.

JACKSON QUADRANGLE



JACKSON SE QUADRANGLE



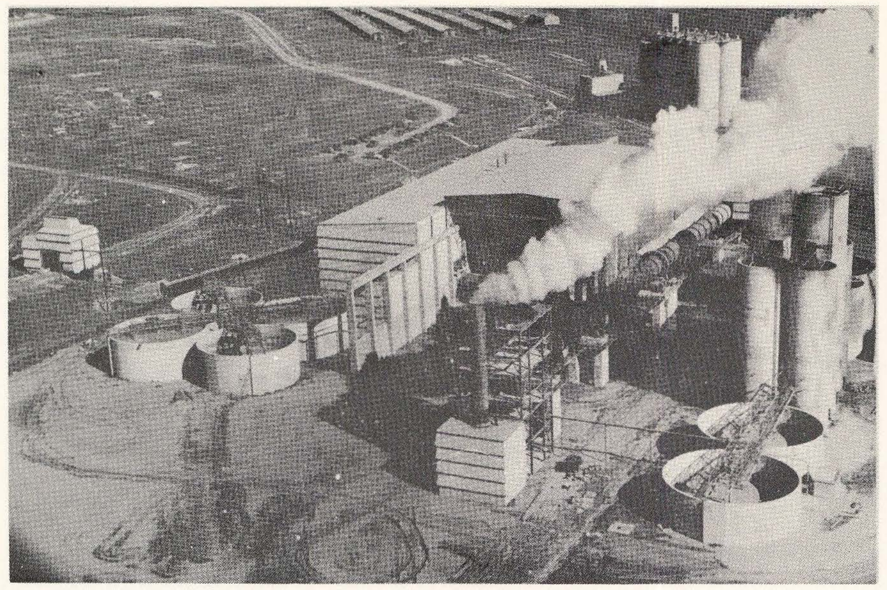


Figure 15. - Portland cement plant, located in Sec. 17, T.5 N., R.3 E., Rankin County. Marl and limestone from the Vicksburg Group provide raw materials.

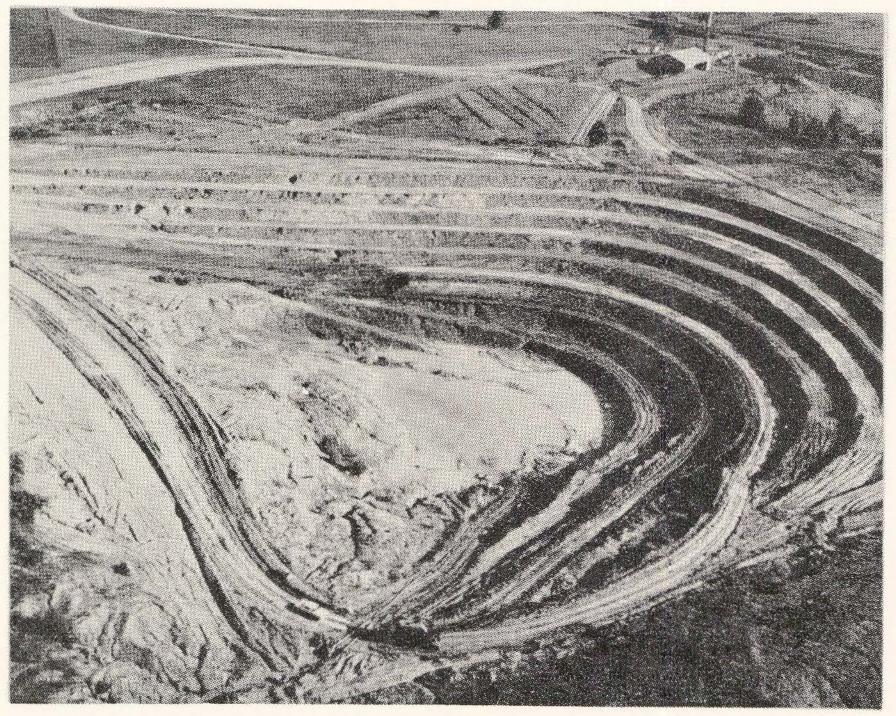


Figure 16. - Clay mined from this pit is used in the manufacture of lightweight aggregate.

JACKSON GAS FIELD

The Jackson Gas Field is located in the Gulf Coastal Plain on the eastern side of the Mississippi Embayment in Hinds and Rankin Counties. It lies entirely within the Jackson quadrangle of this study area.

A structural anomaly at Jackson was discovered by Eugene W. Hilgard, who stated in 1860 that strata at Jackson were at a higher elevation than the same strata at Canton, where under normal conditions the beds at Jackson would have been lower because they normally dip toward the south.

In 1916, O. B. Hopkins conducted further study of the area and came to the conclusion that there was a definite possibility of finding hydrocarbons in the subsurface around Jackson.

Atlas Oil Company and Benedum and Trees both drilled test holes in 1917. These holes had promising showings, but both were abandoned and there was no more activity in the area until 1927. At that time Mrs. Edna Rawls Reader leased state-owned land in the vicinity of what is now the University Medical Center and started a well. After many difficulties her well penetrated the "Gas Rock," but for some reason, probably because of the well being improperly handled, gas was not discovered. Later the site of her well was surrounded by producing wells.

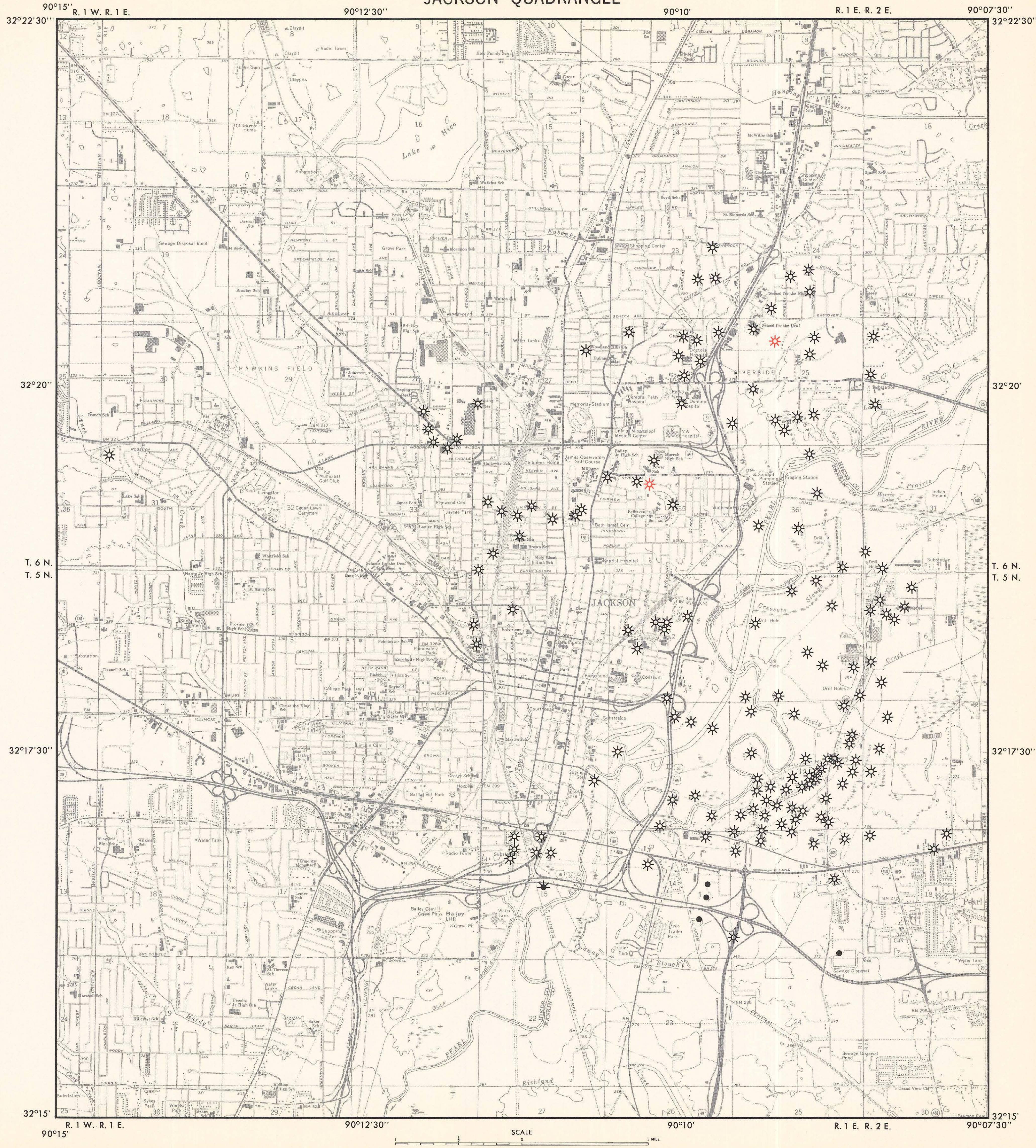
The discovery well was the Mayes No. 1 drilled by Cleve Love for the Jackson Oil and Gas Company in Section 2, T.5 N., R.1 E., Hinds County. This well was brought in February 16, 1930, and produced 1,700,335,000 cubic feet of gas until May of 1939 when it was drowned by salt water.

The well which produced more gas than any other in the field was also completed by Cleve Love. This well was the second producing well in the field and was the Mendoza Outing Club No. 1, located in Section 11, T.5 N., R.1 E., Hinds County. Completion date was May 2, 1930. This well produced until it was flooded by salt water in August, 1938. Total production for the Mendoza Club No. 1 was 4,075,379,000 cubic feet of gas.

LEGEND

- PRODUCING GAS WELL
- GAS WELL
- OIL WELL
- OIL WELL WITH SHOW OF GAS

JACKSON QUADRANGLE



The first well in the field to show noticeable amounts of oil was the Rainy 1-A, drilled by the Gulf Refining Company of Louisiana. Tests showed that this well contained oil, gas, and salt water. Efforts were made to complete the hole as an oil well but the attempts failed, and gas from the well was used as fuel to drill other wells. A total of four wells, all on the southern edge of the gas field in Rankin County, produced some heavy asphaltic oil, but not enough to be of commercial value.

Drilling activity was vigorous through 1932, and a few wells were completed each year through 1940. Wells have been drilled sporadically since. In 1969 the Victor P. Smith No. 1 State of Mississippi was completed as a gas producer. Below is a table which shows wells completed between 1917 and 1940.

In 1955 all wells which were still producing, with the exception of one, were shut in, and the Rankin County portion of the field was converted to gas storage. This one exception is still in use today and supplies gas to a local college.

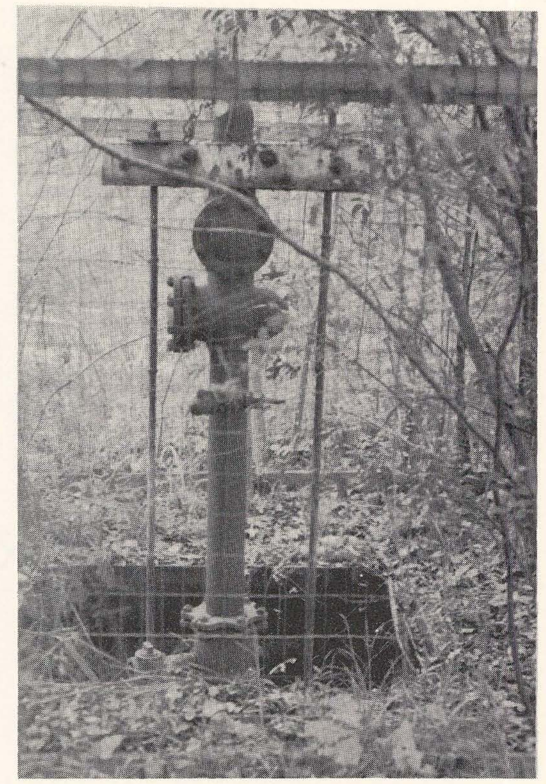


Figure 18. - Abandoned well in the Jackson Gas Field.

WELLS COMPLETED BY YEARS

	1917	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Total
Gas wells			30	35	35	15	8	5	2	3	6	1	1	141
Gas well lost by blow out									1					1
Small gas wells never on pipe line			2	2	1	4		1					1	11
Dry holes in limits of field		1	12	11	4	2		4	4	1	1	3	1	44
Dry holes drilled outside limits of field	2	1	3	6	2	1	6					1	3	25
Total wells drilled	2	2	47	54	42	22	14	10	7	4	7	5	6	222

Source: USGS Bulletin 986, p. 124 (1954)

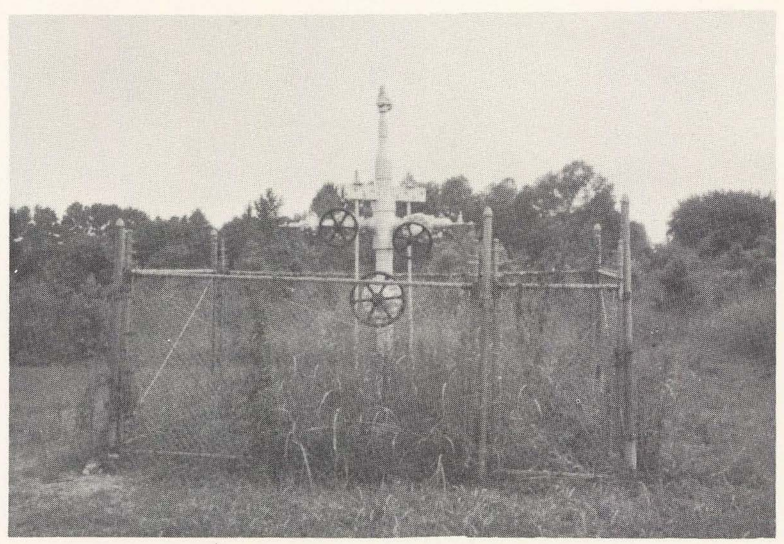


Figure 17. - Abandoned well in the Jackson Gas Field.

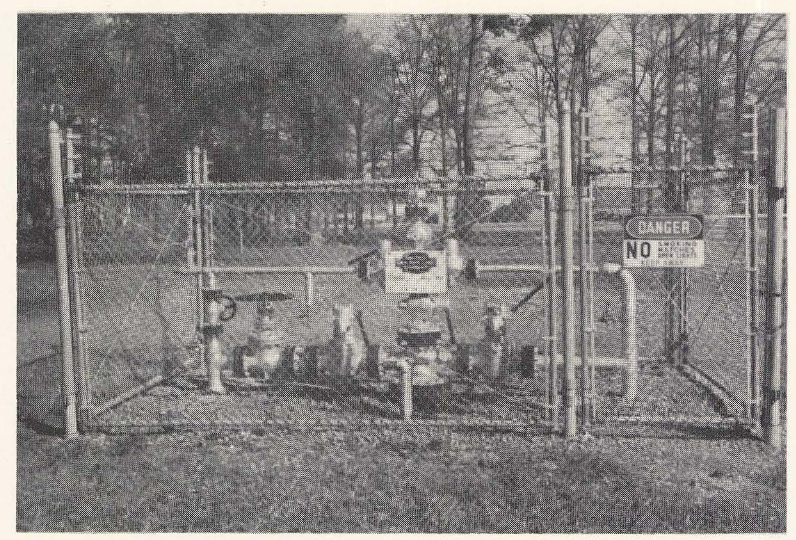


Figure 19. - Gas reservoir injection well.

JACKSON DOME

The principal structural feature within this study area is the Jackson Dome. The dome is an elongate anticline which extends northeast to southwest with a length in excess of 25 miles and a maximum width of 23 miles. The crest of the dome is in the Belhaven College area of the city of Jackson in Sections 35 and 36, T.6 N., R.1 E. Geologic strata dip in all directions from this crest for a distance of approximately 10 miles.

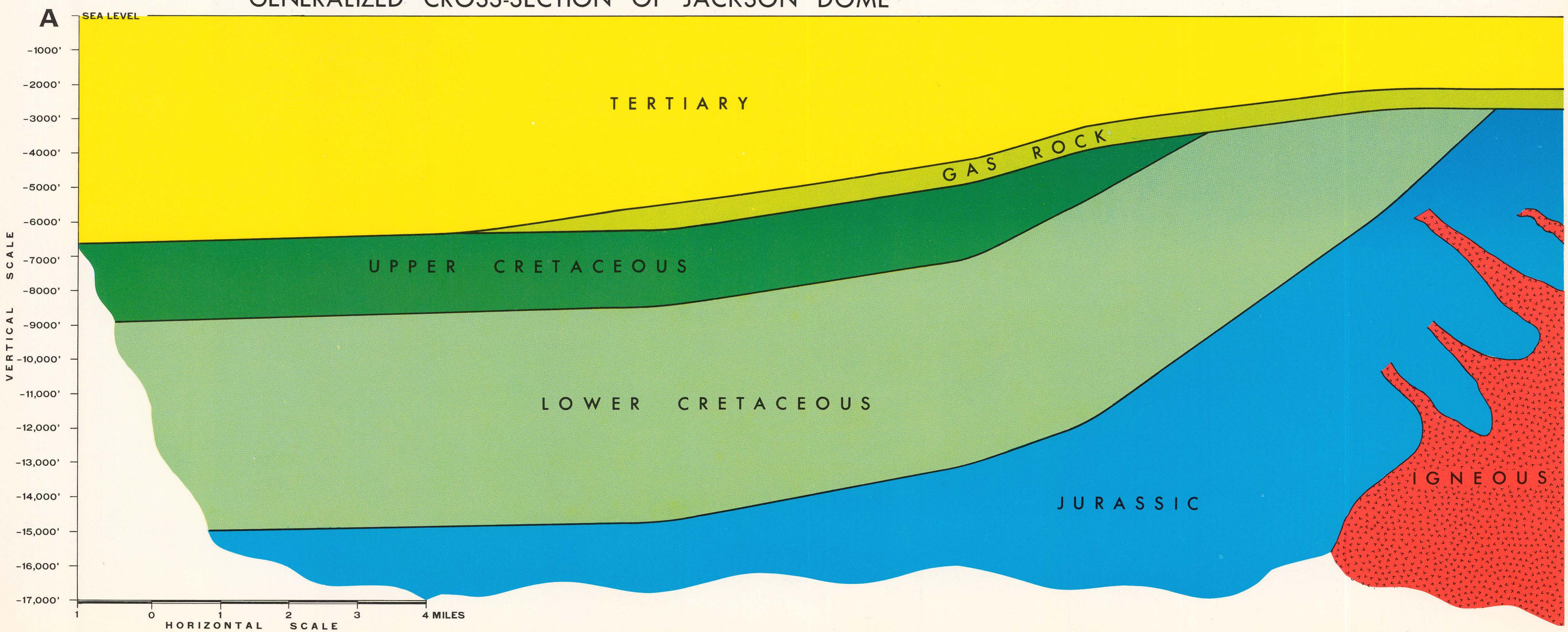
Approximately seventy million years ago a sea covered what is now Mississippi, and sediments of sand and clay were deposited throughout the area. At this same time, intense volcanism was occurring from Arkansas southeastward to the Jackson area. Igneous rock intruded its way upward through the overlying sedimentary rocks forming dikes and sills, and in certain places where the earth's crust was weaker than elsewhere, this igneous rock reached the surface and was expelled into the atmosphere by the violent, explosive force of volcanoes.

The igneous intrusions elevated the Jackson area into a high hill which projected from the sea as an island. Gradually the island was eroded and eventually subsided. Successive periods of subsidence and emergence continued for many millions of years before the landforms which we see today evolved.

Gas was discovered on the Jackson Dome in 1930. Well cuttings showed that the reservoir rock, or the formation in which the gas was trapped, was a porous limestone that contained fossils indicative of a coral reef. Corals live in clear seas, warm water, and at relatively shallow depths, so it is believed that the reef was formed in a tropical climate and that it grew upward from a shallow sea bottom.

Subsequent drilling furnished subsurface evidences of uplift. Geologic strata which would have been present in the normal course of events were absent. These beds were presumably eroded by wave action. Uplifts were also revealed by igneous materials, such as dikes and sills, which cut through and forced their way between pre-existing strata during times of igneous intrusion.

GENERALIZED CROSS-SECTION OF JACKSON DOME

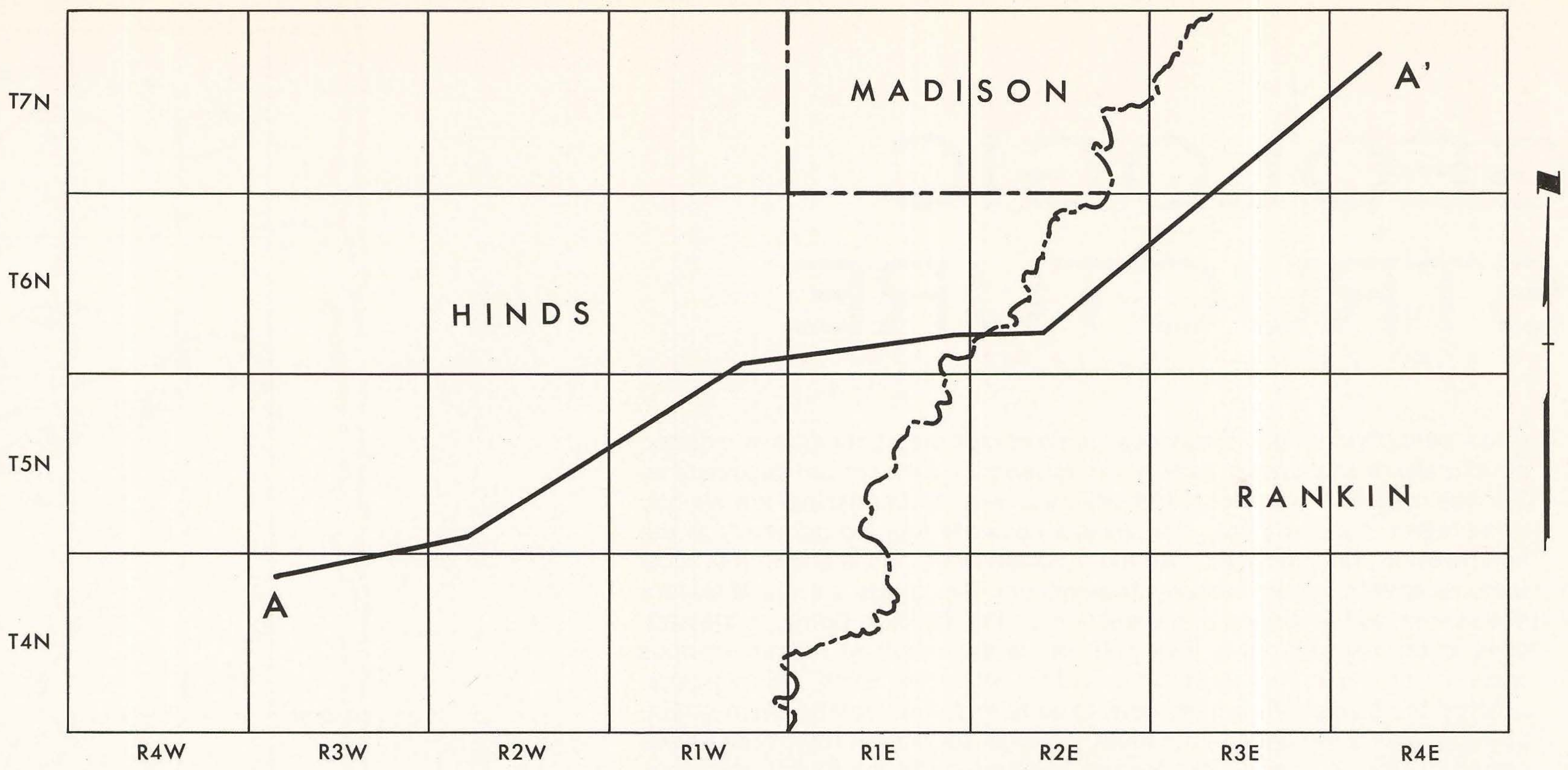


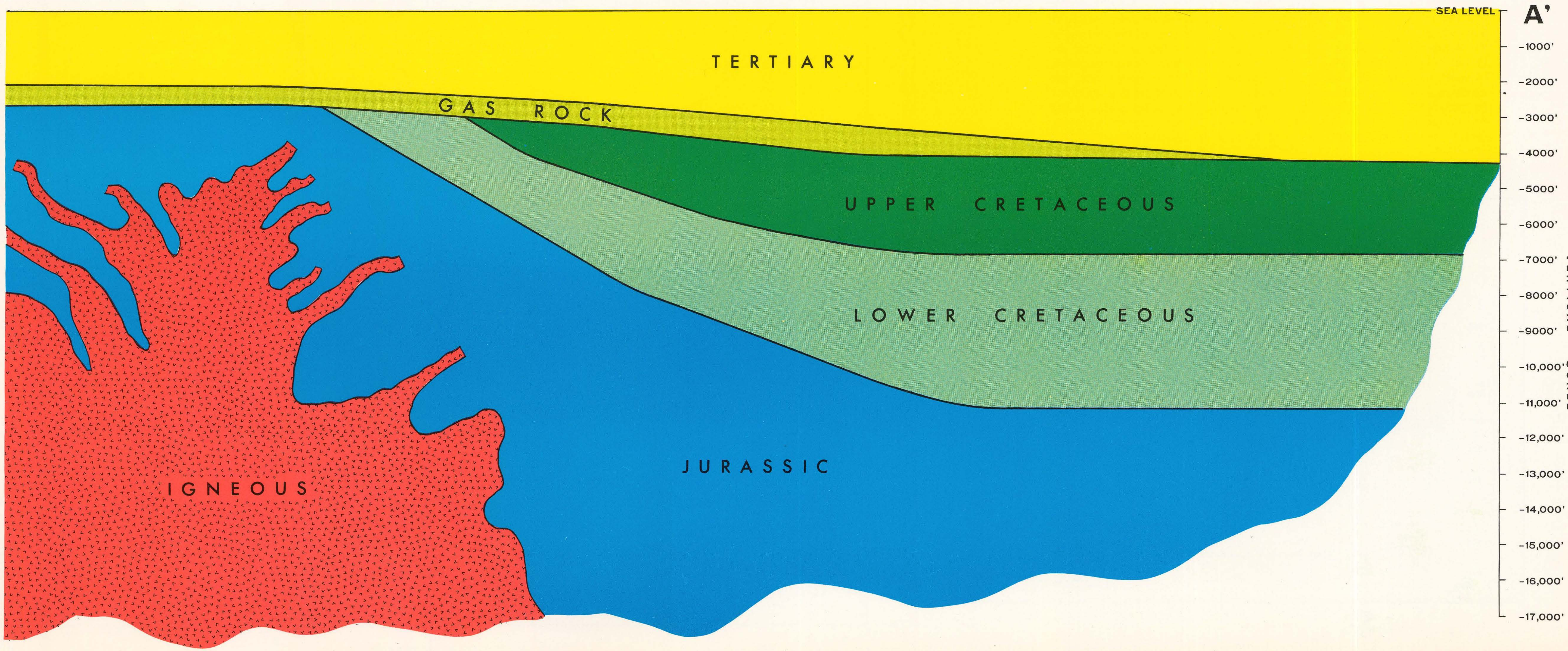
Another subsurface evidence for doming was discovered more than 60 years ago, when the first deep wells were drilled in the area as a source of fresh water. The temperatures of the water produced from some of these wells was as much as 10 degrees warmer than water produced from the same depths in other areas. This phenomenon is believed to have been caused by continuing heat loss from solid igneous rocks which were at one time molten (*ie.* during periods of volcanism).

Exposures of the Cockfield Formation and the Moodys Branch Formation in the Jackson area suggest surface evidence of doming. The normal outcrop area for these strata is north of Canton, Mississippi, about 25 miles from the Jackson exposures. The normal dip is approximately 20 feet per mile to the south; therefore, the beds at Jackson must have been forced upward at least 500 feet.

Another surface evidence for the Jackson Dome is the path of the outcrop belt of the Glendon Formation. This formation crops out across central Mississippi in a northwest-southeasterly direction, from Warren County to Wayne County, except in the Jackson area. Here the outcrop belt deviates from its normal path and skirts around Jackson, going through Clinton, Byram, and on to Brandon before resuming its typical outcrop pattern.

The mere mention of the word volcanism may raise the thought that if a volcano were present here in the past, there may be a possibility of that same volcano erupting again today. The probability of that happening is next to nil. The volcano is not dormant. It is extinct, completely, having died out millions of years ago.



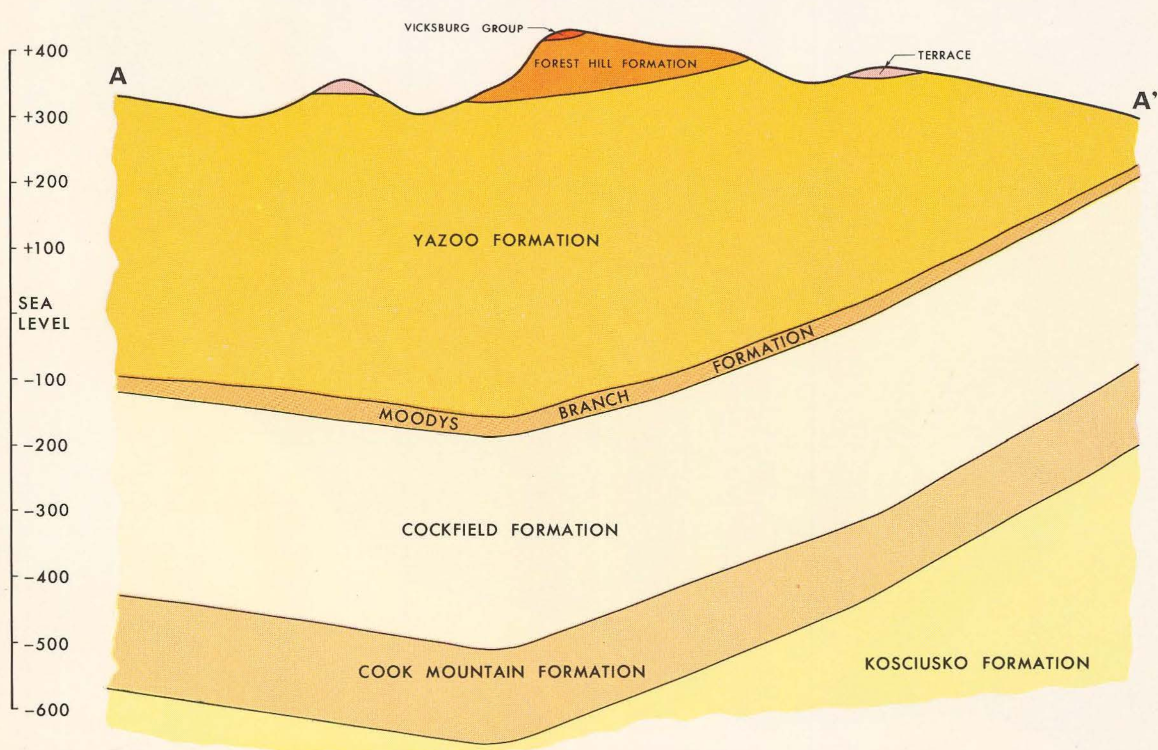


GEOLOGIC STRUCTURE

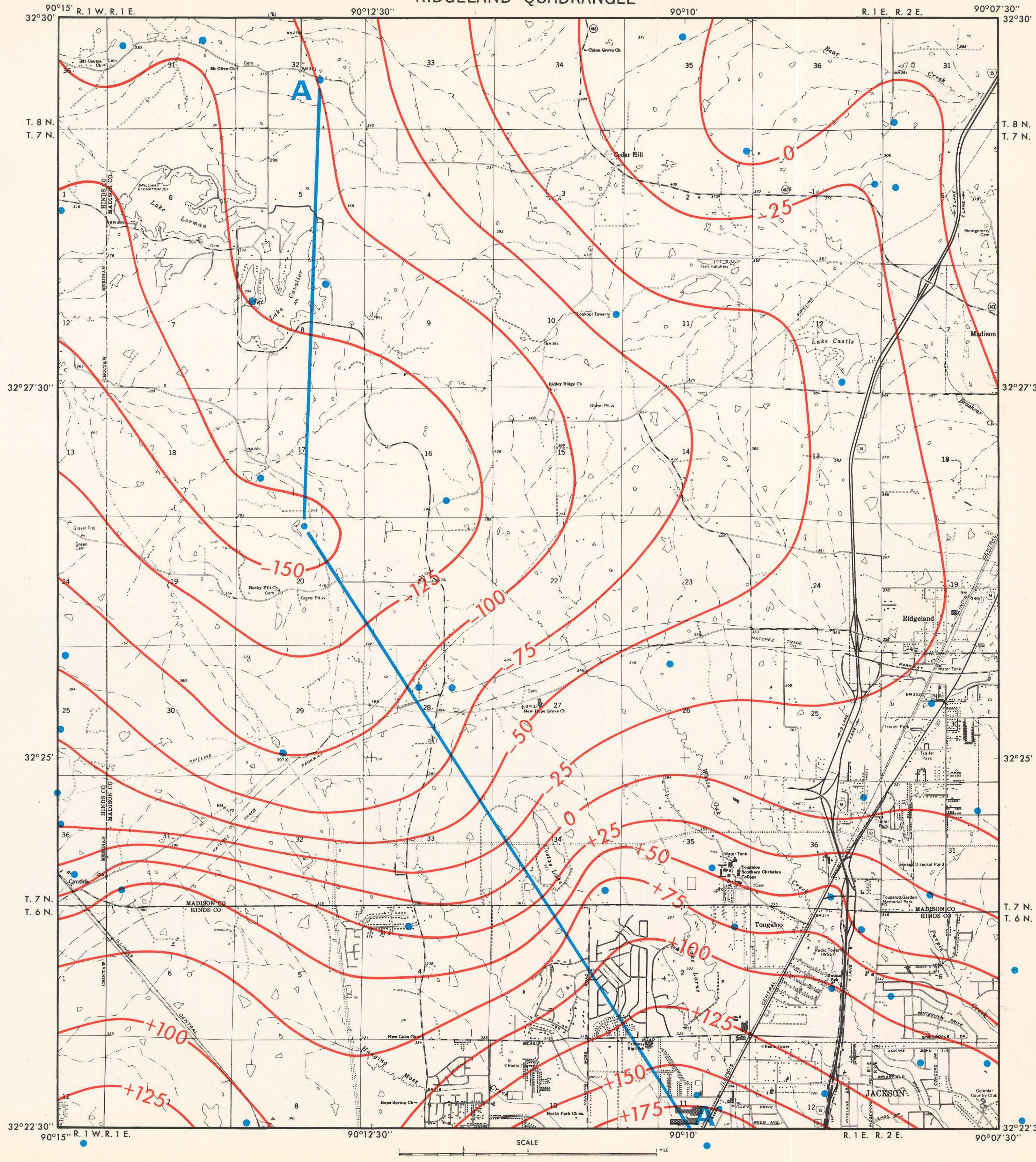
It has been mentioned in previous sections that the study area is situated structurally on the eastern flank of the Mississippi Embayment geosyncline. For this reason, the geologic formations present in Mississippi are slightly tilted rather than lying flat. The shallow beds are dipping generally to the southwest in the subsurface. An examination of the maps shows that local features alter this southwesterly, regional dip. The largest structural feature in the area, as mentioned in the section on the Jackson Dome, is the anticline in the Jackson area. This anticline is the result of molten igneous material forcing its way upward from deep within the earth. This intrusion uplifted the formations which were already in place, leaving them structurally high over the crest of the mass. Younger beds were deposited after a period of erosion levelled this feature. Subsequently, additional uplift took place, causing these younger formations to be arched over the structure.

The datum for these maps is the top of the Moodys Branch Formation of upper Eocene age. This formation crops out, or is found on the surface, in the eastern part of Jackson, as the reader can ascertain by viewing the General Geology maps. The Moodys Branch Formation lies immediately beneath the Yazoo Formation and consists of green to gray-green, calcareous, fossiliferous, glauconitic, clayey sand and weathers to a tan color. Its maximum thickness is approximately 45 feet. The reader is able to see on all four quadrangle maps that the dip on the Moodys Branch is steeper on the flanks of the dome than it is in the area outside the influence of the structure.

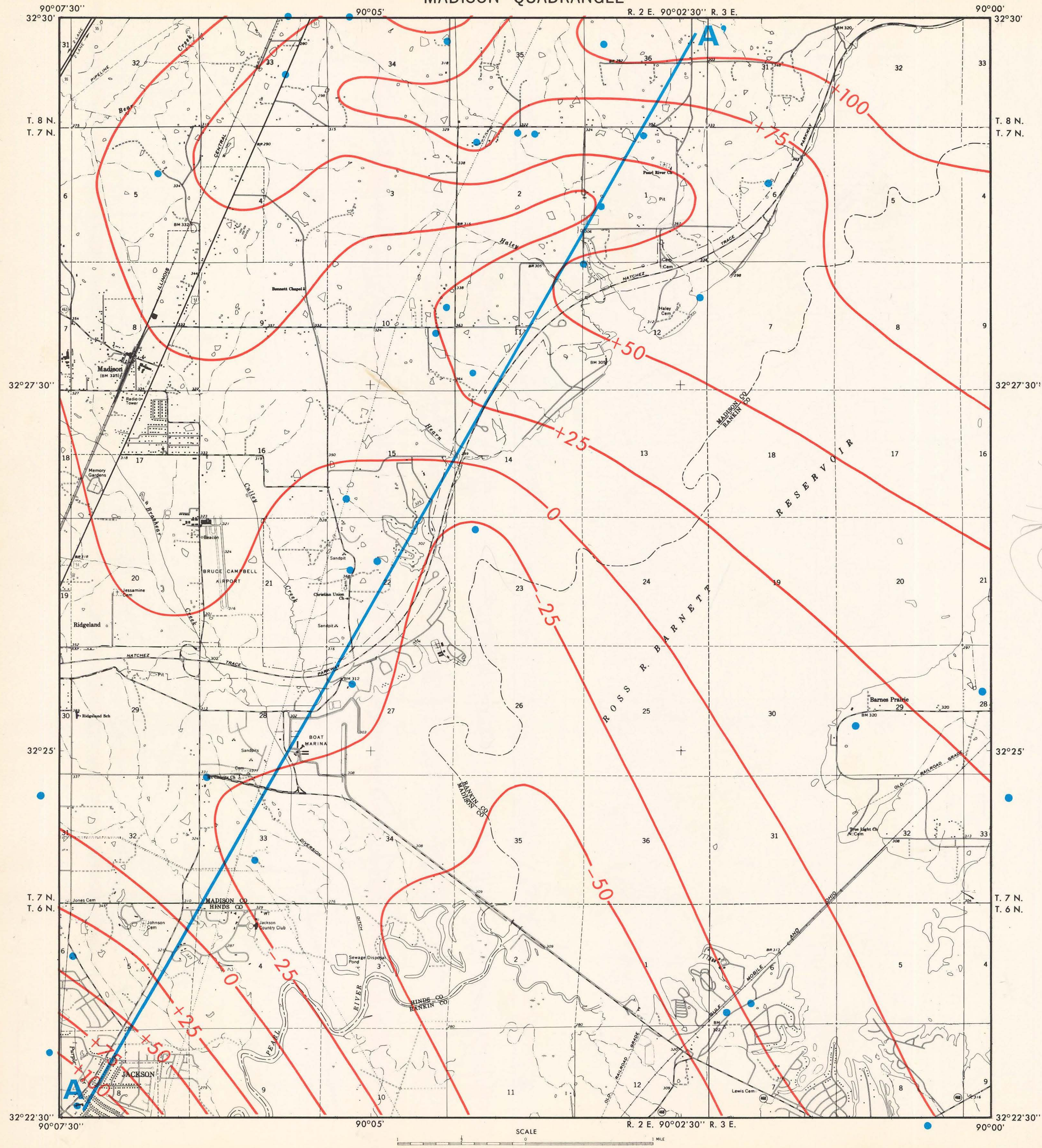
RIDGELAND QUADRANGLE CROSS-SECTION



RIDGELAND QUADRANGLE



MADISON QUADRANGLE



LEGEND

(For all four Structure Maps)

Control Points

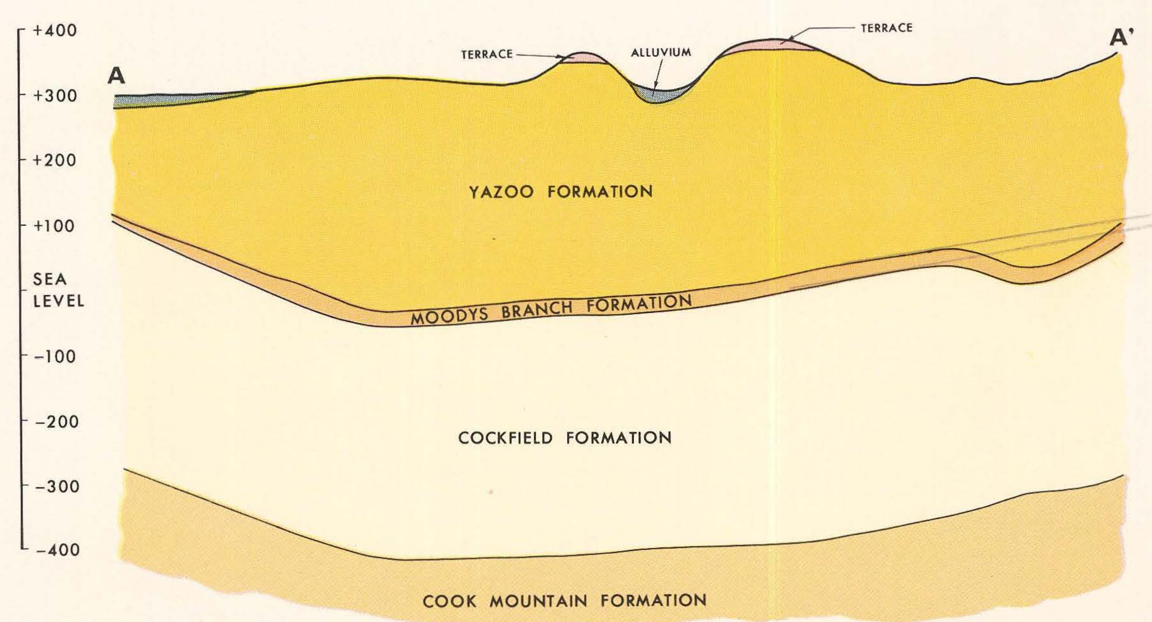
Contours on top of Moodys Branch Formation

Depression

Line of Cross-Section

Contour Interval = 25 Feet

MADISON QUADRANGLE CROSS-SECTION

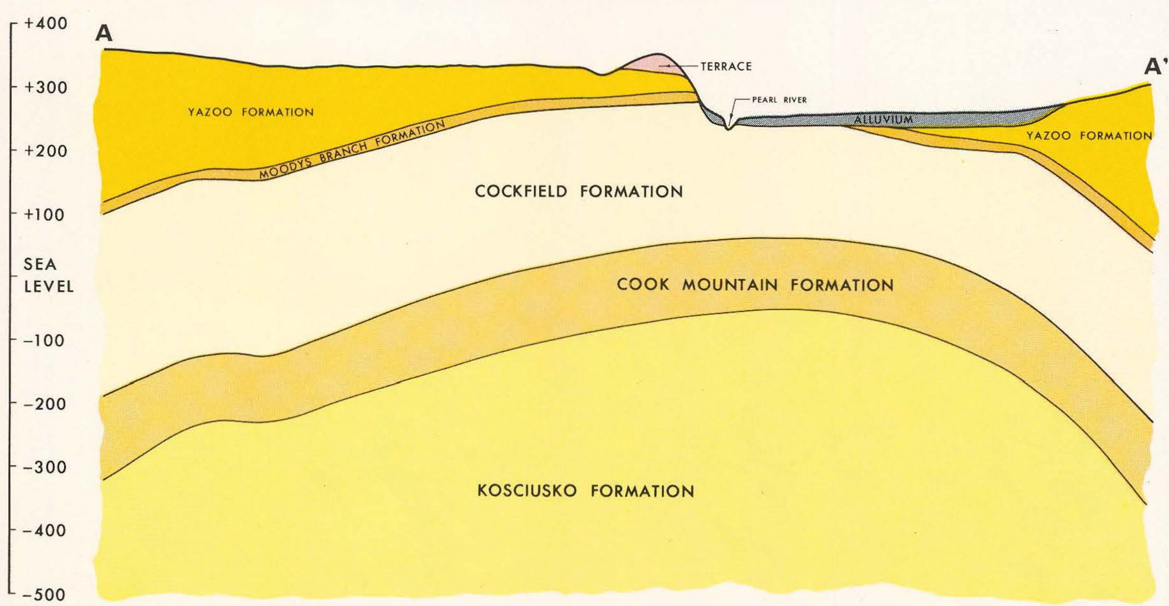


On the northern half of the Ridgeland quadrangle map, the Moodys Branch follows its normal dip, but toward the south and southeast the formation dips to the north and northwest away from the Jackson Dome, forming a rim syncline.

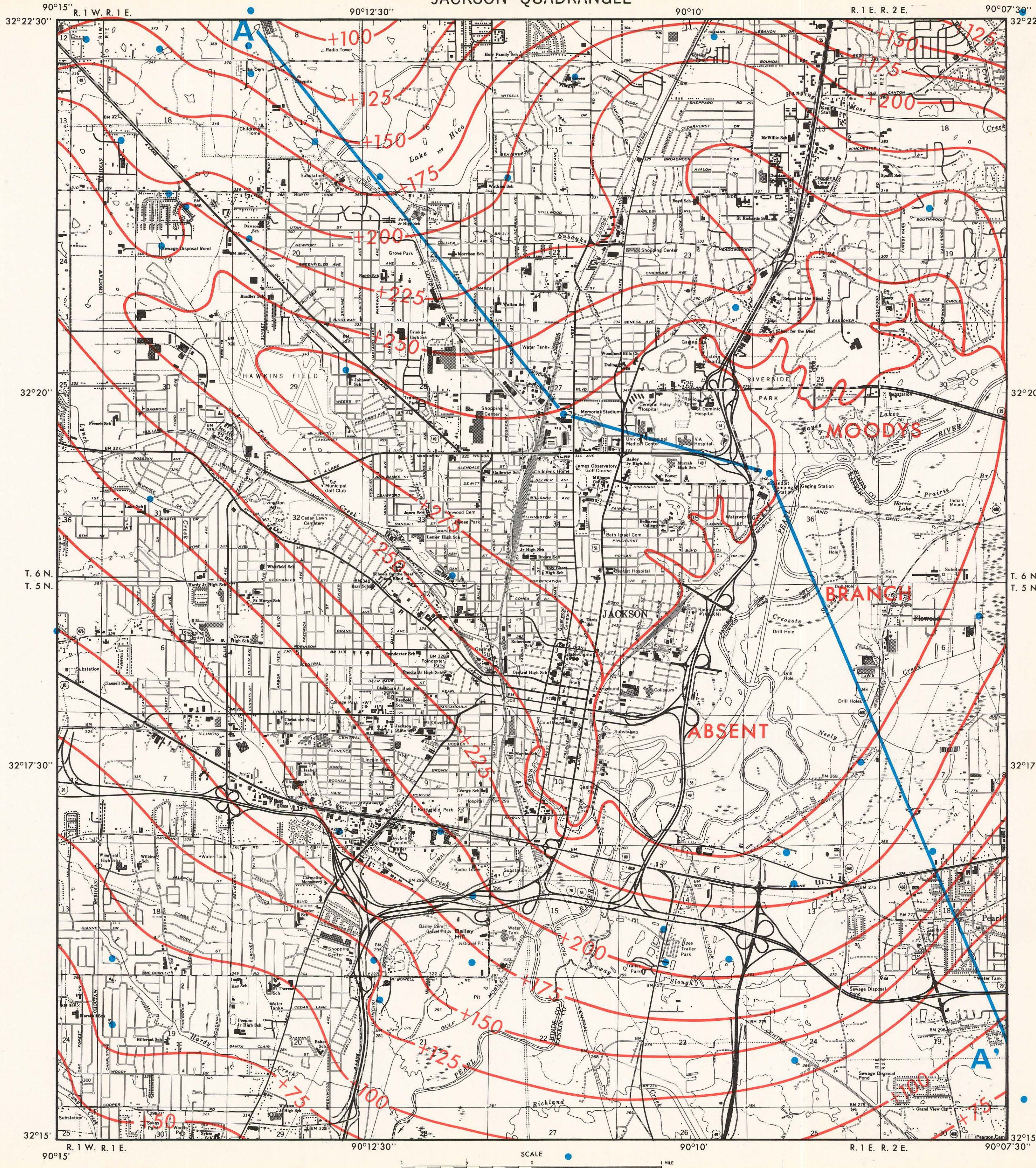
The Moodys Branch exhibits regional southwesterly dip in the Madison quadrangle, except in the southwest corner where the structure is affected by the Jackson anticline, and dip is toward the northeast. The rim syncline can be seen on this map. As the authors had limited access to information in the area of the Ross Barnett Reservoir and the land just south of the reservoir, the full nature of the structure in this tract is unknown.

As mentioned above, the Moodys Branch is at the surface in the eastern Jackson area. From the outcrop area, the formation dips away from the crest of the dome in all directions.

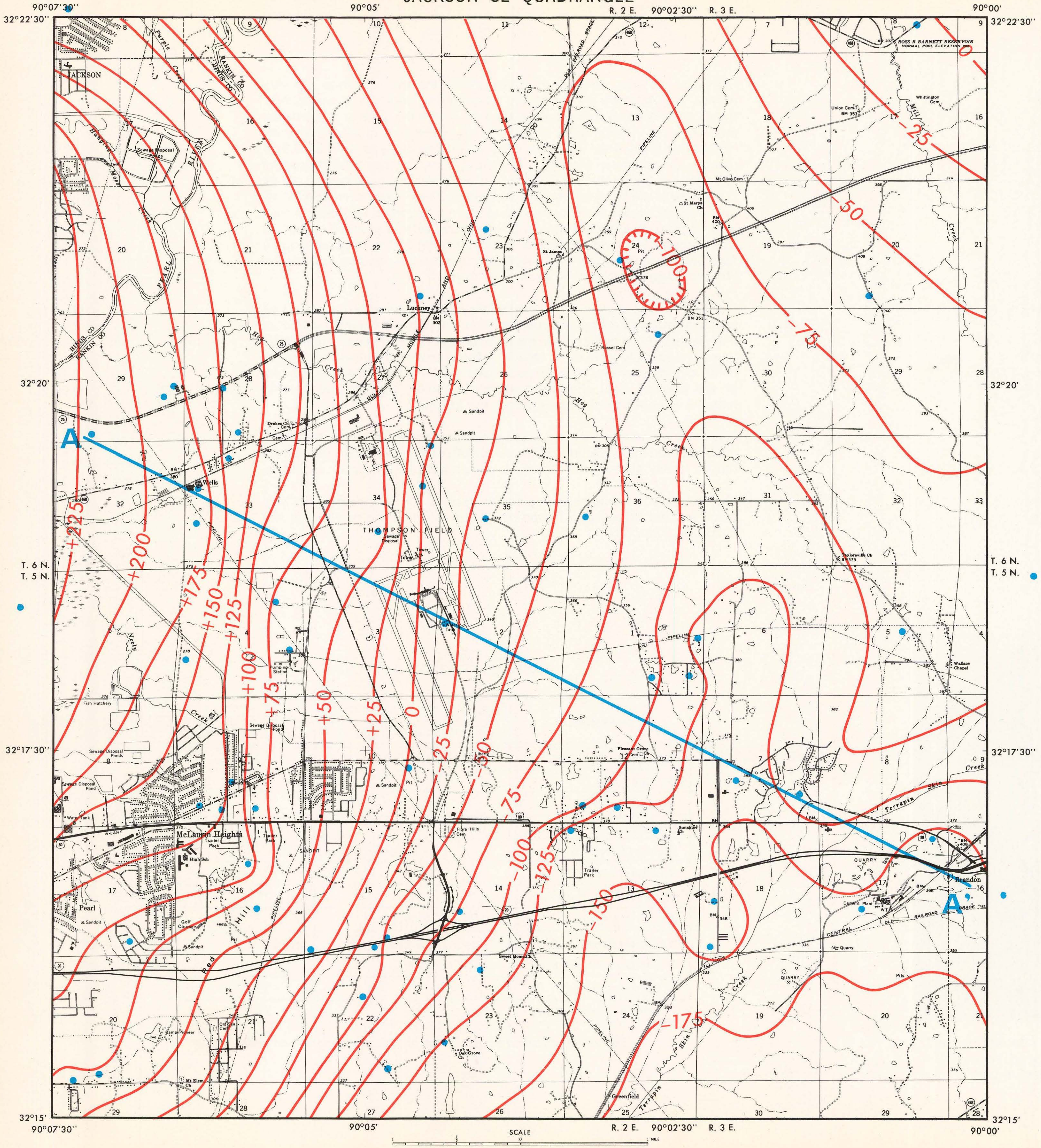
JACKSON QUADRANGLE CROSS-SECTION



JACKSON QUADRANGLE

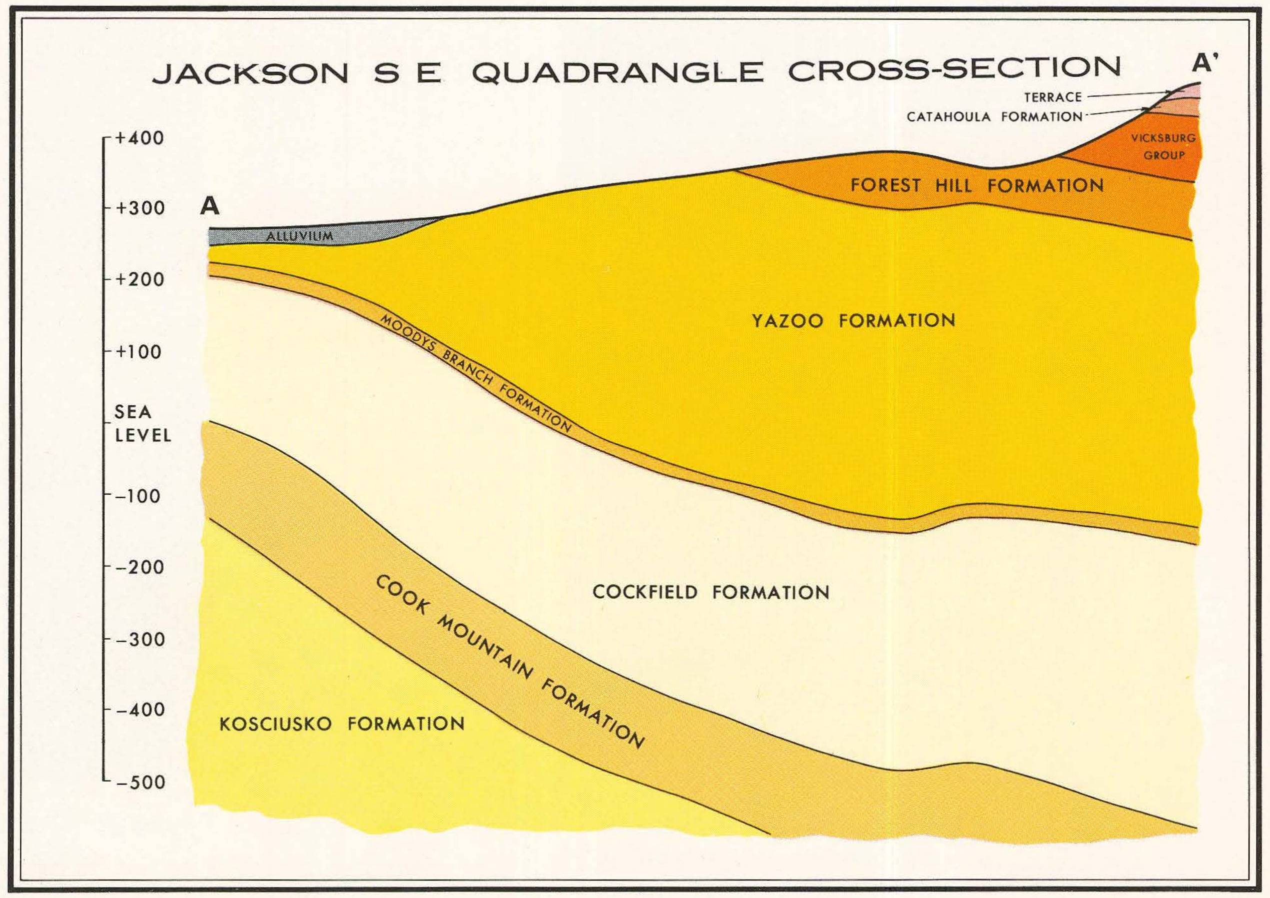


JACKSON SE QUADRANGLE



The formation continues to dip away from the dome in the eastern half of the Jackson SE quadrangle. The map here also shows the rim syncline, where the normal dipping beds in the northeastern area of the quadrangle flatten out and then reverse their dip on the flanks of the dome.

Shallow faulting in the study area has been indicated by anomalous dips, and there are sites where small displacement occurs. Deep-seated faulting, associated with the massive Jackson anticline, possibly also exists in the vicinity of the city of Jackson. As faulting is associated with earthquakes, the preceding two statements may lead one to believe that the threat of earthquakes would be rather great in this region. To the contrary, the events which were responsible for the faulting are no longer active today and, therefore, the area appears to be stable. Although the possibility of earthquakes may be present, the probability is slight. The geologic structure of the study area, consequently, is not believed to be severe enough to have detrimental influence on future developments.



ENGINEERING GEOLOGY

Engineering geology, as defined by the Association of Engineering Geologists, is the application of geologic data, techniques, and principles to the study of rock and soil materials or ground water for the purpose of assuring that geologic factors affecting the location, planning, design, construction, operation and maintenance of engineering structures, and the development of ground-water resources, are properly recognized and adequately interpreted, utilized, and presented for use in engineering practice.

Engineering geology differs from general geology primarily in scope. General geology involves studies of the entire Earth, along with the processes that formed it and are altering it. Studies related to engineering geology are confined to an extremely thin surface layer where construction of engineered structures takes place. General geology studies usually involve large areas, but this results in information of a nature too general to be useful to the engineer. Engineering geologic investigations, therefore, have to be concentrated at the individual site.

In this area of study, as in much of Mississippi, the soil conditions can vary widely, both laterally and vertically. Engineering geologic investigations, therefore, should be somewhat detailed on most sites. One of the greatest problem soils in Mississippi is found in all of the four quadrangles comprising this study area, and that is the weathered clays of the Yazoo Formation. As is shown in the table on this page, the clay has a fair amount of strength, but the problem is in its high volume change characteristic, which is because of the fact that the material contains the mineral montmorillonite. This mineral causes the clay to expand when it becomes wet and contract when it dries. Volume changes in this soil have been measured as high as 225 percent, and swell pressures in excess of 25,000 pounds per square foot have been recorded. Several photographs on the pages in this section show damage resulting from expansive clays.

The Glendon Formation of the Vicksburg Group is another geologic unit which normally offers good structural foundation, but problems may occur if inadequate investigations are made. Weathering has reduced the bedded limestone to boulders in some localities. Small cavities may also be present in the material. If either of these conditions exist at a particular site, a builder will possibly find, after adequate investigation, that reliable bearing material will not be continuous across the location.

The other formations that can cause structural problems in this study area are Loess and the Bucatunna Formation. Both of these units are either very thin or locally absent and, therefore, should not present major problems.

The table of soil strengths shown on this page is offered strictly as an indicator, and the values must not be construed as remaining constant in any particular outcrop belt.

Figure 20. - Miniature cave in Glendon Formation. Such cavities in subsurface could cause foundation problems.

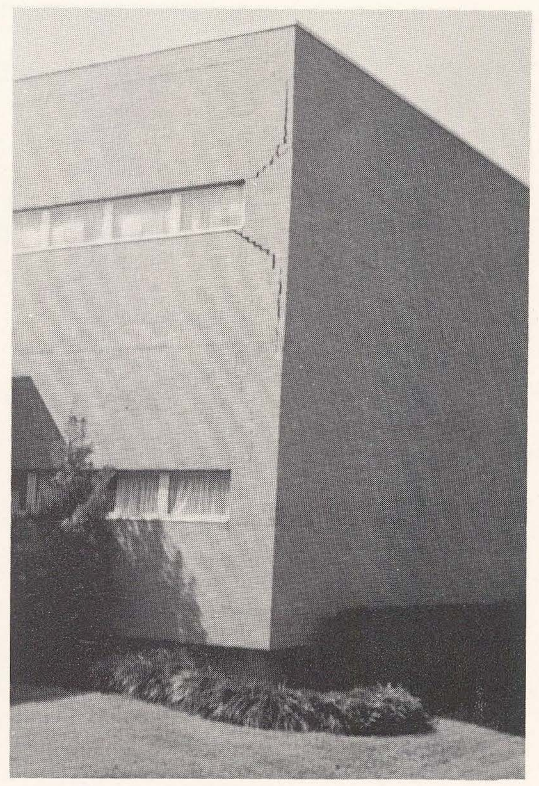


Figure 21. - Cracked masonry is not uncommon in Yazoo Formation outcrop belt.

TABLE OF STRENGTH INDICATORS

MATERIAL	COHESIVE OR CLAYEY SOILS	SANDY SOILS
	Strength in Pounds per Sq. Ft.*	S.P.T. Blows/Foot
Pearl River Alluvium		3–44
Terrace sands		20–75
Bucatunna clay	4000–4500	
Byram marl		40–51
Glendon limestone	Competent Rock Layers	
Mint Spring marl		35–70
Forest Hill sand and silt		25–70
Forest Hill clay	4000	
Yazoo weathered clay	1500–2500	
Yazoo unweathered clay	6000	
Moodys Branch marl		23–55
Cockfield sand and silt		23–61

*Based on unconfined compression and triaxial compression tests.

Figure 22. - Slump in Vicksburg Group outcrop causing damage to interstate highway.

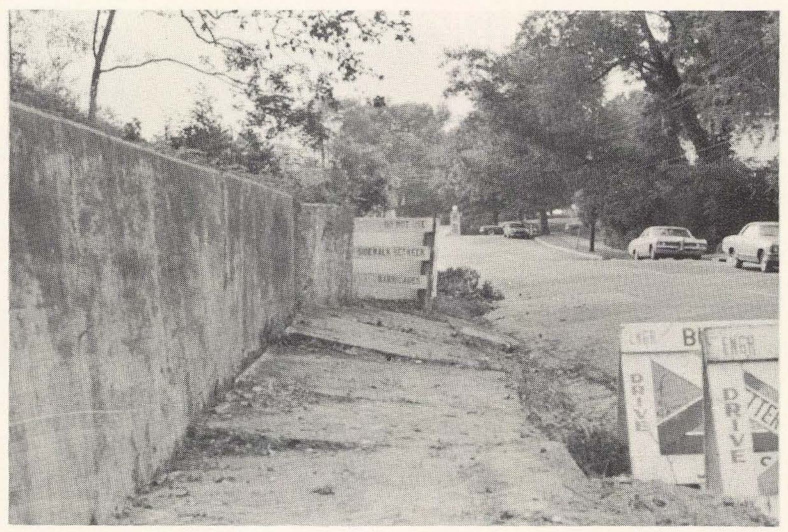


Figure 23. - Expansive clay of Yazoo Formation rendered sidewalk virtually impassable.

Figure 24. - Expansive Yazoo Formation clay causes numerous street failures in many of the towns in the study area.

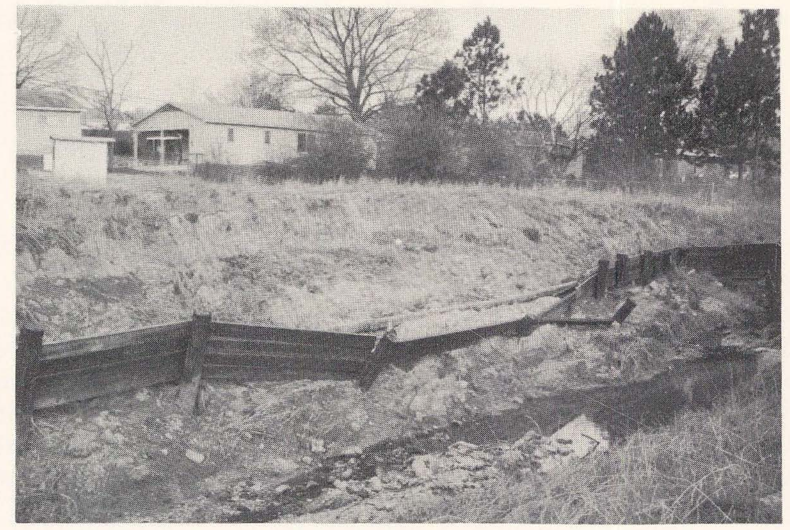


Figure 25. - Slumping stream bank has defied a remedial measure, exposing a utility line, and causing possible damage to residential property.

Figure 26. - Failure of bridge-end slope dictated remedial measures to save abutment. This structure built in Yazoo Formation outcrop belt.

SOIL ASSOCIATIONS

Soils are the product of the weathering of bedrock, and generally reflect the physical characteristics of the underlying material. A comparison of the soil associations map on this page with the geologic maps on pages 14 through 17 indicates that this situation does not hold true throughout this study area. The Yazoo Formation crops out extensively in the area, but is overlain by at least six different soil types. Each geologic unit shown is covered by more than one soil association. The degree of weathering, erosion, and stream deposition in the area is responsible for this phenomenon. The amount of rainfall, humidity, temperature fluctuations, and the work of organisms are certainly contributing influences. Disturbances to the physical environment as a result of development in the Jackson area would have to be given consideration as a factor causing different soil types to overlie the same geologic formation.

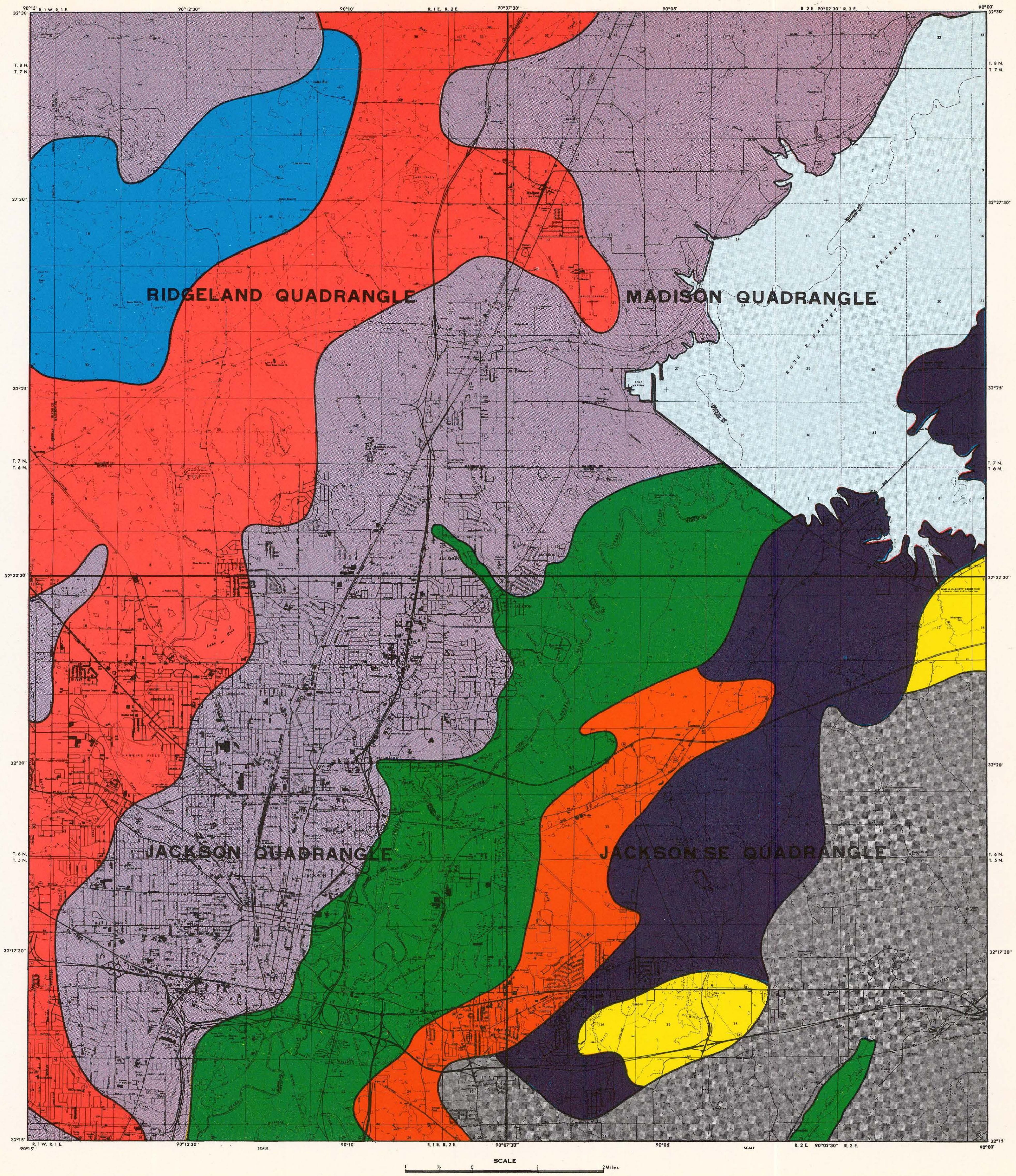
Detailed subsurface information about the bedrock should be obtained before any type of construction or other development is initiated in this area. This is advisable because the surface soils usually conceal the bearing material which must support any structure that is built.

Soils are a very important segment of the environment and should be conserved as well as utilized to the betterment of society as we know it.

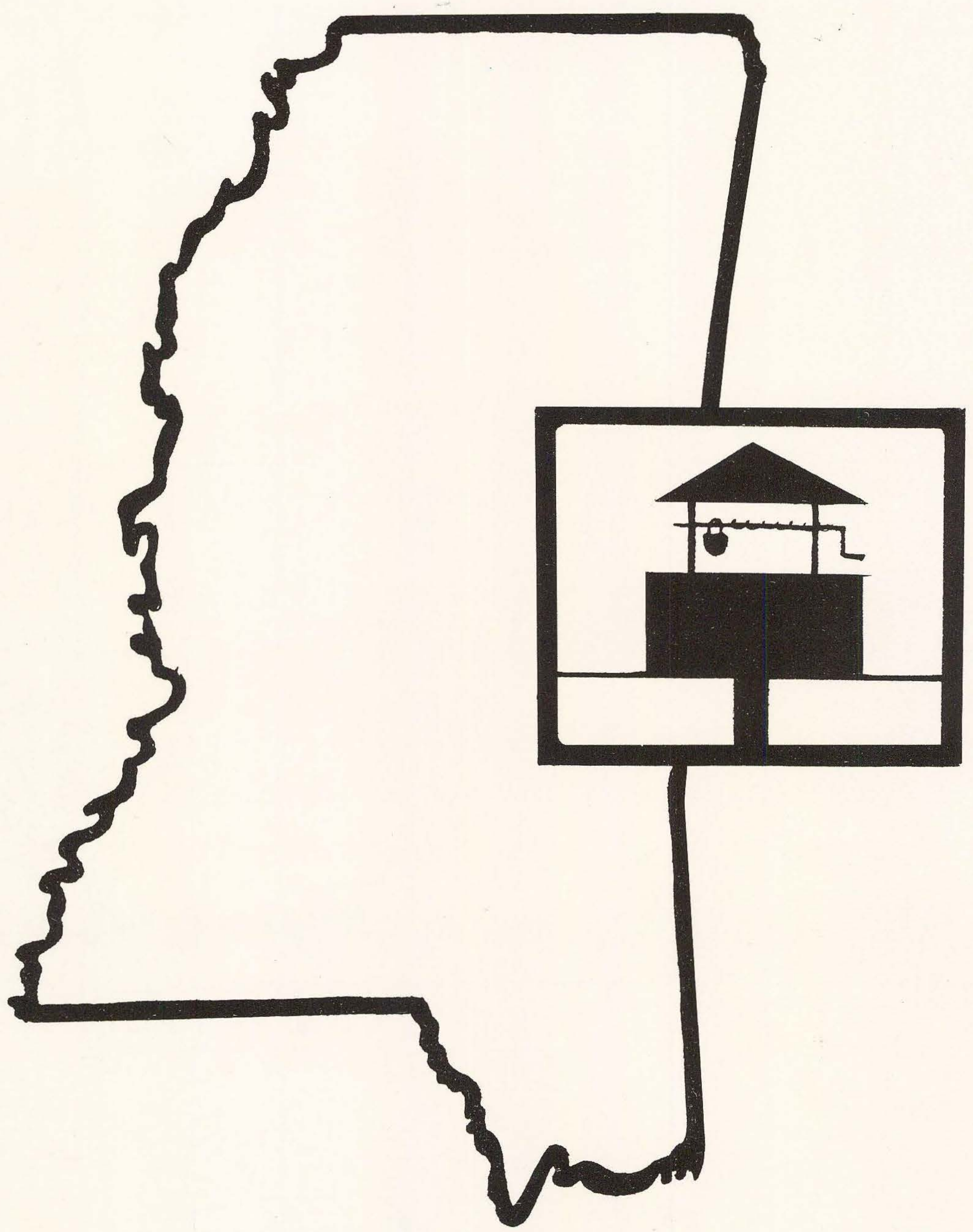
LEGEND

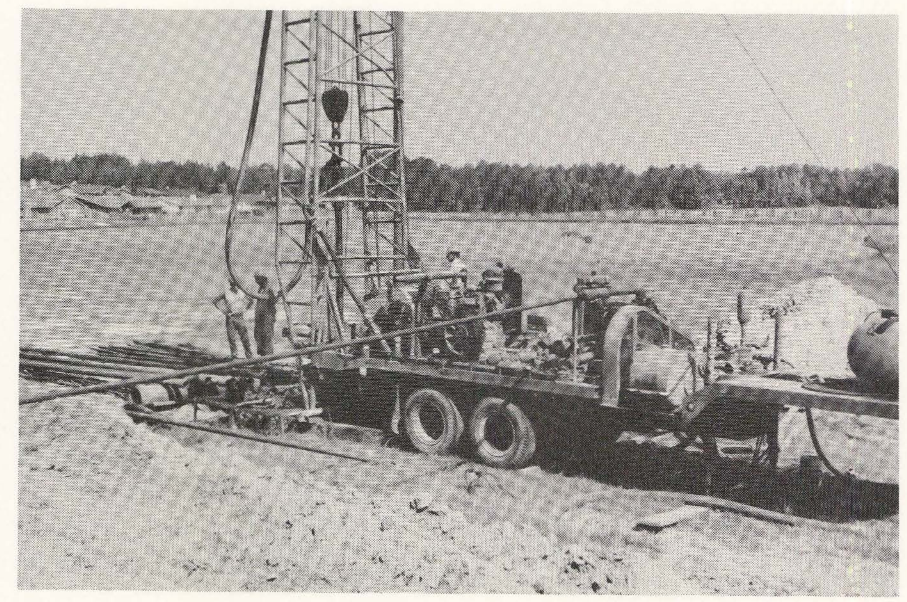
- Loring-Grenada association – Moderately well drained, nearly level to sloping, silty soils that have a fragipan.
- Jena-Velda-Rosebloom association – Well drained, loamy and silty soils and poorly drained silty soils on flood plains.
- Providence-Smithdale-Loring association – Moderately well drained, gently sloping to sloping silty soils that have a fragipan and well drained, steeply sloping loamy soils.
- Kipling-Savannah-Pheba association – Nearly level to sloping, poorly drained soils that have a clayey subsoil and moderately well and somewhat poorly drained, loamy soils that have a fragipan.
- Smithdale-Ora-Boswell association – Well and moderately well drained, sloping to steep soils that have loamy and clayey subsoils and moderately well drained, sloping, loamy soils that have a fragipan.
- Calloway-Grenada-Henry association – Somewhat poorly to moderately well drained and poorly drained, nearly level to gently sloping, silty soils that have a fragipan.
- Loring-Providence association – Moderately well drained, gently sloping, silty soils that have a fragipan that is underlain by clayey subsoils.
- Providence-Bude association – Moderately well drained to somewhat poorly drained, gently sloping to sloping, silty soils that have a fragipan.

NOTE: The soil information shown on this page is from the general soil maps of Hinds, Rankin, and Madison Counties by the Soil Conservation Service, U.S. Department of Agriculture.



WATER RESOURCES





WATER AVAILABILITY

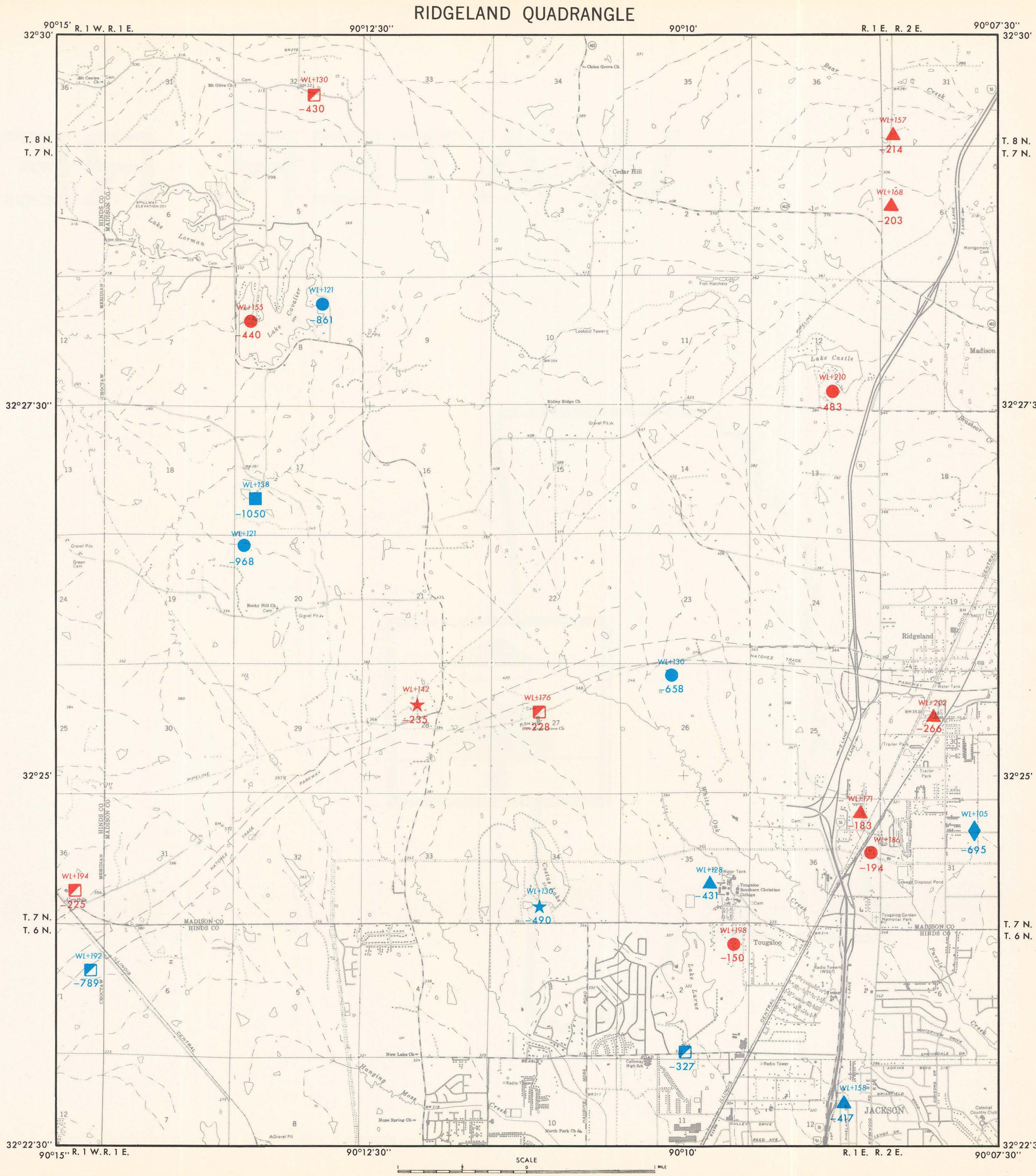
One of Mississippi's most valuable natural resources is the State's abundant supply of surface and subsurface water. This study area is no exception to the statewide situation. At this time, residents of the city of Jackson rely on water from the Pearl River for their domestic, industrial, and agricultural needs. The Ross Barnett Reservoir may perform a paramount function in the future, as the city expands, by supplying the fresh-water needs for the Jackson metropolitan area. Provisions have already been made for the city to draw its water supply from the reservoir when and if the need arises. Inhabitants of the study area who live outside the City of Jackson depend on ground water for their fresh-water requirements.

Approximately 50 inches of precipitation fall annually on central Mississippi, and numerous porous and permeable formations crop out in the area. When this combination of phenomena exists, copious ground water ordinarily results. There are water-bearing sands, or aquifers, indigenous to four geologic formations in this study area. The aquifers currently being utilized are in the Pearl River alluvium, the Cockfield Formation, the Kosciusko Formation, and the Upper Wilcox Group. These geologic units are listed from the shallowest to the deepest.

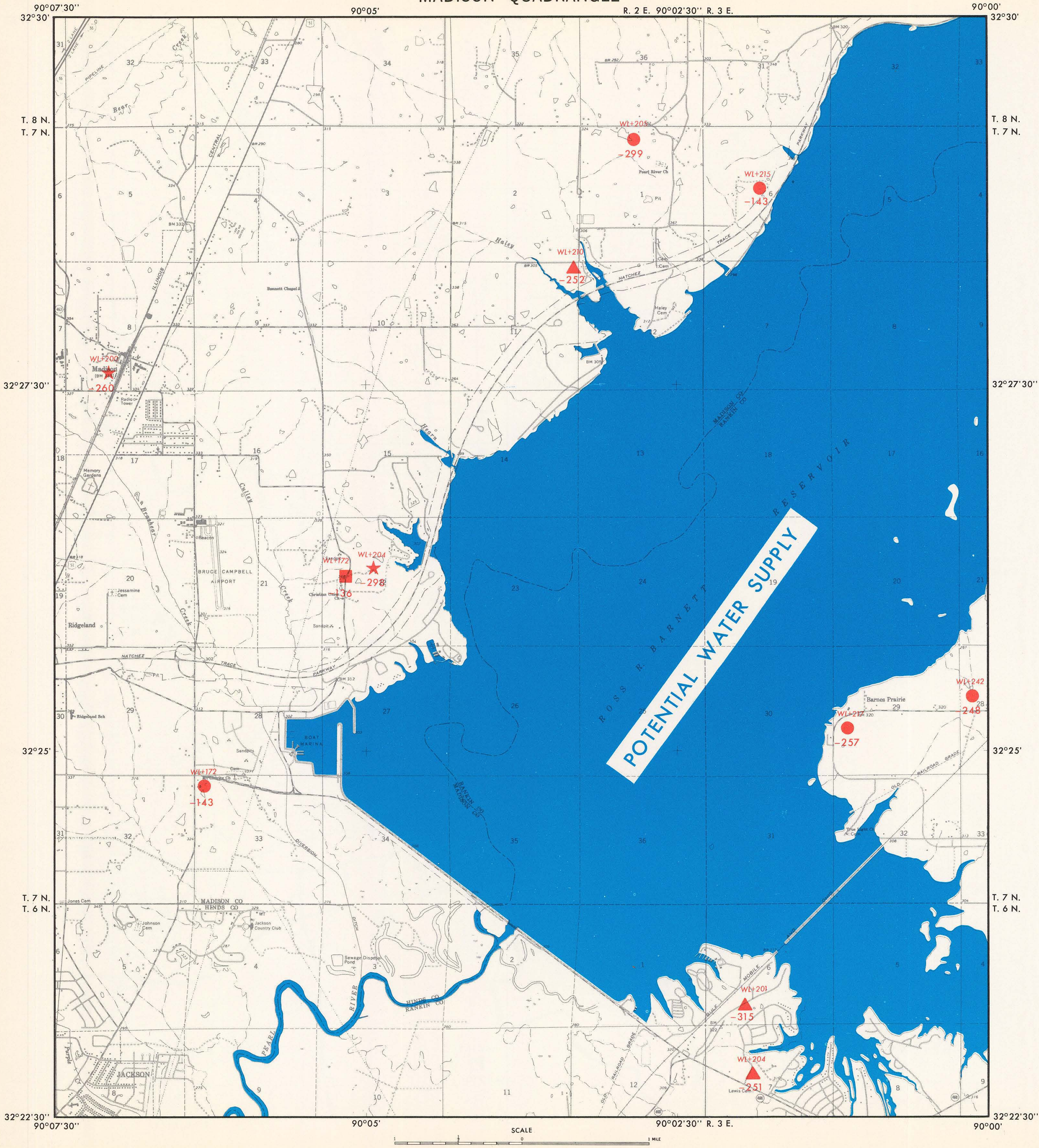
The maps shown in this chapter indicate the locations of selected water wells, the aquifer from which each is producing, the actual yields (when known), and the elevations of the base of the well screen and the static water table relative to sea level.

After examining the maps in this section, the reader can realize that the people in this study area are heavily dependent on the Cockfield and Kosciusko aquifers for subsurface fresh water. Aquifers in these two formations are the only ones which are developed in the Ridgeland quadrangle area. Moderate-to high-yield wells could be made in both of these aquifers, and, in fact, several wells have been drilled in the more heavily populated southeastern corner of the quadrangle.

The Madison area is probably the least developed of this study area. Consequently, well development in this area is not as pronounced as in the other quadrangles. Wells of moderate yield developed in sands of the Cockfield Formation are found here, but if the need arises this formation is capable of increased production. Sands of the deeper Kosciusko Formation also are available to help provide ample supplies of fresh water for future development. As in the Ridgeland quadrangle, however, these two formations are the only ones capable of producing fresh water of good quality. The aquifers in the Wilcox Group contain water that is undesirable because of high salinity. The Ross Barnett Reservoir, of course, serves as a potential source of surface water for the Jackson area if growth ever dictates the need.



MADISON QUADRANGLE



LEGEND

(For all four Aquifer Maps)

AQUIFERS

- ● Pearl River Alluvium
- ● Cockfield Formation
- ● Kosciusko Formation
- ● Wilcox Formation

YIELDS

- ◪ Unknown
- ■ <15 Gallons Per Minute
- ● 15-49 Gallons Per Minute
- ★ 50-149 Gallons Per Minute
- ▲ 150-499 Gallons Per Minute
- ♦ ≥500 Gallons Per Minute

Colors in the YIELD symbols correspond to the appropriate aquifer.

FIGURES SHOWN ABOVE THE WELL POINTS DENOTE THE APPROXIMATE ELEVATION OF THE STATIC WATER LEVEL WITH DATUM BEING SEA LEVEL.

FIGURES SHOWN BELOW THE WELL POINTS DENOTE THE APPROXIMATE ELEVATION OF THE TOP OF THE WELL SCREEN WITH DATUM BEING SEA LEVEL.

The water supply for the city of Jackson is obtained from the Pearl River, but numerous moderate-to high-yield water wells have been developed in the sands of the Kosciusko Formation by industries in the area. The Kosciusko is uplifted by the Jackson Dome and, consequently, can be drilled into at shallower depths than in the surrounding area. Several wells have been made in the Upper Wilcox Group at Jackson for the same reason. The water in the Wilcox over the Jackson Dome is of slightly better quality than it is downdip and can be utilized for certain purposes. A few domestic wells (probably with small yields) have been made in the Pearl River alluvium on the eastern side of the city. The quality of this water is not generally considered to be very good, so this source should not be depended upon for a fresh-water supply.

In the area of the Jackson SE quadrangle, both the Cockfield and the Kosciusko are capable of supplying large quantities of fresh water. In the eastern half of the quadrangle the Kosciusko is not utilized because it is deeper than the Cockfield.

Escalating requirements will be made on the sources of water supply as the study area is further developed. Conscientious planning will be essential if we are to preserve our aquifers and surface streams for subsequent generations. Aquifers can be over-pumped and virtually dried up. Water levels have already declined in some of the aquifers in this area of study. Improper waste disposal is a source of pollution to both aquifers and surface-water sources, and it is quite possible for people living in this study area to contaminate their own water supply if waste is not properly handled.

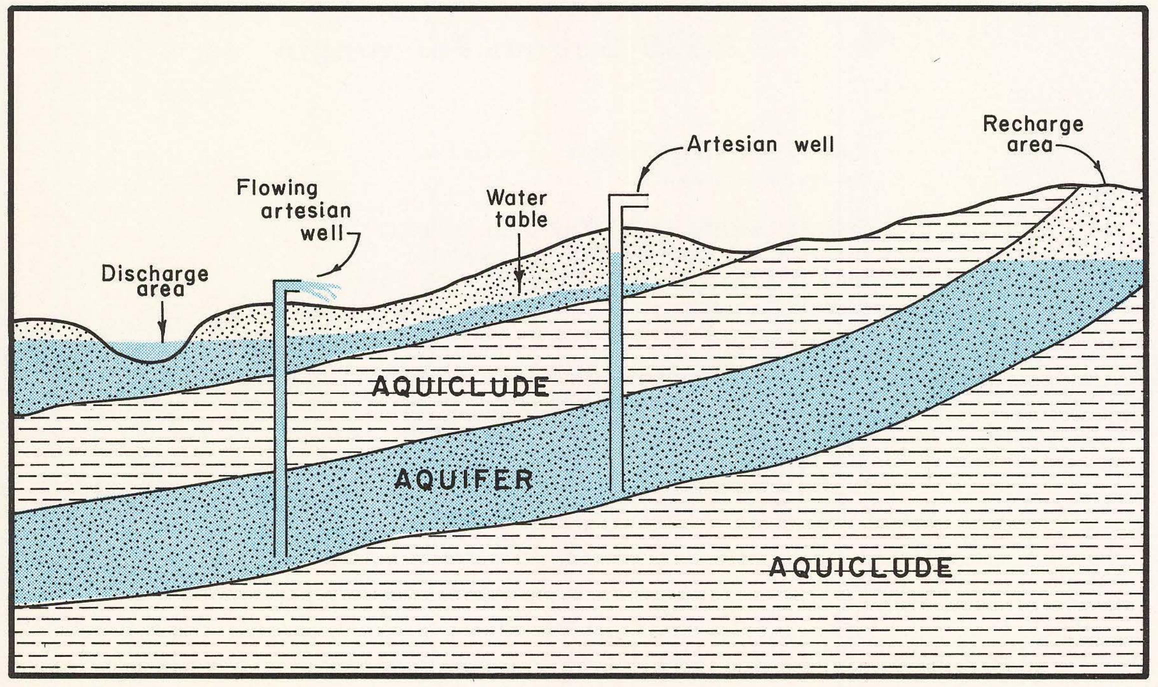
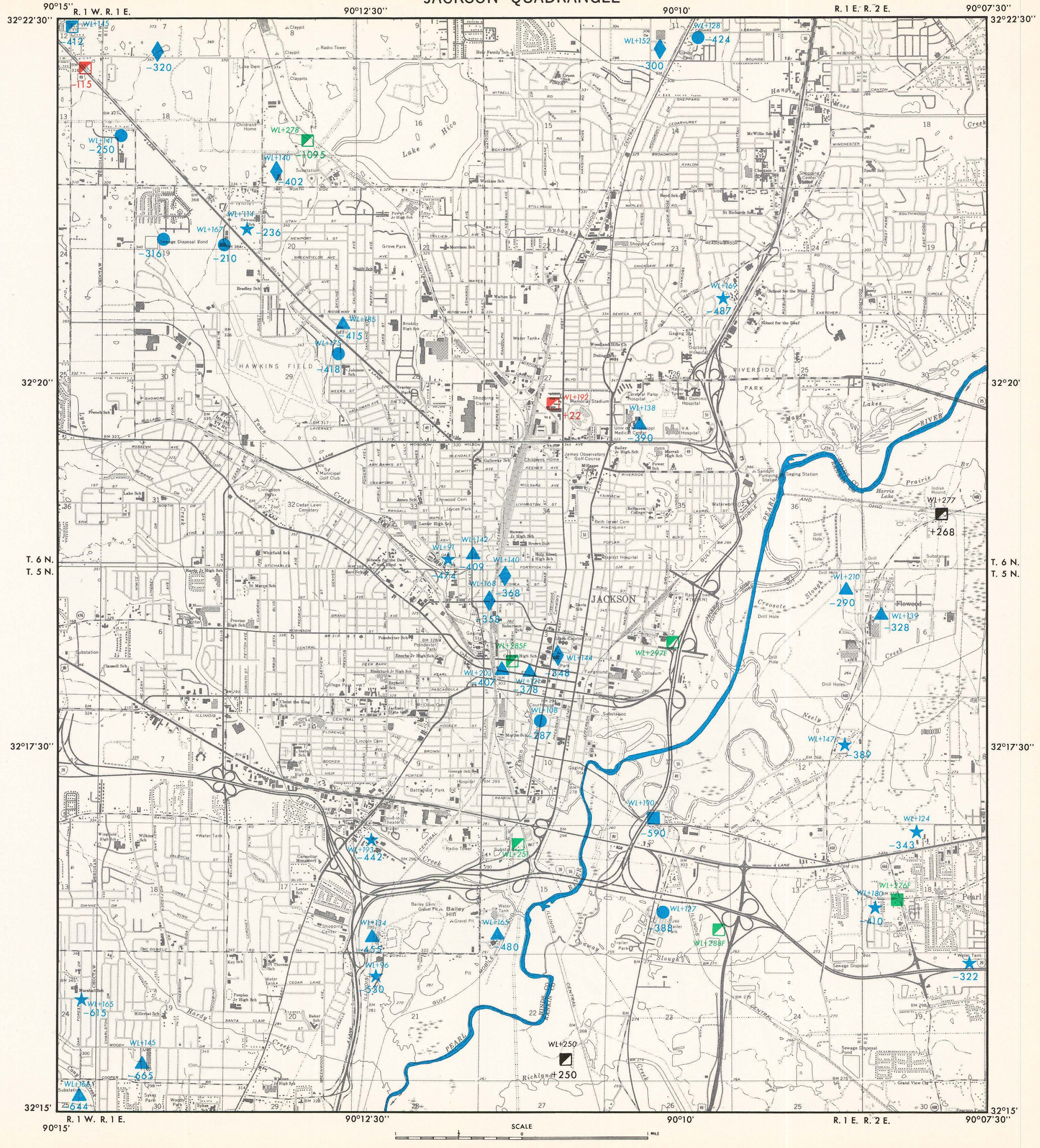
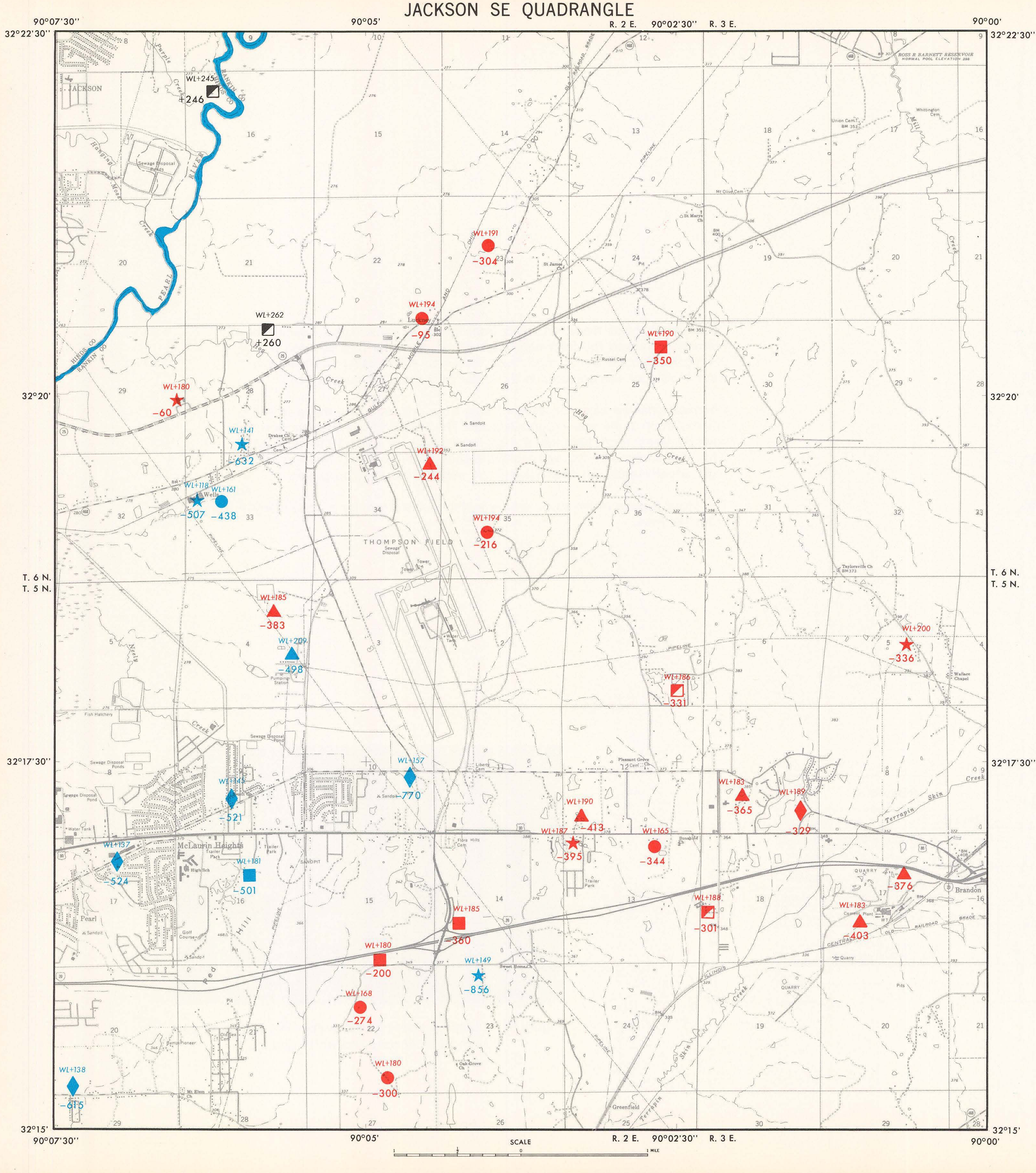


Figure 27. - Diagram illustrating difference between an artesian well and a flowing artesian well.

JACKSON QUADRANGLE



JACKSON SE QUADRANGLE



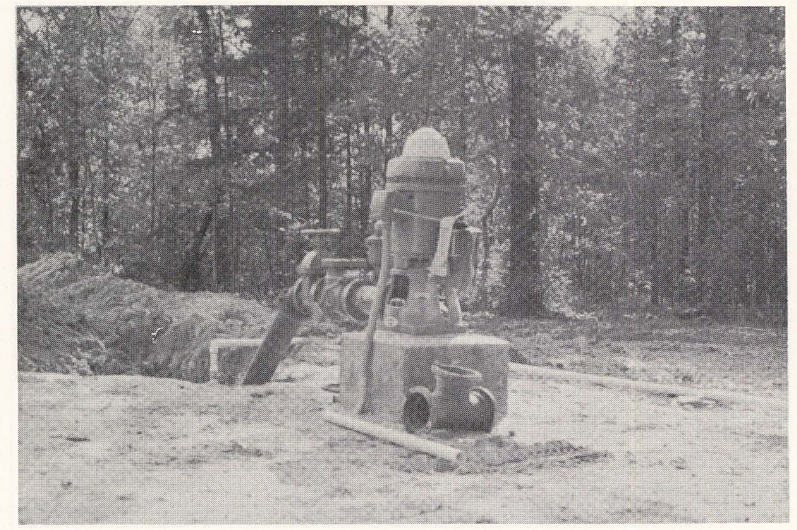


Figure 28. - A major segment of the area's populace is served by ground water, a large portion of which is pulled to the surface by pumps such as this.

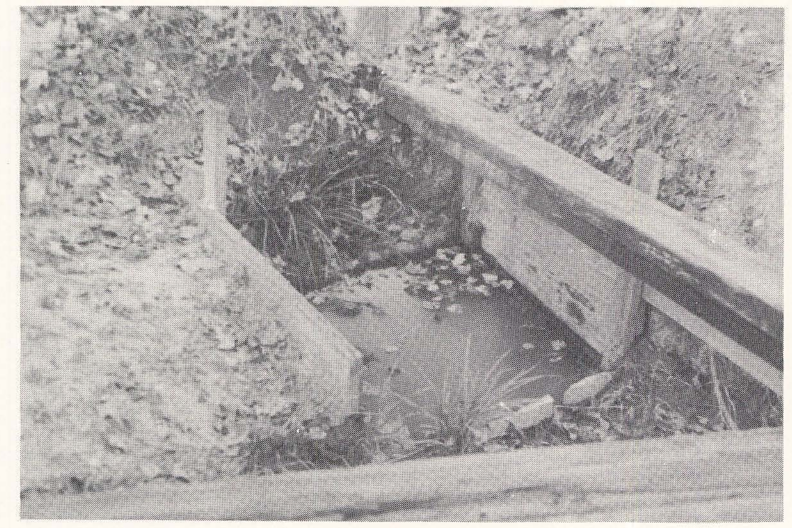


Figure 29. - A few people still obtain some of their water from springs.

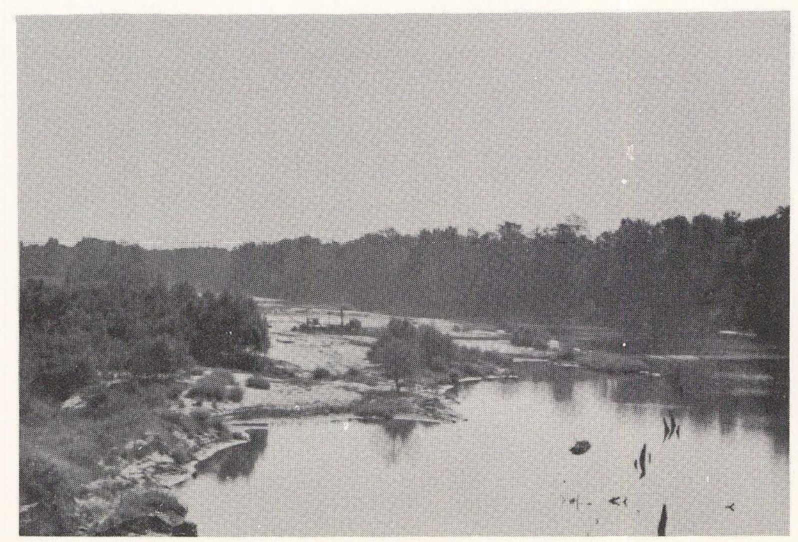


Figure 30. - The Pearl River provides the water supply for the city of Jackson.

WATER QUALITY

The study area not only is blessed with an abundance of subsurface water, but the quality of this water is generally quite good for most industrial uses. The chart found on this page shows the water quality tolerances for certain industrial applications as recommended by the American Water Works Association. There are three geologic units which serve the needs of industry in the area. From the youngest to the oldest they are the Cockfield, the Kosciusko, and the Upper Wilcox.

A selection of area wells made in the Cockfield Formation which had chemical analyses performed on the water showed the following variation of results: color 50 to 250 (caused by varying amounts of lignitic particles in the sands of the formation); iron 0 to 1.2 mg/l; hardness 0 to 93 mg/l; total dissolved solids 314 to 512 mg/l; no odor to a slight H_2S odor.

Chemical analyses made on water from selected wells in the Kosciusko Formation showed the following range of results: color 5 to 50; iron 0 to 0.4 mg/l; hardness 0 to 5 mg/l; total dissolved solids 217 to 288 mg/l; a slight H_2S odor was detected in the water from many of these wells.

Chemical analysis of water was available from only one well made in the Wilcox Group in the area around Jackson. The results of this analysis were: color 80; iron 0 mg/l; hardness 0 mg/l; total dissolved solids 1938 mg/l; no odor. The analysis on this water sample showed a chloride content of 220 mg/l, which means it is brackish but still suitable for many purposes.

The ground water in the study area is suitable, therefore, for a great many industrial uses.

WATER QUALITY TOLERANCE FOR CERTAIN INDUSTRIAL APPLICATIONS

USE	COLOR	Fe	Mn	HARDNESS	TOTAL DISSOLVED SOLIDS	REMARKS
Air Conditioning		0.5	0.5			No H_2S Odor No Corrosiveness
Baking	10	0.2	0.2			Conform to Drinking Water Standard.
Boiler Feed (150-250 p.s.i.)	40			40	500-2500	pH 8.5 +
General Canning		0.2	0.2			Conform to Drinking Water Standard
Carbonated Beverages	10	0.2	0.2	250	850	Conform to Drinking Water Standard
Ice	5	0.2	0.2		300	Conform to Drinking Water Standard
Laundering		0.2	0.2	50		
Paper & Pulp Ground Wood	20	1.0	0.5	180		No Corrosiveness
Kraft Pulp	15	0.2	0.1	100	300	
Confectionery		0.2	0.2		100	pH 7.0 +

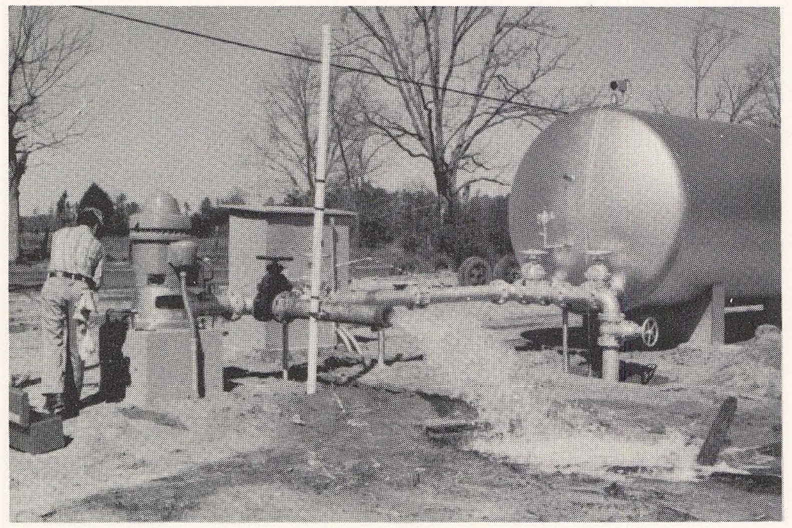


Figure 31. - Pumping tests provide authorities with data on both well capacity and water quality.

U.S. PUBLIC HEALTH SERVICE, DRINKING WATER STANDARDS		
CONSTITUENT	CONCENTRATION LIMIT (mg/l)	REMARKS
Iron (Fe)	0.3	Will cause staining of laundry, dishes, and plumbing fixtures. Imparts disagreeable taste. May be removed by aeration, precipitation, and filtration.
Manganese (Mn)	0.5	Will cause staining similar to iron.
Nitrate (NO_3)	44.0	May indicate sewage pollution. Presence above the limit maybe hazardous to infants ("Blue-baby disease").
Chloride (Cl)	250.0	May indicate sewage pollution. Imparts salty taste and is corrosive to plumbing fixtures.
Flouride (F)	0.8 to 1.7	Presence in large amounts may cause mottling of teeth. Water with concentration of about 1 mg/l may substantially reduce tooth decay in children.
Sulfate (SO_4)	250.0	Presence contributes to pipescale. May have a laxative effect on some users.
Total Dissolved Solids	500.0	Water with high content may be corrosive to well screen and other parts of the well structure. If better water is not available, 1000 mg/l is acceptable.

HARDNESS

Hardness is a common concern people have about their water supply. This condition is caused by calcium and magnesium being in solution. Hardness is commonly recognized by an increase in the quantity of soap needed to produce a lather. Excessively hard water will also produce boiler-scale, which may be objectionable to some industries. Water having hardness of 60 mg/l or less is considered soft; 61-120 mg/l is moderate; and over 121 mg/l is considered hard.

COLOR

Colored water is caused by organic material in suspension. Color of 10 units or less usually goes unnoticed. Larger color counts may be objectionable but, generally, are not harmful. Certain industrial uses find colored water objectionable. It can usually be removed by coagulation, settling, and filtration.

The water supply for the city of Jackson is obtained from the Pearl River, which flows along the eastern side of the city. This leaves a vast amount of water in three formations under the city to serve both industrial and varied domestic usages. The deepest of these three aquifers is the Wilcox. Only a few wells have been made in the Wilcox in this study area and the full potential of the aquifer in this vicinity, consequently, is unknown. The other two aquifers are the Kosciusko and Cockfield. It has been estimated in recent years that these latter two aquifers contain approximately 13 trillion gallons of water in Hinds County. Based on this estimate there should be many billions of gallons of water in these two aquifers under this study area. The availability of this large volume of good quality fresh water at a relatively shallow depth is the reason the deeper Wilcox has scarcely been developed.

The lack of well development in the Wilcox is further attributed to the fact that the dissolved solids content of the water is rather high, and the amount of chlorides has been measured to be between 200 and 250 mg/l. This concentration of chlorides is great enough to cause the water to taste slightly salty, and is approaching the limit allowed by the Health Department for drinking water. The general quality of the water in this aquifer worsens with depth, so well development needs to be limited to the uppermost Wilcox, especially for domestic purposes. Otherwise, the water is soft, slightly alkaline, and slightly colored, so it can be used for many industrial as well as domestic purposes.

The Kosciusko Formation aquifers are well utilized in the study area because the beds are at a moderate depth over the Jackson Dome. The overall quality of water obtained from the Kosciusko is generally quite good, though locally the iron content may be moderate and the water may be slightly colored because of lignitic material in the sands. Chemical analyses have been performed on the water from many wells developed in the Kosciusko. A selection of these analyses shows the following range of values for parameters considered critical for drinking water standards: pH 8.0 to 9.0 (slightly alkaline); sulfate 3 to 28 mg/l; chloride 3 to 33 mg/l; iron 0 to 0.4 mg/l; fluoride 0.1 to 0.5 mg/l; total dissolved solids 217 to 288 mg/l.

Fresh water developed from Kosciusko aquifers in this area is of good quality for most uses and many large-capacity wells are made in this formation.

The shallowest formation containing aquifers supplying the Jackson area is the Cockfield. The Cockfield is exposed at the surface in the Riverside Park area of the city and underlies part of the Pearl River alluvium on the eastern edge of town. It is probably receiving some recharge from the river. The overall quality of water obtained from the Cockfield in the area is good, but locally is quite variable in color and iron content, and varies from soft to moderately hard. A selection of analyses from Cockfield wells in the area show the following range of values: pH 7.0 to 8.7; sulfate 16 to 102 mg/l; chloride 14 to 69 mg/l; iron 0.1 to 0.8 mg/l; fluoride 0.2 to 0.6 mg/l; total dissolved solids 314 to 512 mg/l.

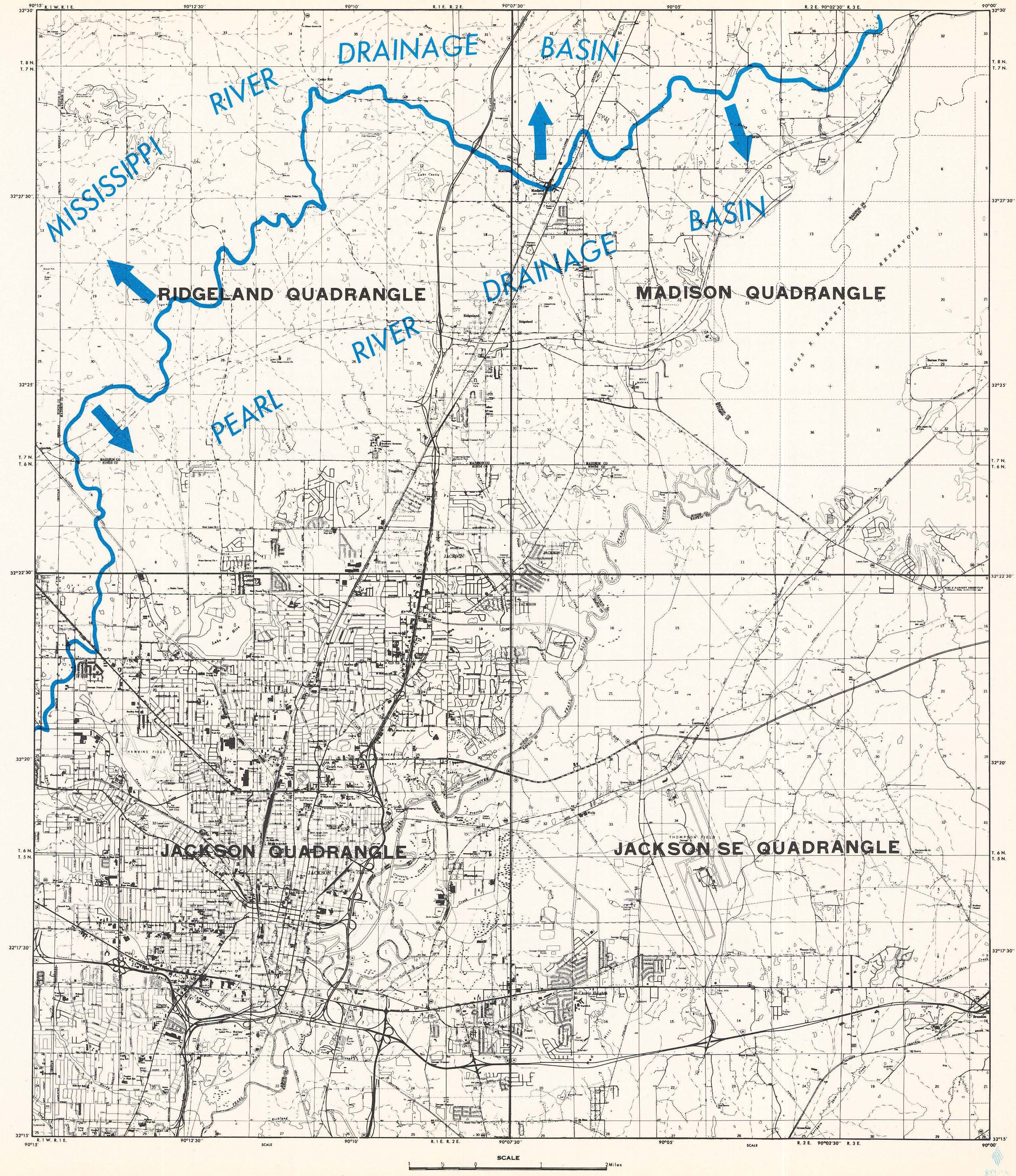
Fresh water obtained from aquifers in the Cockfield in this area is usually of good quality and several large-capacity wells have been made in them.

DRAINAGE DIVIDE

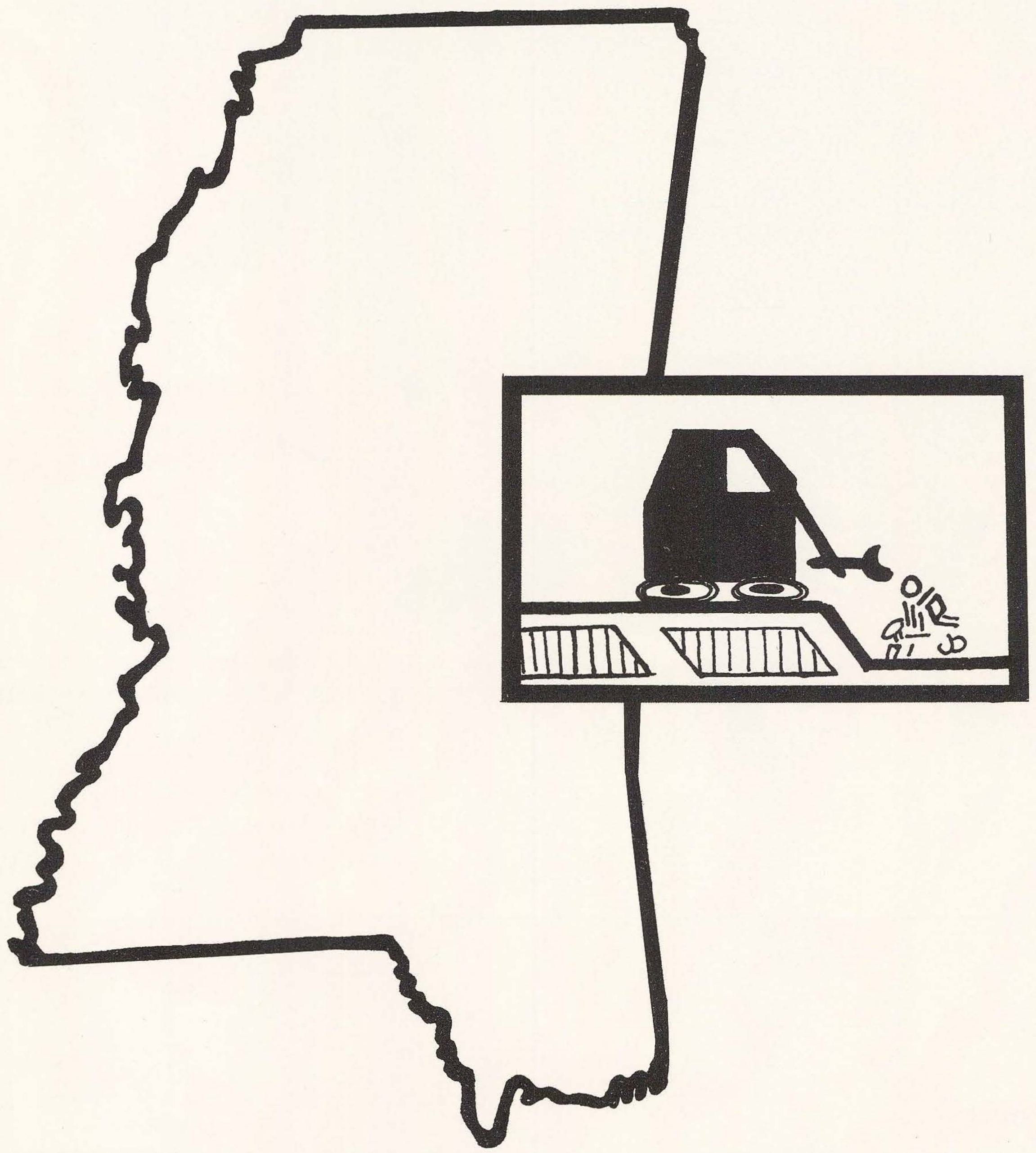
An examination of the drainage pattern on the western side of the Pearl River in this study area shows that all of the surface runoff does not flow easterly into the Pearl. A major drainage divide is indicated on the map on this page. This divide follows a gentle ridge trending northeast-southwest across portions of the Jackson, Ridgeland, and Madison quadrangles. Drainage on the northern and western sides of this ridge flows into tributaries of the Big Black River, itself a tributary of the Mississippi River. Drainage on the eastern and southern sides of this divide flows into the Pearl River, which flows into the Gulf of Mexico.

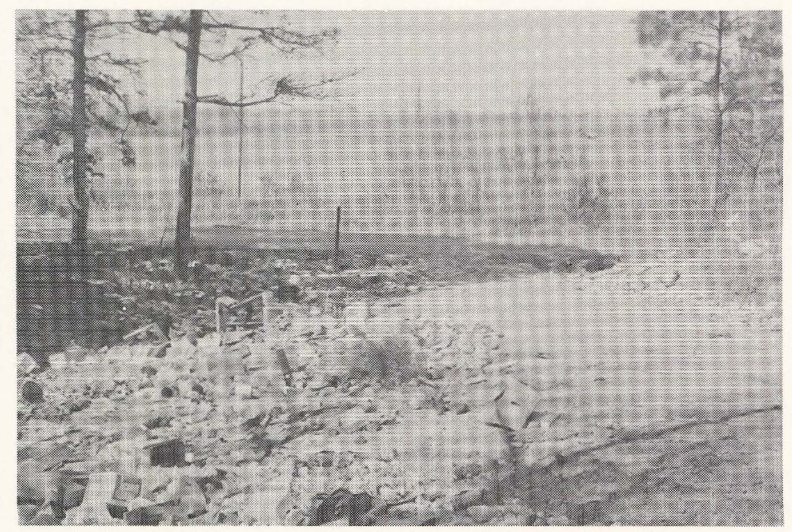
The major tributaries of the Big Black River that have their headwaters in this study area on the northern and western flanks of this divide are Bear Creek, Limekiln Creek, and Bogue Chitto Creek. A number of streams which are tributaries of the Pearl River have their headwaters on the southern and eastern sides of the study area. These are Haley, Hearn, Culley, Brashear, Purple, White Oak, Hanging Moss, Eubanks, Lynch, and Town Creeks.

The authors wish to point out the proximity of this major divide to the shore of the Barnett Reservoir near the northeastern corner of the map on this page. The drainage basin of the Big Black River (Mississippi River) approaches to within one-half mile of the Pearl River basin in this area. This might indicate that capture of the Pearl by the Big Black is forthcoming. This possibility is further exemplified by the fact that the Big Black lowlands are approximately 100 feet lower in elevation than the Pearl River bottomlands. It is a basic geologic and hydrologic principle that as a divide is eroded between two drainage basins of unequal base level, the higher basin will drain into the lower basin. If this stream piracy does take place, Jackson and points south will be left "high and dry." The probability of stream capture actually taking place in the foreseeable future is considered remote by most geologists. There are at least two reasons for this belief. One is the fact that on the northwestern side of the Barnett Reservoir in this area the divide is heavily wooded, which inhibits the erosional processes. The second reason is that the streams flowing toward the Big Black River have a low gradient, and consequently are cutting very slowly, if at all. If a great deal of channelization of these streams were to take place, or if excessive land is cleared for major developments, this situation could become much more serious.



SANITARY LANDFILLS





LANDFILL SUITABILITY

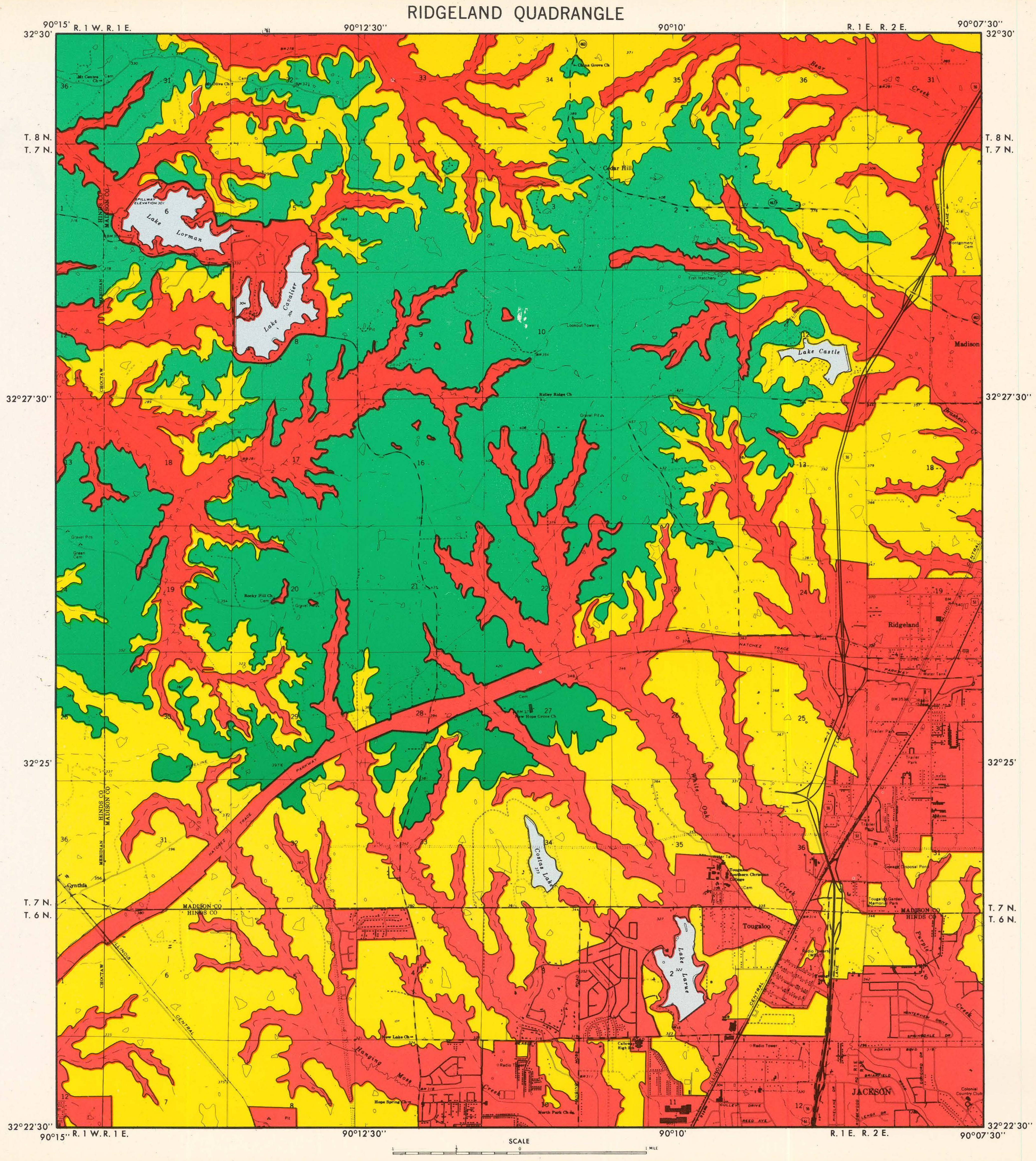
The sanitary landfill is the most practical and economical method of disposing of solid wastes, as well as being one of the most aesthetically pleasing methods. With the sanitary landfill operation, the vast amounts of refuse produced by individuals, industry, and agriculture are taken each day, or more often when necessary, and compacted and covered with a layer of soil. This is in direct contrast with the open garbage dump, where refuse is discarded indiscriminately at a certain locality. Open dumps are sources of visual pollution, biological pollution, and elemental environmental contamination.

Visual pollution is a very subjective concept, and what may seem undesirable or unwholesome to one person may not seem so to another. Reactions and decisions regarding this type of pollution are usually determined by emotional stimulation. As the mere sight of bare earth will be visually offensive to some, even the sanitary landfill will be a visual pollutant to certain segments of the population.

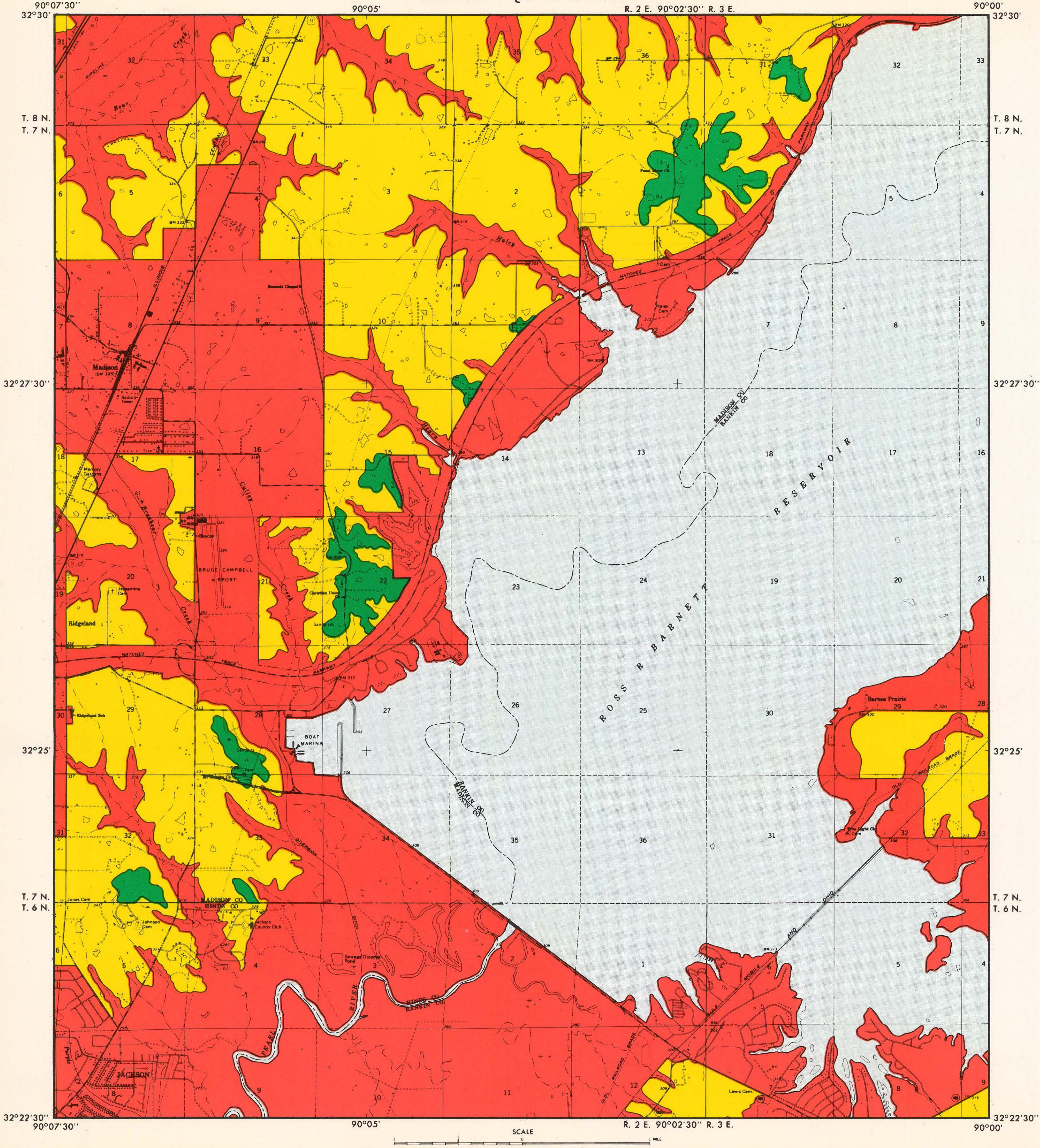
Biological pollution should be an area of primary concern to all people. Pathogenic materials do exist in solid waste, and unless waste disposal sites are carefully maintained (such as at a sanitary landfill site), it is possible for transporting agents, or vectors, to carry the disease agents from the site and subsequently infect nearby populations. At an open dump, human scavengers, pets, rodents, insects, and birds are all potential disease carriers. This problem can be practically eliminated with the use of a properly managed sanitary landfill.

Other disease carriers are wind and water. Wind, as a disease-carrying agent, presents a very minimal problem at a sanitary landfill since all refuse is constantly being covered. Water moving from a disposal site carries impurities from the site. These impurities consist of bacteria and viruses (biological contamination) and natural elements and man-made compounds (elemental environmental contamination). This water, called leachate, is formed when rain and/or ground water percolates through the refuse in a landfill or dump. In order to alleviate this problem at a sanitary landfill, careful planning and knowledge of specific geologic factors must be considered.

Only in an arid climate, where precipitation is very slight and the water table is far below the surface of the ground, can it be assumed that little or no leachate will be formed. Although non-production of leachate is the safest solution, this condition is rare in the United States, especially in populated areas. Therefore, it can be assumed that in most parts of the United States, and in all parts of Mississippi, leachate will be formed. Usually, the greater the amount of rainfall, the greater the amount of leachate that will be produced. At the sanitary landfill site the daily soil cover and thicker final soil cover should be of a relatively impermeable material so as to retard the movement of rainwater into the refuse. This will not prevent the infiltration of water, since even a well compacted, stiff clay will crack open in dry weather and provide easy access for the water. The next safest situation, since leachate will be produced, is to have all of the leachate collected and treated. This requires the installation of a tile drain field and a treatment plant. Since this method is relatively expensive, it is not practiced in any but the largest and most desperate cities.



MADISON QUADRANGLE



The alternatives to collection and treatment are (1) containment and (2) natural purification. This is where the geology of the site becomes the most important consideration. Scientific selection of the site is a must, so as to determine pollution potentials. Containment of the leachate is possible when the landfill is located in a layer of hard impermeable rock, such as a shale, or in a stiff clay. These materials have a low permeability which retards leachate from moving any appreciable distance from the landfill. A problem which may appear with a landfill placed in an impermeable substance is that the leachate may seep onto the surface at any nether point around the perimeter of the compacted refuse. Also, ponds of contaminated water will form in the refuse, even when the waste is placed above the water table, because rainwater will be able to invade the fill more rapidly than the leachate will be able to depart. A method of attacking this problem is to allow for natural purification of the leachate. This can be accomplished by permitting the leachate to flow, as ground water flows, through a slightly permeable material. A coarse sand is too porous and permeable to do a considerable amount of cleaning of the leachate. Gravels should be avoided because the leachate would flow unchecked throughout the area. The ideal material would be a silty, clayey loam. The leachate would be able to flow, and it would be purified in two ways. Biological contaminants in the leachate would be physically filtered out by silt and sand particles, and chemical contaminants would be reduced by the clays through the process of ion exchange.

LEGEND

(For all four Maps showing Sanitary Landfill Suitability)

Areas Of Least Suitability

Areas Of Moderate Suitability

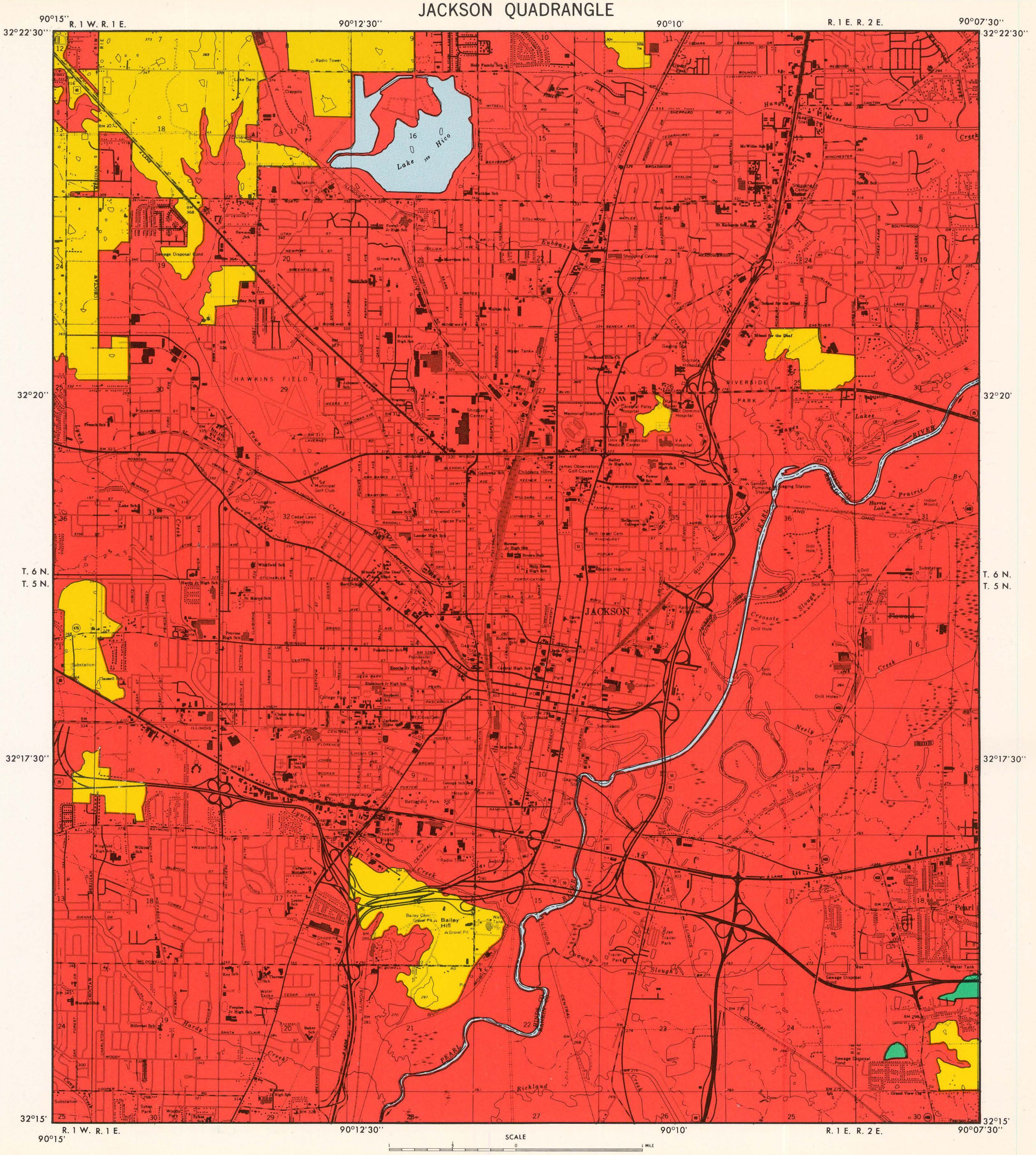
Areas Of Greatest Suitability

Certain other factors must be considered in the placement of sanitary landfills. Surface drainage patterns should be examined to insure that runoff caused by precipitation will not flow through the landfill site and empty into a stream. Areas subject to flooding should be avoided. Flood plains are also unsuitable locations for landfills because the water table is usually very close to the surface of the ground. Ideally, the water table should be thirty feet below the base of the refuse in the sanitary landfill to avoid contamination of the ground water and the production of greater volumes of leachate. In Mississippi the water table is not always this far below the surface; therefore, this condition can not always be met. All efforts should be made to avoid contact between ground water and the refuse in a landfill. Sanitary landfills should not be placed in those areas that comprise the outcrop belt of geologic formations that serve as sources of ground water. These are recharge areas where water enters the aquifer, and the leachate from a landfill placed therein could contaminate a supply of valuable water. Once polluted, the ground water in an aquifer may remain useless for generations.

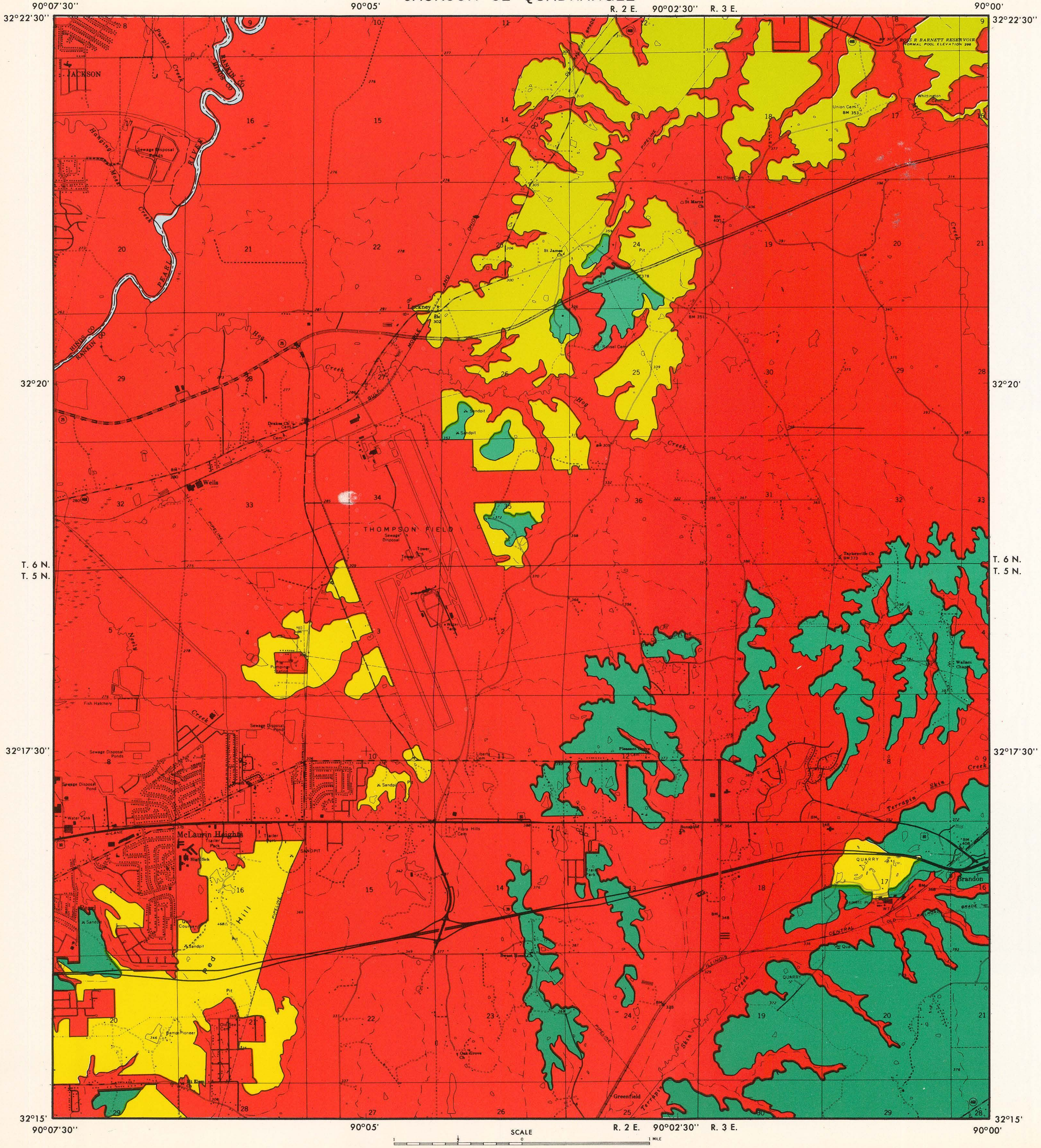
There are three methods of operating a sanitary landfill. In an area sanitary landfill, the refuse is dumped on the original ground surface, a bulldozer compacts the waste, dirt is laid over the waste and compacted to a thickness of six inches, and the daily cell is completed. Several layers of these cells may be made at the landfill site. As the landfill is completed, a final cover of soil two feet thick is put into place. In the area landfill, all of this cover material may have to be trucked in. This type of landfill is useful for creating serviceable land out a low-lying area of little value. In a trench sanitary landfill, a trench is dug and solid waste is deposited, compacted, and covered as in the area landfill method. The trench method is self-contained in that the cover material is provided by the excavation of the trench. The third type of landfill involves the ramp method, sometimes referred to as the slope method. This is a variation of the area and trench methods. Here, the refuse is dumped on the side of an existing slope, compacted, and covered as before. Cover material is provided by excavating a shallow trench at the foot of the slope being worked. The particular method of operating a sanitary landfill will vary with the natural conditions and equipment available at each site.

As was mentioned briefly above, a sanitary landfill may be used to improve the value of the property. Parks, botanical gardens, playgrounds, golf courses, and parking lots are just some of the ways in which a completed landfill can be utilized. There have been cases where people have built expensive homes in the proximity of sanitary landfills with the knowledge that a golf course would be constructed on the completed site. The construction of buildings and other heavy structures on completed landfills should be avoided, or carefully engineered, because minor settlement and the production of some gas may be expected. The idea of multiple land use will be discussed more thoroughly in the Present Land Use section.

JACKSON QUADRANGLE



JACKSON SE QUADRANGLE



The sanitary landfill suitability maps presented in this section are designed as a guide to the proper placement of landfills. Areas shown in red are the least suitable for various geological reasons, and because man's structures are already in place. Specifically, in this study area, areas shown in red include land already built upon, flood plains, terrace deposits that overlie the recharge area of a possible aquifer, and hard rock (limestone)outcrops of the Glendon Formation. Areas shown in yellow are moderately suitable for the placement of sanitary landfills. Parts of this area may be ideal, other parts may be totally unacceptable, and still other parts may be of variable suitability. Included in the yellow area on the maps are the outcrop belt of the Yazoo Formation, which has the advantage of retaining leachate and the disadvantage of being hard to work in wet weather, certain places in the Vicksburg Group where abandoned quarries are located, and certain terrace deposits overlying the Yazoo Formation but in proximity of the Forest Hill Formation, an important aquifer. Areas shown in green are the most suitable sites for the location of sanitary landfills. Included in this area are geologic outliers of the Forest Hill and Catahoula Formations, because there is no connection between the ground water in the outliers and the ground water that is being used as a water supply from these formations in other areas. Also included are terrace deposits overlying the Yazoo Formation, and other areas where ground-water contamination would be a remote possibility.

It must be emphasized that the sanitary landfill suitability maps only serve as a general guide. Not every location in the study area will meet all the qualifications of the area in which it has been mapped. A number of local conditions may have more relevance to a site than the general conditions considered in this report. A careful analysis of every landfill site should be conducted to insure that no damage to the environment will result.

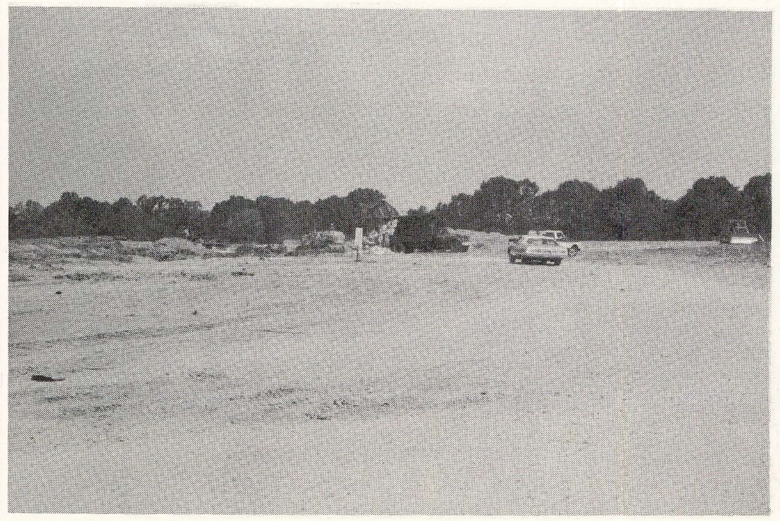


Figure 32. - City of Jackson properly managed sanitary landfill.

Figure 33. - Scavengers should not be permitted in a landfill.

Figure 34. - Cross-roads dump.

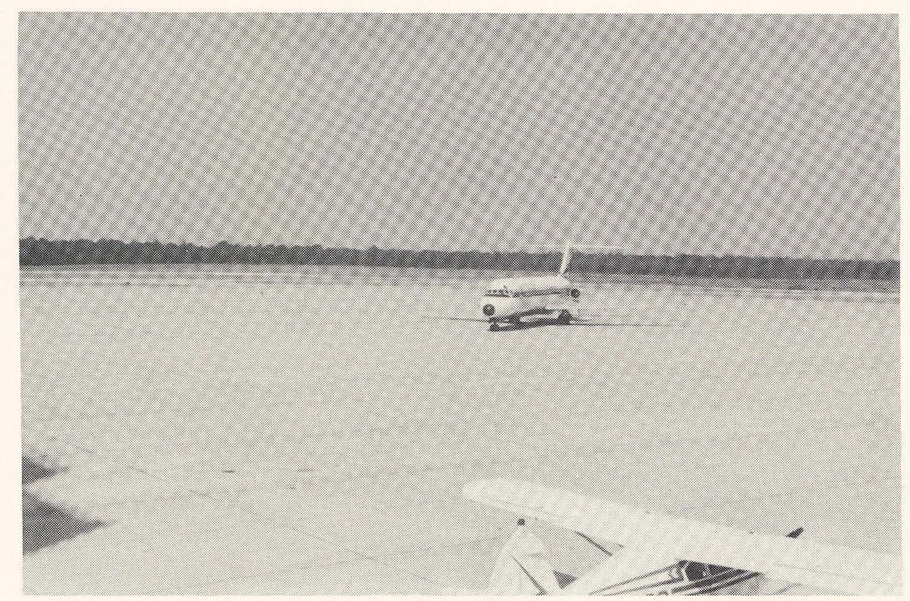
Figure 35. - It usually takes more than signs to stop roadside dumping.

Figure 36. - Burning dump operation.

Figure 37. - Properly managed sanitary landfills are not overly repulsive to citizens in the vicinity.

Figure 38. - Improperly managed trench landfill.

RECREATION AND TRANSPORTATION



TRANSPORTATION

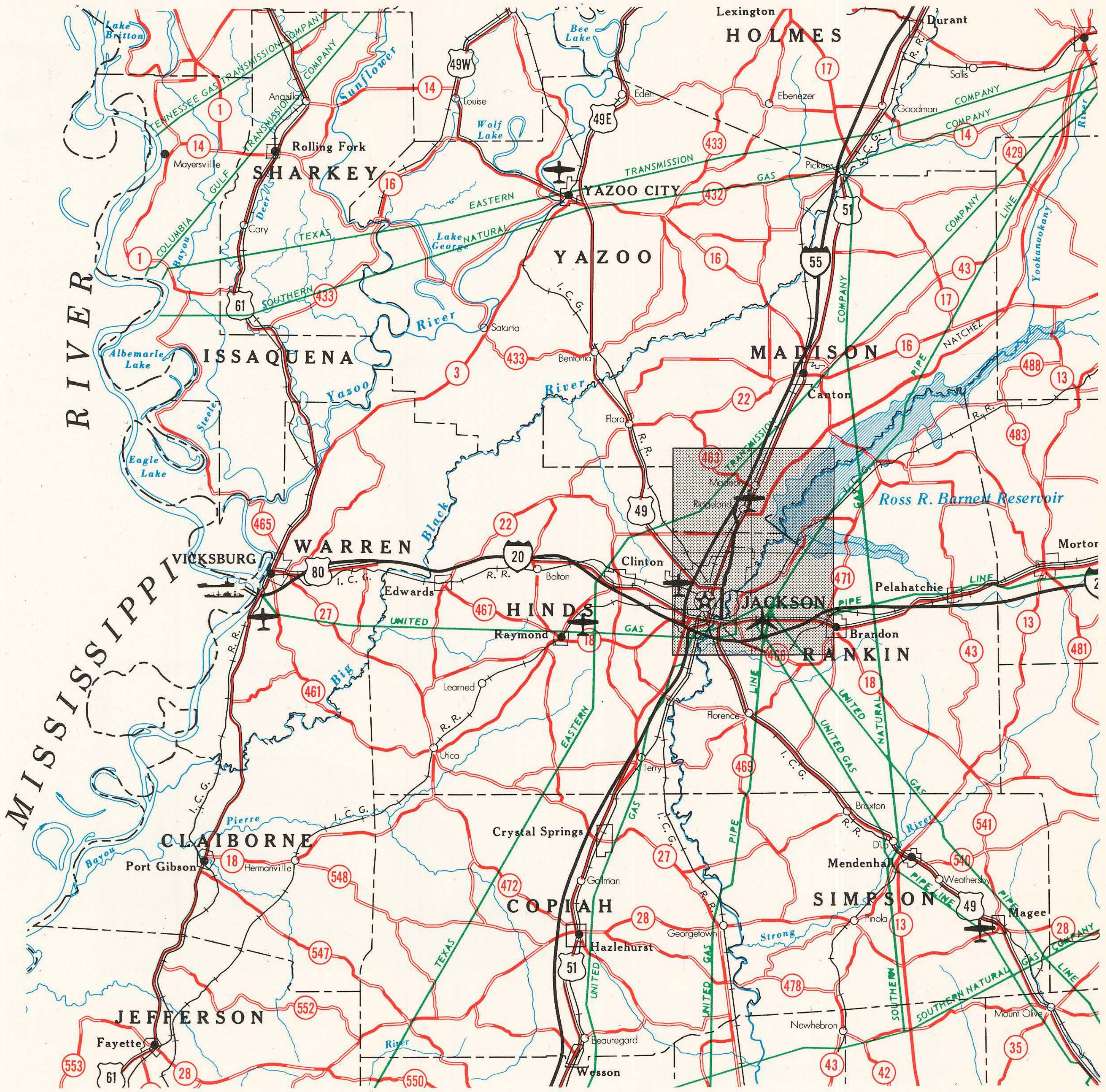
Jackson has been known as "The Crossroads of the South" for a great many years. Primary north-south and east-west highways, north-south and east-west railroads, and north-south and east-west telephone coaxial cables intersect at Jackson. These are among the major reasons the city has received this nickname.

Road transportation is provided in the west-central part of the State by a number of interstate, federal, state and county highways. Interstate-20 traverses central Mississippi in an east-west direction on its route from coast to coast. Interstate-55 connects Chicago with New Orleans and intersects Interstate-20 at Jackson. Three federal highways provide service to the study area and its vicinity. U. S. Highway 49 crosses the area from southeast to northwest connecting the Gulf Coast with the vast agricultural region in the northwestern part of Mississippi. U. S. Highways 80 and 51 are still used extensively by local traffic even though they have been replaced as major transportation routes by Interstate-20 and Interstate-55 respectively. The Natchez Trace Parkway, several state highways, and many county roads provide additional access primarily for local traffic.

Jackson is a junction on the Illinois Central Gulf Railway system. Nine rail lines radiate out of this hub to provide service to all parts of the country.

Air transportation is also readily available to the study area. Three commercial airlines serve Jackson's modern Thompson Field. This jetport has the facilities to handle all types of passenger and freight aircraft. Hawkins Field, in west Jackson, is maintained for private and company planes.

The Mississippi River port at Vicksburg, which is approximately 40 miles west of the study area, provides access to barge transportation to the heart of America as well as to the Gulf of Mexico.



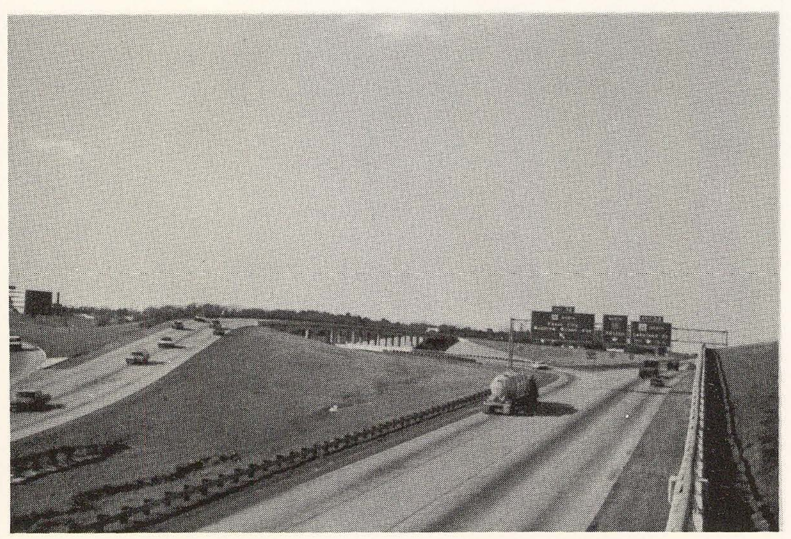
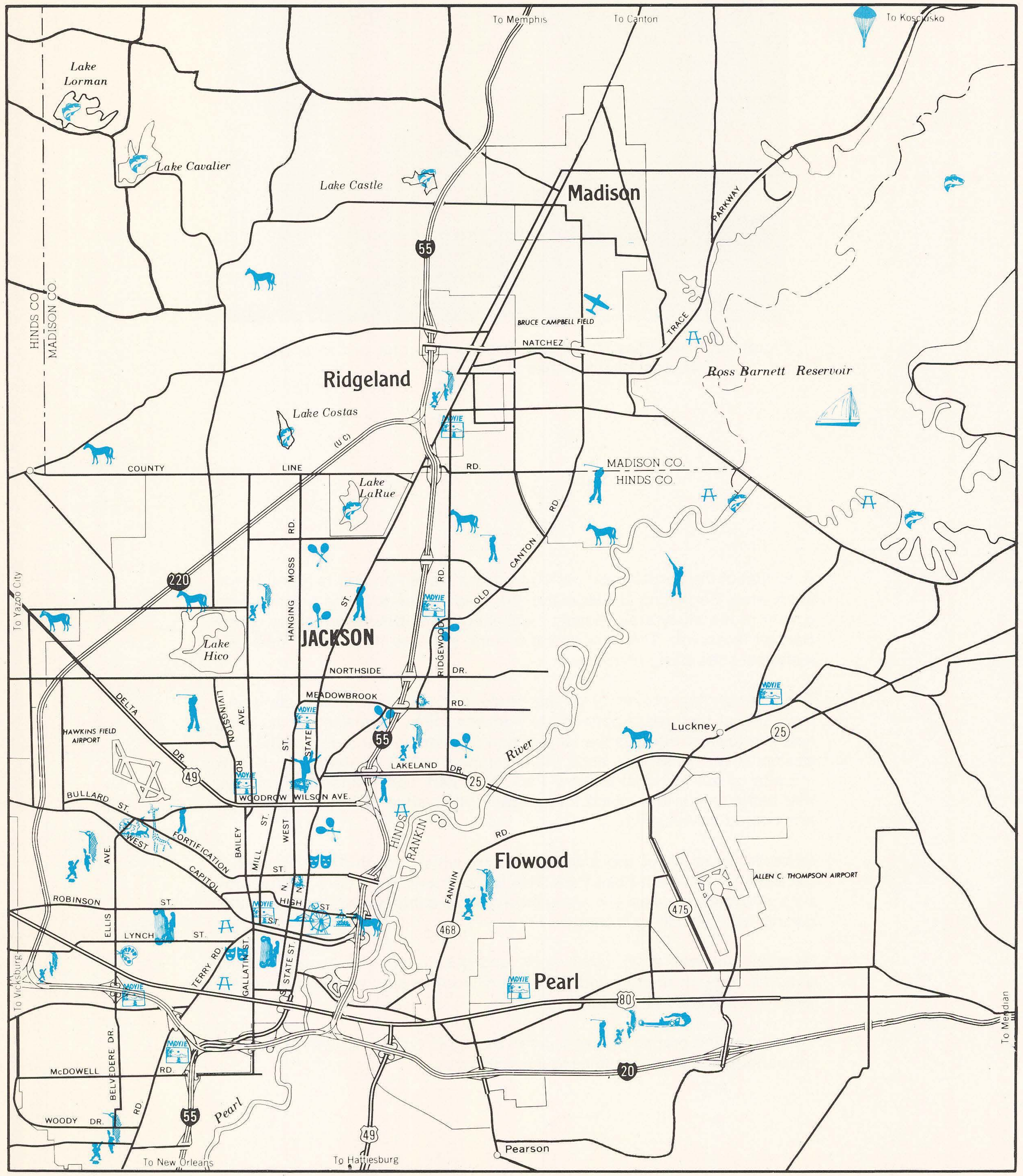


Figure 39. - Modern transportation facilities serve the Jackson area.

RECREATION



LEGEND

- MOVIE THEATRE
- TENNIS
- ART GALLERY
- FOOTBALL
- AUTO RACING
- STATE FAIRGROUNDS
- MUNICIPAL ZOO
- CONCERT THEATRE
- GLIDER CLUB
- RIDING STABLE
- PARACHUTE CLUB
- FISHING
- SAILING
- PICNIC AREA
- STAGE PLAY
- GOLF
- BASEBALL OR SOFTBALL
- HUNTING

Figure 40. - Numerous recreational facilities are found in the Jackson area parks.

Figure 41. - The State Fair and various events at the Mississippi Coliseum provide entertainment for thousands each year.

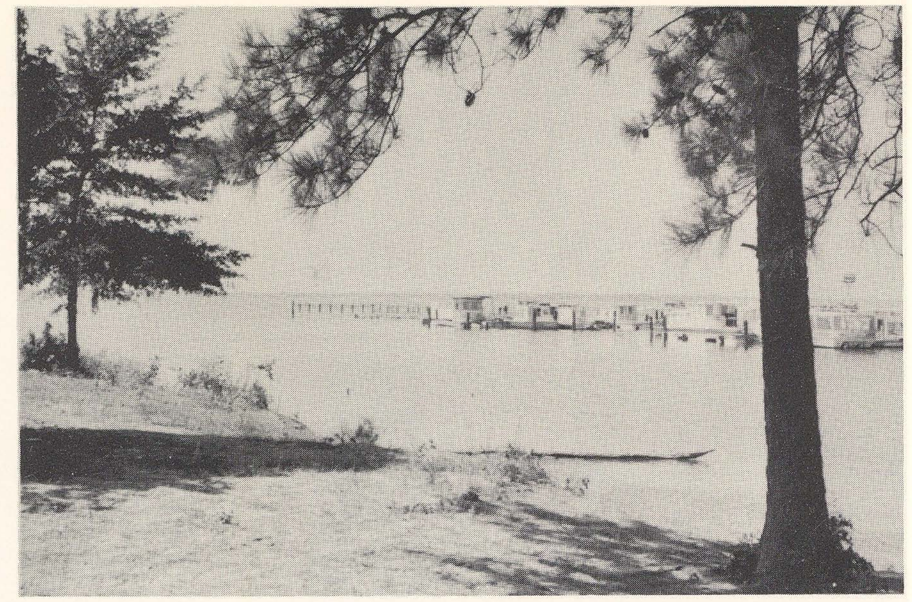


Figure 42. - The Ross R. Barnett Reservoir is one of the primary recreational facilities in the area.

The demand of modern society in this Country for more and better recreational facilities has been increasingly boisterous in recent years. The Federal Government responded with a reorganized and expanded Department of Outdoor Recreation. The city of Jackson greatly expanded their Department of Parks and Recreation, and this has resulted in an increase in the number and variety of recreational facilities in the area in the last few years. The public park acreage in the city has increased from 1069 acres to over 2650 acres in the past three years. Additionally, the parks provided by the communities of Pearl, Flowood, Madison, and Ridgeland furnish ample park and open space to the people of the study area. Facilities offered in these parks and open areas include tennis courts, golf courses, softball fields, camp grounds, nature trails, basketball courts, picnic grounds, ceramic studios, and playgrounds.

The one particular recreational facility that probably dominates the area is the Ross Barnett Reservoir. The Pearl River was impounded to form a vast area for hunting, fishing, boating, skiing, picnicking, and camping. The reservoir covers approximately 49,000 acres of bottomland. Many persons speculate that annually more people enjoy the features for recreation at the reservoir than any other facility in the area.

Many other fine recreational facilities of various types are found within the study area. Several exciting major college football games and other outdoor sporting events are staged each year in the 46,000 seat Mississippi Memorial Stadium. The 10,000 seat State Coliseum is located on the State Fairgrounds and is the site of such activities as indoor athletics, concerts, animal shows, ice shows and other exciting events. The Jackson area offers cultural and recreational opportunities such as the historic Old Capitol Museum, the Museum of Natural Science, golf courses, a modern zoological park, a beautiful botanical garden, little league baseball parks, tennis and swimming clubs, art galleries, concert and theatrical stages, riding stables, auto race tracks, and movie theaters.

A portion of the partially completed Natchez Trace Parkway is found in the study area. Beginning at Ridgeland, the Trace extends to the northeastern corner of the study area, closely paralleling the northwestern shore of the Barnett Reservoir. This scenic and historic parkway has many picnic and historical sites along its route.

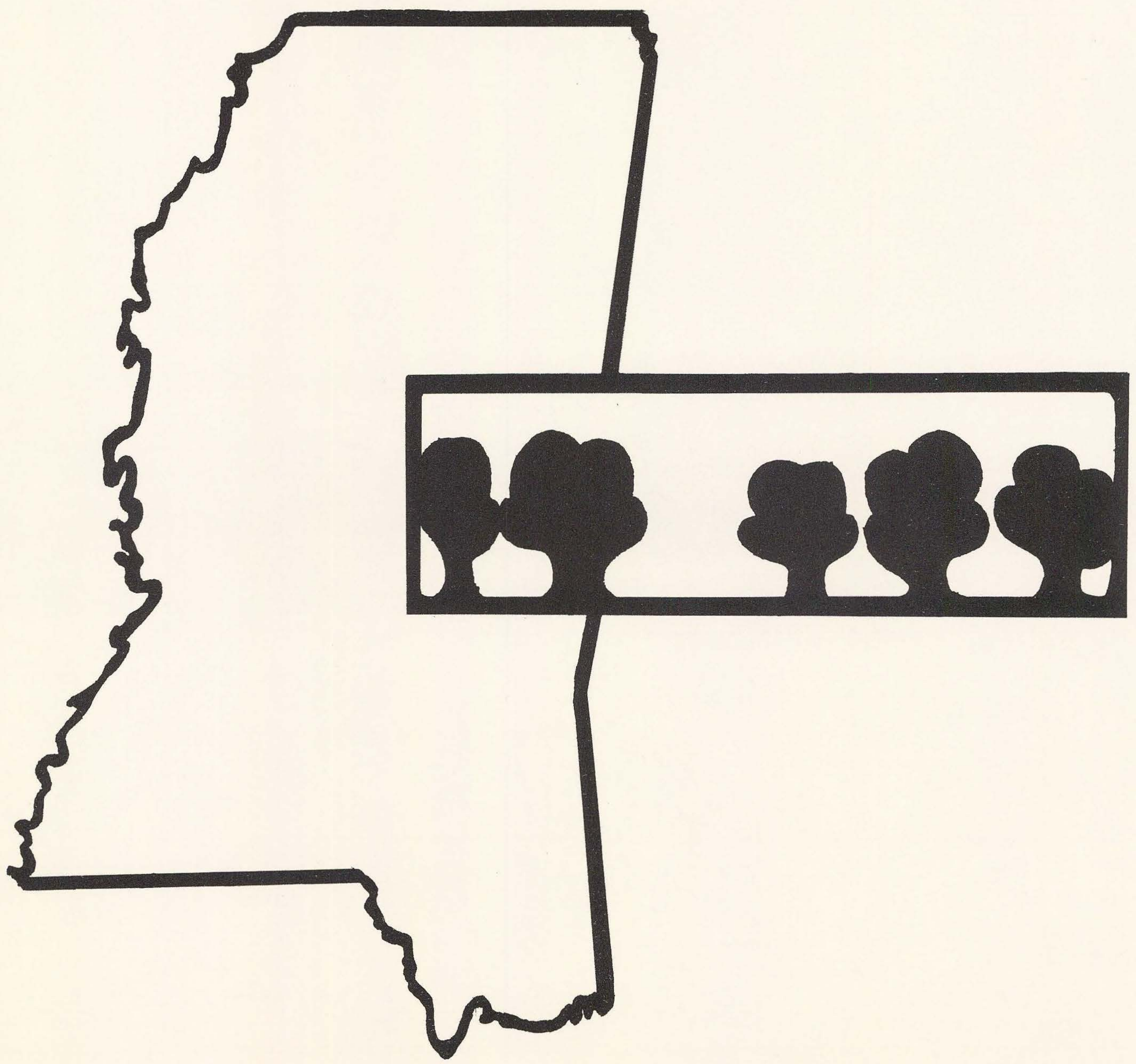
The surrounding proximity of the study area contains many additional recreational features. Approximately fifteen miles northwest of Jackson, near the town of Flora, is the largest petrified forest found east of the Mississippi River. Vicksburg, once the stronghold of the Confederacy, is now the site of the National Military Park. This park commemorates the Civil War battle which took place there. Many other sites of historical interest are located in Vicksburg.

Immediately south of the town of Morton, which lies thirty miles east of Jackson, is Roosevelt State Park. This is the closest state park to the study area, and many local people enjoy the available camping, hiking, swimming, fishing, and picnicking facilities.

Seasonal squirrel, dove, quail, duck, and deer hunting is generally quite good all through and around the region. Additionally, many streams and lakes are available to the local fisherman.

The map on the preceding page shows the approximate location of many of the various recreation facilities found in the area.

LAND USE



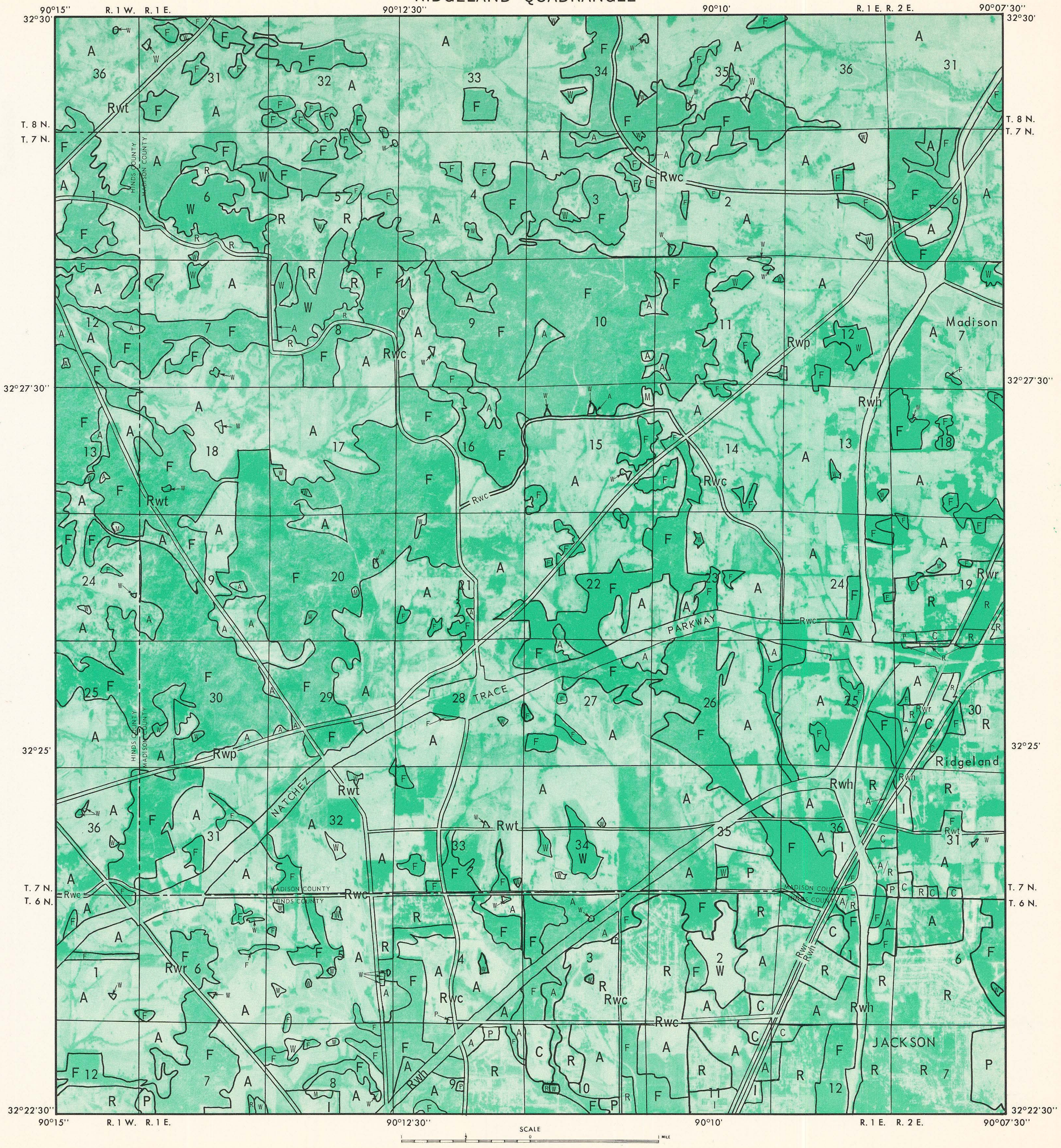
PRESENT LAND USE

The study area is predominantly urban and expanding urban except for extreme outlying and isolated swampy localities. Problems associated with land use should be of concern to citizens of the area. Now is the time to examine priorities and expectations and evaluate natural resources. Planning for the future should be done now so that our natural resources will not be destroyed through ignorance and carelessness.

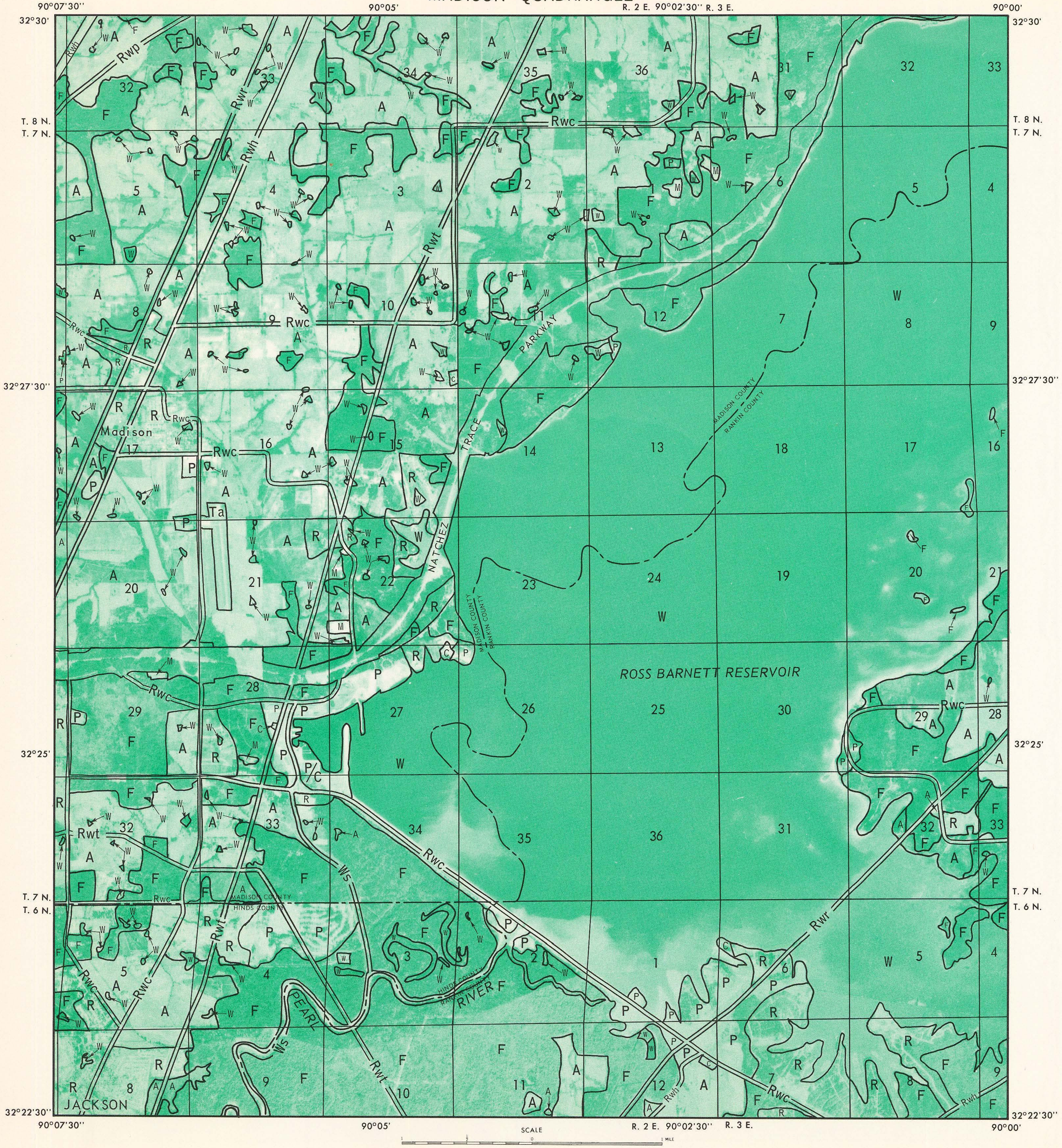
The authors feel it necessary to explain the maps presented here. The base map of the four quadrangles is derived from a mosaic of four aerial photographs that were taken from an altitude of 60,000 feet in November of 1971. The photographs are of high quality, and objects a few yards wide may be discerned with the aid of a magnifying glass. Much of the clarity has been lost in the reproduction of the photographs to make these maps, but the effect is still interesting and useful. The symbols used to indicate the various types of use to which the land has been subjected are explained in the legend.

Future development in the area will be influenced greatly by present land-use patterns. The maps show only current land use, and do not attempt to show plans for future use. The lakes, ponds, farms, and homesites which are shown will generally be either modified or removed during urbanization. Interstate pipelines, power-transmission lines, cemeteries, and major reservoirs, such as the Ross Barnett Reservoir, will be planned around. County roads will probably become main thoroughfares within the city as urbanization encompasses them. Residential areas will continue to grow, and the growth pattern will be adjacent to present suburbs. Industrial areas will extend beyond their present boundaries, following railroads and highways. This growth should not be allowed to follow its course unchecked without having surveys of natural resources and geologic hazards made. Also, any overall plan for land use should include social and aesthetic factors, but these parameters are not geologic and are not included in this publication. The most pertinent physical features affecting present and future land use were discussed in the following sections: Slope, General Geology, Flood Plains, Mineral Resources, Engineering Geology, and Landfill Suitability. It is the combination of this information that is of significance in this section.

RIDGELAND QUADRANGLE



MADISON QUADRANGLE



LEGEND

(For All Four Land Use Maps)

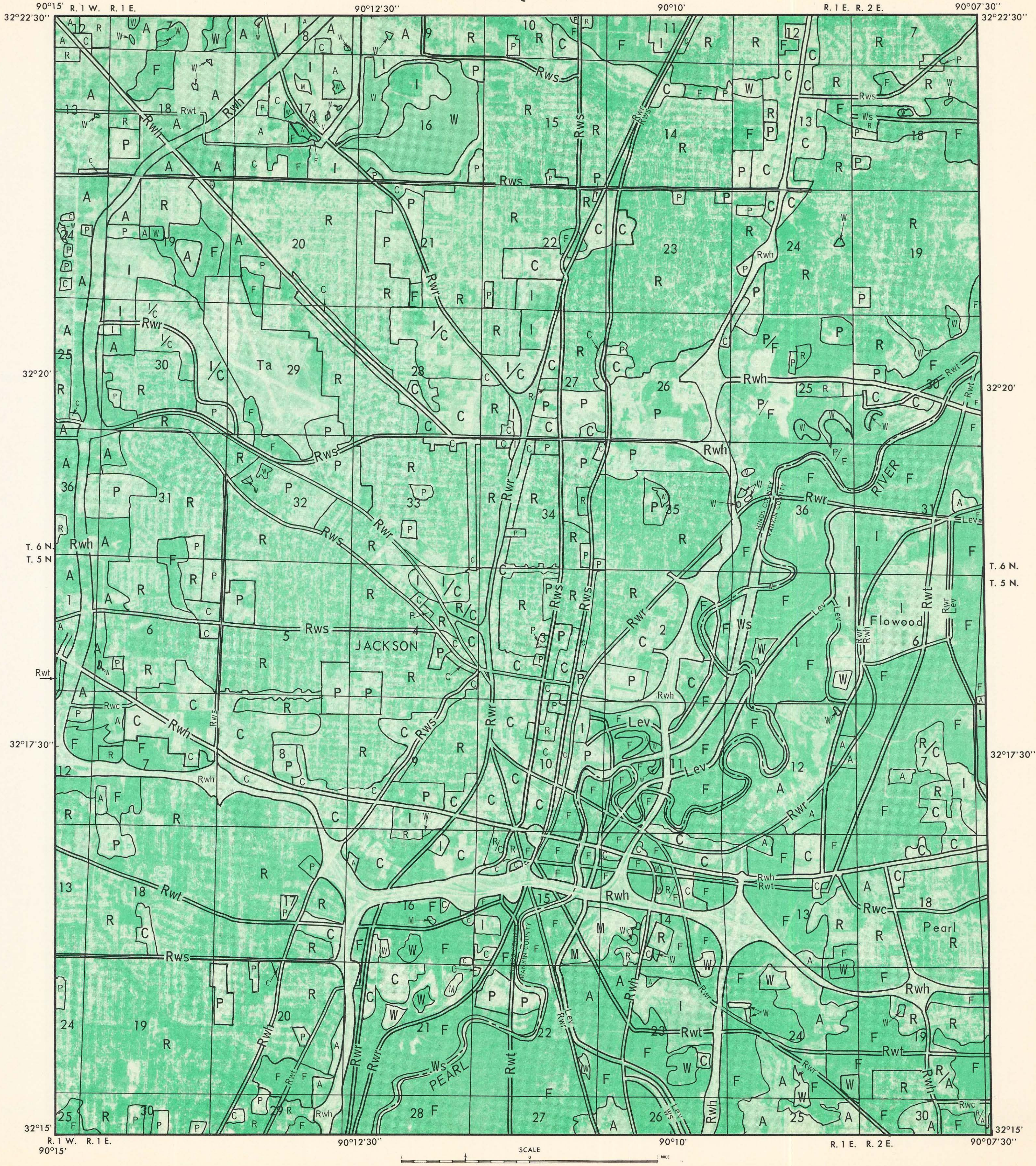
- Rwh - State or Federal Highway Right-of-Way
- Rwc - Principal County Road Right-of-Way
- Rws - Principal Urban Street Right-of-Way
- Rwr - Railroad Right-of-Way
- Rwp - Pipeline Right-of-Way
- Rwt - Power Transmission Line Right-of-Way
- Lev - Flood Control Levee
- Ws - River or Stream
- W - Lake, Pond or Reservoir
- Ta - Airport Facilities
- A - Agriculture (Includes idle agricultural land)
- M - Materials Pit
- F - Forest (Includes swampland)
- P - Public or Semi-Public Facility
- C - Commercial Area
- R - Residential Area
- I - Industrial Area

The blight of urban sprawl has already taken over parts of the study area and is swiftly encroaching on the remainder. If long-range plans to handle a greatly increased population are formulated now, residents of this area are in a good position to insure that potential urban problems can be properly handled.

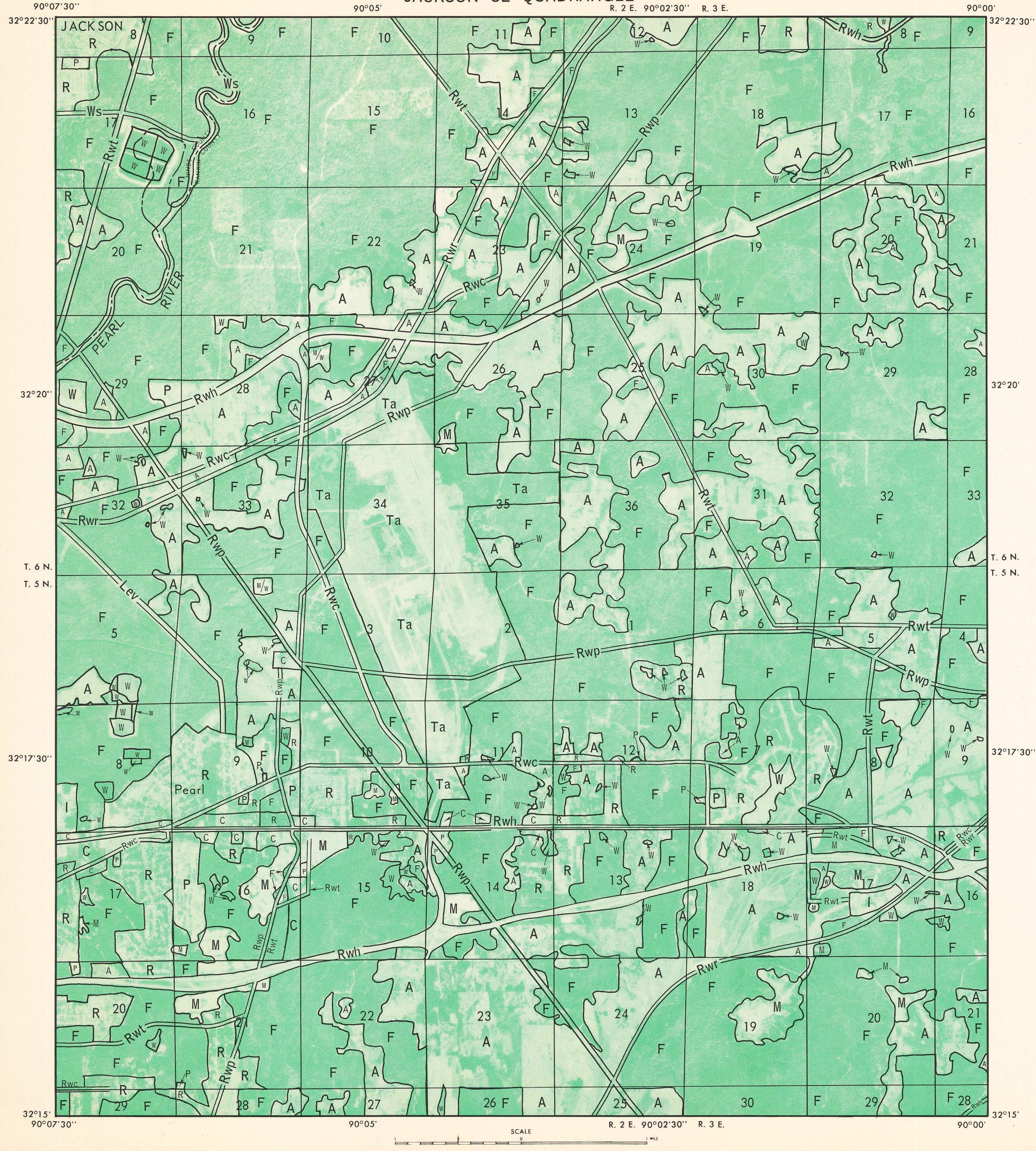
Nearly 2000 years ago, a man named Vitruvius, a Roman architect, warned his colleagues to locate their cities and buildings with care and with understanding of the natural environment. We know much more today about our natural environment than did Vitruvius, but our land use is far more intense and our problems far more complex.

Construction materials, such as brick and tile clays, sand, and gravel serve as a good example of how a lack of proper land-use planning can affect an urban area. These resources are located where natural geologic processes have placed them, not necessarily in locations convenient to man. Such materials have a low unit value, and thus transportation costs are significant in the economics of their use. If the distance between the source and the destination of the material is more than a few miles, much of the cost may be for transportation. When city officials allow construction to take place on those deposits within its boundaries, these materials have to be retrieved from more distant sources. The price of sand, gravel and limestone will be higher, increasing the price of concrete, resulting in higher building costs. In addition, deposits of construction materials that are built upon are lost forever. It should be extremely obvious that if city planners were to take stock of the city's reserves of mineral deposits, the loss of natural resources could be avoided by proper zoning. Cities sustain economic losses because urban development prevents the exploitation of many mineral resources.

JACKSON QUADRANGLE



JACKSON SE QUADRANGLE



A partial solution to the problems associated with the availability and removal of mineral resources is multiple land use. Multiple land use may be instituted in two ways. By sequential multiple use, a number of problems can be solved. Under such a system, a mineral deposit such as gravel can be removed for use, a sanitary landfill can be established to fill in the depression with the city's solid wastes, and a parking lot or a park can be constructed on the completed landfill. Obviously, prior planning is required for the successful application of such a sequence, and this includes the mapping of the original mineral resource. The other form of multiple land use is simultaneous multiple use. This method may be used when the removal of the mineral resource does not require the total disruption of the land's surface. The procedure of multiple land use may run the risk of causing temporary political problems, but the time is drawing nigh when our supplies of construction materials will be exhausted. As stated previously, the study area is already urbanized to a large extent, and that which is not is on the verge of becoming so. The time has come to make decisions about future land use. The cooperation of residents, planners, engineers, architects, political officials, and geologists alike is necessary if we are to provide a healthy, prosperous society for future generations. Hopefully, these ends will be achieved and a path will be opened to the design of urban areas more nearly in equilibrium with their geologic environments.

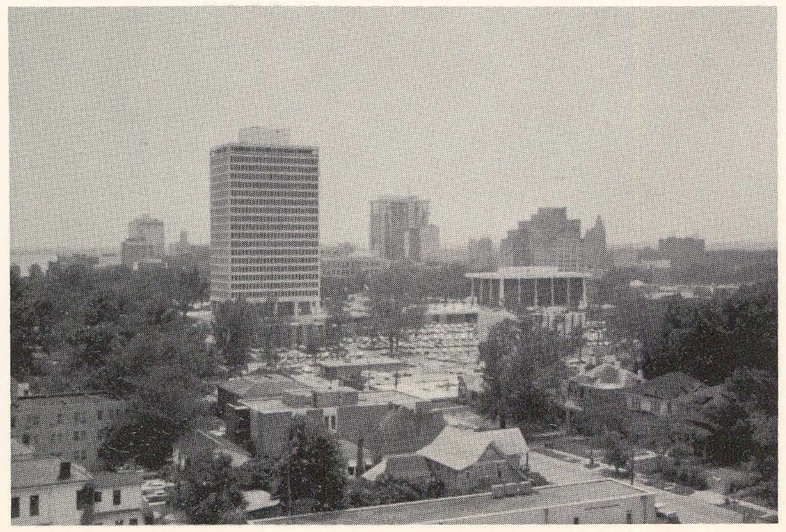


Figure 43. - A view of a portion of the commercial area of downtown Jackson.

Figure 44. - Residential usage encroaching on agricultural land.

Figure 45. - Agricultural land use.

Figure 46. - Forested swampland.

Figure 47. - New residential development.

CONCLUSIONS AND SUMMATION

One of the many challenges to mankind is living in harmony with the physical environment. Of all the living things on this planet, humans alone have the capability of altering the quality of the environment. The processes that control the conditions affecting life exist in a delicate balance, and all consequences should be considered before this balance is tipped. Before any major project is undertaken, all aspects of the project should be examined, and an unbiased, unselfish decision should be made as to the net result it would have on the people and their environment. There are numerous examples of structures built in earthquake-hazard areas which were destroyed because of inadequate design. Poor zoning ordinances in flood plains have resulted in property damage and loss of life. Community water-supply systems have been rendered unusable because of waste-disposal systems being installed without necessary considerations being made during the planning stages of the project.

As urbanization spreads into agricultural areas and other open spaces, its impact on the natural environment will be profound. The changes caused by population expansion strongly affect man and his society. Technological planning for this expansion is an urgent necessity. Environmental management methods to harmonize social needs and limitations with the physical environment and natural resources must be implemented. Problems must be anticipated and plans developed for their solutions.

Environmental geology deals with problems such as these. This report represents the authors' attempt to relate geology to the lives of the people inhabiting the study area. It is an attempt to illustrate how geology can have an affect on types of development and the economy of the area. Society needs to face its physical environmental problems and decide which are the necessary courses to take in order to maintain a suitable standard of living.

The topographic features in this study area have been sculptured by the processes of weathering and erosion and not by hazardous geologic structures. The land is gently rolling and the slope is not so steep as to be considered a hindrance to development. Flat slopes are circumscribed to flood plains, and this places restrictions on types of use to which this land can be subjected. Lowlands along the Pearl River are subject to periodic flooding, and these areas should be subjected only to those uses which do not require much in the way of expensive and permanent structures.

Levels of ground water in supply aquifers are dropping. Water is being withdrawn at a rate faster than nature is replenishing it in parts of the study area. The end product of such a situation can easily be visualized. Conscientious planning is essential if we are to preserve our water supplies for future generations.

Although ground water can possibly be replenished by rain, there are natural mineral resources which cannot be renewed. Resources such as sand, gravel, limestone, petroleum, and natural gas are fixed in amounts and location by natural processes over which man has no control. When the last of a certain natural resource is extracted, then that material will have vanished from the Earth in similar respect as when an animal species becomes extinct.

The demand for petroleum and natural gas is exceeding the amounts being produced. This fact is responsible for the Country's current energy crisis. Society is making greater demands on the earth's resource base than that base can support - and there will be no recharge. Gravel of a quality to meet exacting concrete specifications is another example of resource depletion that can soon affect citizens of Mississippi and of the study area. Reserves of gravel are not overly copious, and as the need for high-strength concrete increases, they will near depletion. There have been reports of communities that have covered deposits of natural resources with residential developments, shopping centers, parking lots, and commercial centers. Once these deposits are built upon, society has deprived itself of their use. This is the reason why land-use planning should include investigations of subsurface natural resources before implementation takes place.

Liquid-waste disposal facilities and sanitary landfills present potentially serious problems to mankind's well being if geologic conditions are not considered. If waste disposal facilities are located without regard to potential pollution problems, unusable water supplies will result. This has happened in some areas of our Country and our State. It has been discovered that once the source of pollution has been rectified, the aquifers remain unfit for human use for a decade or longer. An examination of the materials beneath the landfill site, the water table depth and aquifer recharge belts in the area, surface drainage and susceptibility to flooding are the primary evaluations to be made regarding the suitability of a location for a sanitary landfill.

In many parts of the study area people are plagued with construction problems because of the expanding clay of the Yazoo Formation. Cracks in slab foundations, supporting pillars moving from under frame houses, rough streets and roads, broken water mains and gas lines, and sliding cut slopes are some of the results of inadequate planning and design with regard to this clay. If construction is attempted in the study area without the aid of a soil investigation, or if proper corrective measures are not designed into a structure after such an investigation has been made, serious and expensive problems can result. The study area may not be earthquake prone, but is not without its own hazardous geologic conditions as far as construction is concerned.

The study of the Earth is the basic definition of the word geology. Therefore, it is apparent that the basis of man's environment is geology, and if man uses his environment without respect for natural geologic processes, then his very existence could be threatened. Geologists hold an unequaled perspective that helps them to separate emotionalism and sensationalism from environmental reality. Geologic expertise needs to be introduced into land-use plans while these plans are being formulated. Wise and responsible environmental and conservation methods can result in the continued advancement of mankind.

GLOSSARY OF TERMS

ANTICLINE - A fold in rocks that is convex upward or had such an attitude at some stage of development.

AQUICLUDE - A formation that is capable of absorbing water slowly, but functions as an upper or lower boundary of an aquifer and does not transmit ground water rapidly enough to supply a well or spring.

AQUIFER - A formation or part of a formation that contains sufficient saturated porous and permeable material to conduct ground water and to yield significant quantities to wells and springs.

BED - Informal term for stratum.

CHANNELIZATION - The act of straightening of a stream or construction of a new channel to which a stream is diverted.

COLLUVIUM - A general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity.

CONTACT - A plane or irregular surface between two different types or ages of rock units.

DATUM - The top or bottom of a rock unit on which structure contours are drawn.

DATUM PLANE - A permanently established horizontal plane or surface to which soundings and ground elevations are referred. Usually sea level.

DEPOSIT - Sediment of any type or from any source that has accumulated by some natural chemical or physical process, either in the form of consolidated or unconsolidated material.

DIKE - A tabular body of igneous rock that cuts across the structure of adjacent rocks, usually a result of intrusion.

DISSOLVED SOLIDS - The dissolved material in a sample of water. The total amount of these solids may be abbreviated T.D.S.

DRAINAGE BASIN - A part of the surface of the lithosphere that is occupied by a drainage system or contributes surface water to that system.

DRAINAGE DIVIDE - The boundary between adjacent drainage basins.

EMBAYMENT - An area that has sagged concurrently with deposition so that an unusually thick section of sediment results. An embayment is similar to a geosyncline.

EROSION - The group of natural processes whereby the earthy and rocky materials of the Earth's crust are loosened or dissolved and subsequently transported from one place to another.

EXPOSURE - A continuous area in which a rock formation or geologic structure is visible, either naturally or artificially.

FOSSIL - The remains or traces of animals or plants which have been preserved by natural causes in the earth's crust exclusive of organisms which have been buried since the beginning of historic time.

GARBAGE - The animal and vegetable waste resulting from the handling, preparation and cooking of food.

GEOLOGIC FORMATION - The fundamental stratigraphic unit in the local classification of rocks, consisting of a body of rock (usually sedimentary stratum) generally characterized by some distinctive lithologic features such as chemical composition, texture or fossil assemblage.

GEOLOGIC STRUCTURE - The relative position or arrangement of the rock strata of an area. For example: sedimentary strata may be horizontal; or they may be bent into folds by internal pressures; or they may be offset along fractures, known as faults, which are also caused by internal pressures.

GEOSYNCLINE - A large, generally linear trough that subsided deeply throughout a long period of time in which a thick succession of stratified sediments and possibly volcanic rocks commonly accumulated.

GROUND WATER - Water beneath the surface of the ground in a saturated zone.

GROUP - A major stratigraphic unit next higher in rank than formation. Usually consists of two or more formations.

HARDNESS - A quality of water that causes the formation of an insoluble residue when used with soap, and the formation of scale in pipes and other vessels. It is primarily due to the presence of magnesium and calcium ions.

HYDROLOGY - The science dealing with water in the subsurface, on the surface of the land, and in the atmosphere.

IGNEOUS - A type of rock or mineral that solidified from molten material, such as a lava.

INDURATION - The process of hardening of sediments or other rock aggregates through cementation, pressure, heat or other natural causes.

INTRUSION - The forcible entry of molten rock or salt into or between pre-existing rock formations, often doming this overlying material.

LAMINA - The thinnest unit layer of original deposition in a sediment, differing from other layers in color, composition, or texture.

LIMESTONE - A bedded sedimentary deposit consisting chiefly of calcium carbonate.

LIMY - A descriptive term for soil or rock containing significant amounts of calcium carbonate.

MARL - Slightly or non-indurated sedimentary deposits composed of variations of limy sands, silts, and clays. Often containing fossils and the mineral glauconite.

MINERAL - A naturally formed, inorganic, chemical element or compound having a definite composition and usually a characteristic crystal form.

MONTMORILLONITE - A group of clay minerals that characteristically swell when wetted.

OUTCROP - That part of a geologic unit that is exposed at the surface of the earth.

OUTLIER - An isolated mass or detached remnant of sediments separated by erosion from the main body to which it belongs.

PATHOGENIC MATERIALS - Any agents that are capable of causing disease.

PERMEABILITY - The property of a porous rock or sediment for transmitting a fluid without impairment of the structure of the medium.

POROSITY - The percentage of open space in a rock or other earth material.

QUADRANGLE - a four-sided tract of land bounded by parallels of latitude and meridians of longitude, used as an area unit in systematic mapping.

RECHARGE AREA - An area in which water is absorbed that eventually reaches the zone of saturation in an aquifer.

REFUSE - Solid wastes; can be classified by kinds of material into garbage, ashes, sewage solids, etc.

SALT WATER - In this publication, salt water implies a dissolved-solids content greater than 5000 milligrams per liter.

SALT-WATER INTERFACE - The contact plane in the subsurface between fresh water and salt water.

SANDSTONE - A cemented or otherwise compacted sediment composed predominantly of sand-sized particles.

SECTION - The local succession of beds constituting a group or formation.

SEDIMENT - Solid material, both organic and inorganic, that is in suspension, is being transported, or has been moved from its place of origin and deposited in layers by air, water, or ice.

SILL - An intrusive body of igneous rock which has been emplaced parallel to the bedding of the intruded rocks.

SILTSTONE - A cemented or otherwise compacted sediment composed predominantly of silt-sized particles.

SLUMP - A landslide characterized by a shearing and rotary movement of an independent mass of earth along a curved slip surface.

SOLID WASTE - Useless, unwanted, or discarded material with insufficient liquid content to be free flowing.

STRATIGRAPHY - That branch of geology which deals with the formation, composition, sequence, and correlation of the stratified rocks as parts of the earth's crust.

STRATUM - A single sedimentary bed or layer; the plural form is strata.

SYNCLINE - A fold in rocks in which the strata dip inward from both sides toward the axis.

TERRACE DEPOSIT - Unconsolidated sediments deposited by streams in the past at elevations higher than the present flood plains.

VOLCANISM - All natural processes resulting in the formation of volcanoes, volcanic rocks, lava flows, etc.

WASTE - Useless or discarded materials including solids, liquids, and gases.

WATER TABLE - The upper surface of the zone of saturation, which is the subsurface zone in which all the pore spaces in the soil or rock are filled with water.

WEATHERING - The physical disintegration and chemical decomposition of rock material at or near the earth's surface.

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