GROUND-WATER CHEMISTRY AND SALT-WATER ENCROACHMENT, SOUTHERN BALDWIN COUNTY, ALABAMA

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GEOLOGICAL SURVEY OF ALABAMA

Ernest A. Mancini
State Geologist

WATER RESOURCES DIVISION

James D. Moore
Chief

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By

Robert V. Chandler, James D. Moore, and Blakeney Gillett

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1985

GEOLOGICAL SURVEY OF ALABAMA

420 Hackberry Lane
P. O. Box O, University Station
Tuscaloosa, Alabama 35486
(205) 349-2852

ERNEST A. MANCINI
State Geologist
and
Oil and Gas Supervisor

DIRECTORS

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December 19, 1985

Honorable George C. Wallace
Governor of Alabama
Montgomery, Alabama

Dear Governor Wallace:

I have the honor to transmit herewith a report entitled "Ground-Water Chemistry and Salt-Water Encroachment, Southern Baldwin County, Alabama" by Robert V. Chandler, James D. Moore, and Blakeney Gillett which is published as Bulletin 126.

Ground water is the primary source of fresh water for municipal and domestic supplies, industrial needs, and irrigation in southern Baldwin County. Excessive withdrawals of ground water to meet these needs can lead to salt-water encroachment. This report contains information on water chemistry and hydrogeology and identifies areas of potential and existing salt-water encroachment. Information in the report will be useful in the future development and management of the ground-water resources in the coastal areas of Alabama.

Respectfully,

Ernest A. Mancini

Ernest A. Mancini
State Geologist

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GROUND-WATER CHEMISTRY AND SALT-WATER ENCROACHMENT, SOUTHERN BALDWIN COUNTY, ALABAMA

By

Robert V. Chandler, James D. Moore, and Blakeney Gillett

EXECUTIVE SUMMARY

Ground water is a vital resource in southern Baldwin County where it is the only source of fresh water for industrial, municipal, and private use. Although ground water is abundant in this area, the possible encroachment of salt water into the freshwater zones in response to overpumping and possible salt-water contamination of ground-water supplies may place constraints on the increased use of water.

The principal aquifer zones occur in Pleistocene-Holocene, Pliocene-shallow Miocene, and deep Miocene siliciclastic sediments. The average annual rainfall of about 64 inches provides recharge to these aquifer zones, which may yield from 10 to 1,500 gallons per minute per well.

The chemistry of water in the aquifer zones reflects the depositional environments and natural chemical and biochemical processes related to depth and proximity to the Gulf of Mexico. In coastal and bay-shore areas, high concentrations of iron, bicarbonate, chloride, and sometimes sulfate ions occur in the water, accompanied in some areas by high levels of calcium and sodium. The water in inland recharge areas is typically acidic, low in sodium-chloride content, and low in mineral content and hardness. Sporadic high iron contents also characterize these inland recharge areas. In the deep subsurface, at depths normally exceeding 1,000 feet, saline waters may have high pH values and high trace-metal contents. Gases in water include dissolved carbon dioxide in the inland areas and hydrogen sulfide, a product of sulfate reduction, in the coastal areas.

Three specific areas of coastal salt-water contamination or lateral salt-water encroachment have been identified in southern Baldwin County. These are the Gulf State Park golf course, where overproduction of an aquifer zone has resulted in salt-water encroachment; western Fort Morgan peninsula, where sea-water flooding and natural sea spray have caused high chloride contents in the shallow ground water; and the Claude Peteet Mariculture Center, where leakage from salt-water ponds has caused salt-water contamination of the fresh ground water.

A feasibility study for the need of a ground-water management plan for coastal areas of Baldwin County should be considered . The proper spacing of wells and regulated pumping may prevent the overproduction of aquifer systems and assist in the control of salt-water encroachment.

INTRODUCTION

Fresh ground water is a resource of vital importance to the southern Baldwin County area, particularly its rapidly expanding coastal residential zone. Ground water is the only source of water for private homes, municipalities, businesses, industries, and large-scale agricultural enterprises. Water use is increasing at a rapid rate. The increasing use of water may cause overdevelopment of the ground-water resources and cause salt-water encroachment in freshwater zones. Salt-water encroachment (or contamination) and other water-quality problems may inhibit the use of this resource. These problems have been recognized for a number of years in the coastal areas of Alabama and are a subject of much discussion by water planners.

PURPOSE OF STUDY

This report presents the results of a 1-year study of the fresh ground-water resources of southern Baldwin County, Alabama. The study was initiated on January 1, 1984, as part of the water-resources program of the Geological Survey of Alabama.

The purposes of this study were to assess the fresh ground-water resources and hydrogeology of the area, to identify areas of potential salt-water encroachment, and to identify potential management techniques that may assist in the prevention or control of water-quality problems related to overdevelopment of the aquifer systems. This report should provide information useful in the development and future management of the ground-water resources of southern Baldwin County.

LOCATION AND EXTENT OF STUDY AREA

The research area encompasses 628 square miles (mi^2) of southern Baldwin County, Alabama. The area is south of Interstate Highway 10 and is bordered by Mobile Bay, Perdido Bay and the Perdido River, and the Gulf of Mexico, on the west, east, and south, respectively (fig. 1). Included in the area is the Gulf Shores/"Pleasure Island" area, where freshwater aquifer zones are subject to salt-water contamination.

PHYSICAL FEATURES

The physical features of the southern Baldwin County area are those of a gulf coastal environment. The principal physiographic divisions of the area are the Coastal Lowlands, or "Pine Meadows" of Fenneman (1938), and the Southern Pine Hills (fig. 2). The Coastal Lowlands occupies a narrow zone of land along the Gulf of Mexico, Perdido Bay, and Mobile Bay and has a maximum width of approximately 20 miles. This area is characterized by low topographic relief and a coastal plain featuring tidewater streams, bays, and estuaries. Beaches, Gulf shoreline, beach ridges, marshes, bay inlets, islands, and peninsulas are major features of the Coastal Lowlands.

Inland of the Coastal Lowlands is the Southern Pine Hills. Included in the Southern Pine Hills is an elevated cuesta-like plain that slopes southward. This elevated plain, with flat interfluves and rolling terrane, has a maximum elevation of approximately 150 feet above mean sea level (msl) near Interstate Highway 10, the northern limit of the study area. Located in the interfluvial areas are a number of circular-to-elliptical depressions that retain water for part of the year and are swampy.

Planimetric and bathymetric features of the Gulf Shores/"Pleasure Island" area are shown on the National Oceanic and Atmospheric Administration Chart No. 11378, "Florida-Alabama Intracoastal Waterway from Santa Rosa Sound to Dauphin Island" (U.S. Department of Commerce, 1980). The topography of the entire southern Baldwin County area is illustrated on the 21 U.S. Geological Survey 7.5-minute topographic quadrangle sheets indexed on plate 1.

CLIMATE

The climate of the area is markedly influenced by the Gulf of Mexico and is classified as humid, nearly subtropical (McBride and Burgess, 1964). The average air temperature of the area is about 68 degrees Fahrenheit (°F), and monthly variations are less than 20°F from this average. The winds are generally southerly during the spring and summer and northerly during the winter. Tides in the coastal waters are diurnal and average about 1.5 feet. Tropical storms and hurricanes in the Gulf, which occur normally between June and November, the "hurricane season," occasionally produce high winds, storm tides, coastal flooding, and torrential rains in the area. An average of one hurricane every 5 years has impacted the Gulf of Mexico coastline since 1711 (O'Neil and Mettee, 1982).

Due to the warm climate, precipitation in the area is nearly all in the form of rain. Rainfall averages about 64 inches each year with a slight concentration during the summer thunderstorm season, followed by a normally dry late fall. Two comparative rainfall climographs for the Robertsdale, Alabama, National Oceanic and Atmospheric Administration weather station are shown in figure 3. These climographs, illustrating monthly variations in rainfall and temperature, are for the periods 1910-83 and 1984. For the 1984 study period, below-average rainfall was recorded in the months of June and September to December, causing a yearly precipitation amount about 10

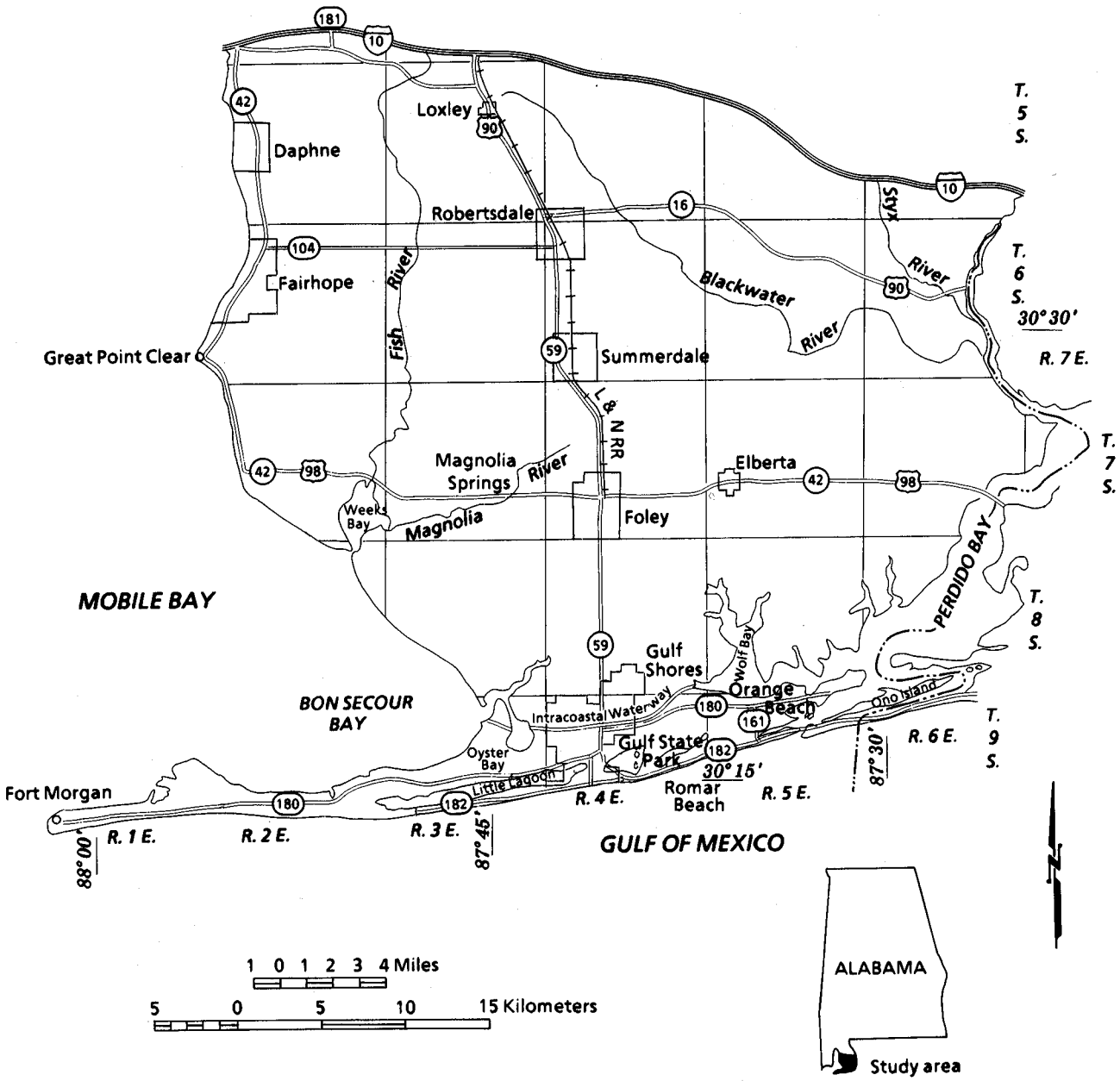
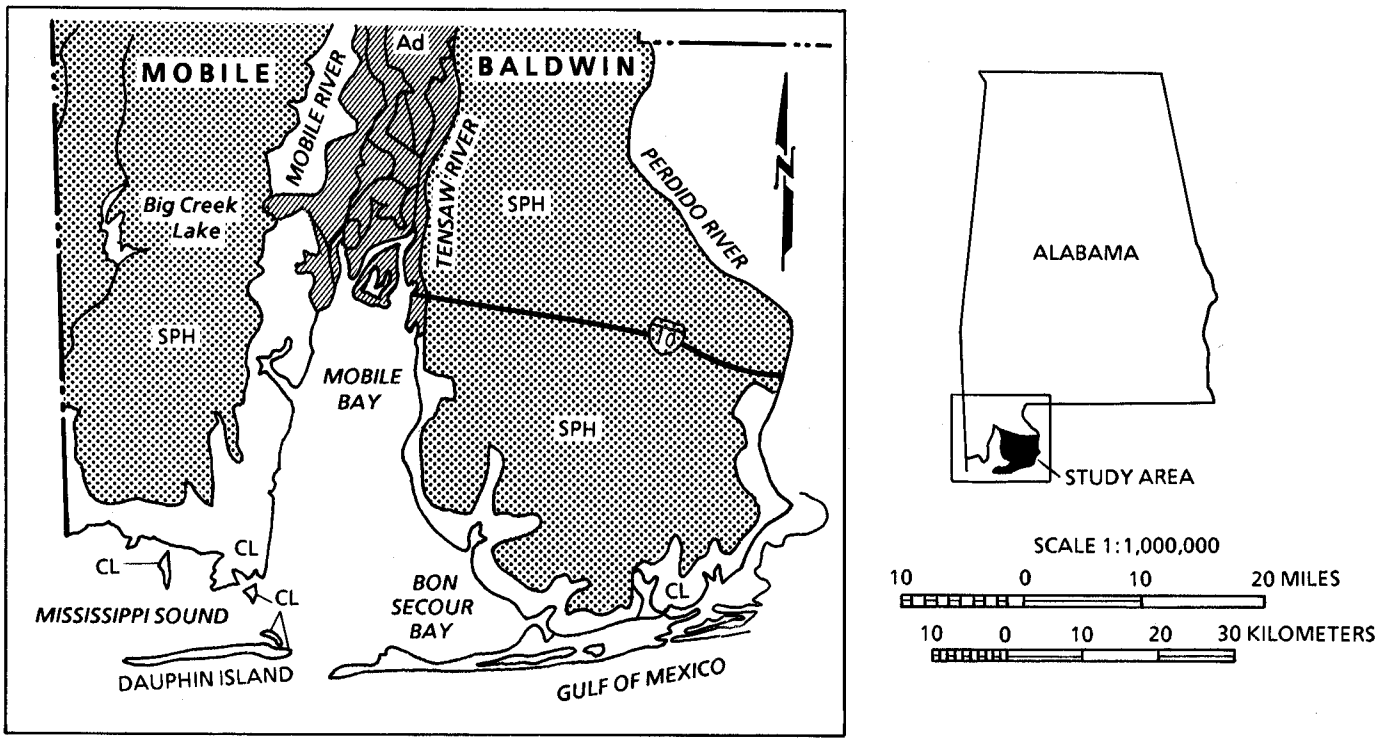


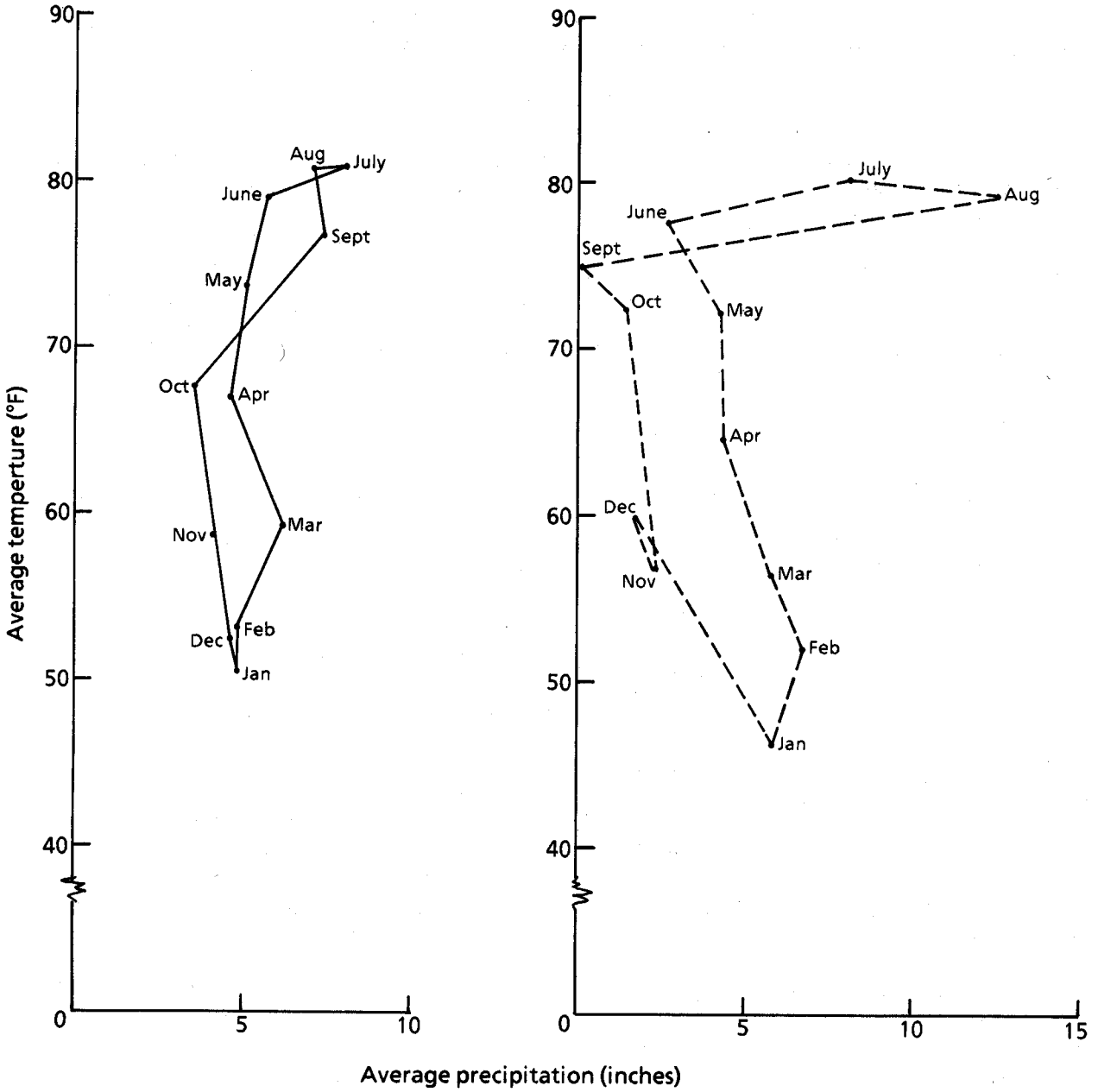
Figure 1.--Location of the southern Baldwin County study area, Alabama.



PHYSIOGRAPHIC CLASSIFICATION

District (and map symbol)	Characteristics
Southern Pine Hills (SPH)	Upland underlain by Pliocene-Pleistocene terrigenous sediments of the Citronelle Formation. Younger terrace deposits occur along major streams. Upland slopes gradually southward from 400 to 500 ft (122 to 152 m) elevation to 25 to 30 ft (8 to 9 m) at southern limit, adjacent to the Pamlico marina scarp. Relief up to 250 ft (76 m) in north but less than 100 ft (30 m) in the south.
Coastal Lowlands (CL)	Flat to gently undulating locally swampy plain underlain by terrigenous deposits of Holocene and late Pleistocene age. Includes mainland plain indented by many tidal streams and fringed by tidal marsh and offshore barrier islands. Landward edge of district is defined by base of Pamlico marine scarp at 25 to 30 ft (8 to 9 m) of elevation. Barrier islands and tidal marsh are undergoing continuing modification by erosion and deposition.
Alluvial-deltaic Plain (Ad)	Ad - Alluvium of Mobile River delta.

Figure 2.--Physiographic map for southwest Alabama.



EXPLANATION

——— 1910-83 period of record (temperature, 1929-83)

– – – – 1984 period of record

Note: Information for climograph plots from NOAA climatological data summaries.

Figure 3.--Rainfall climographs for periods 1910-83 and 1984, National Oceanic and Atmospheric Administration weather station, Robertsdale, Alabama.

inches below the average. Long-term average precipitation rates range from a low of 54 inches for Fort Morgan to 65 inches for the Robertsdale area (Crance, 1971).

GROUND-WATER USE

In the southern Baldwin County area, ground water is widely used for drinking, irrigation, industrial, and numerous special-use purposes. Virtually all of the water used in the area is from ground-water sources.

Figure 4 provides a 5-year comparative graph for two major water-use categories, municipal water supply and irrigation, for the period 1980-84 in southern Baldwin County and in the Gulf Shores/"Pleasure Island" area. The two major water-use categories account for an estimated 94 percent of the water used in 1984. Water use in the Gulf Shores/"Pleasure Island" area increased 248 percent during the 5-year period, 1980-84. Because of this rapid increase in water use, a better understanding of the area's fresh ground-water resources is essential.

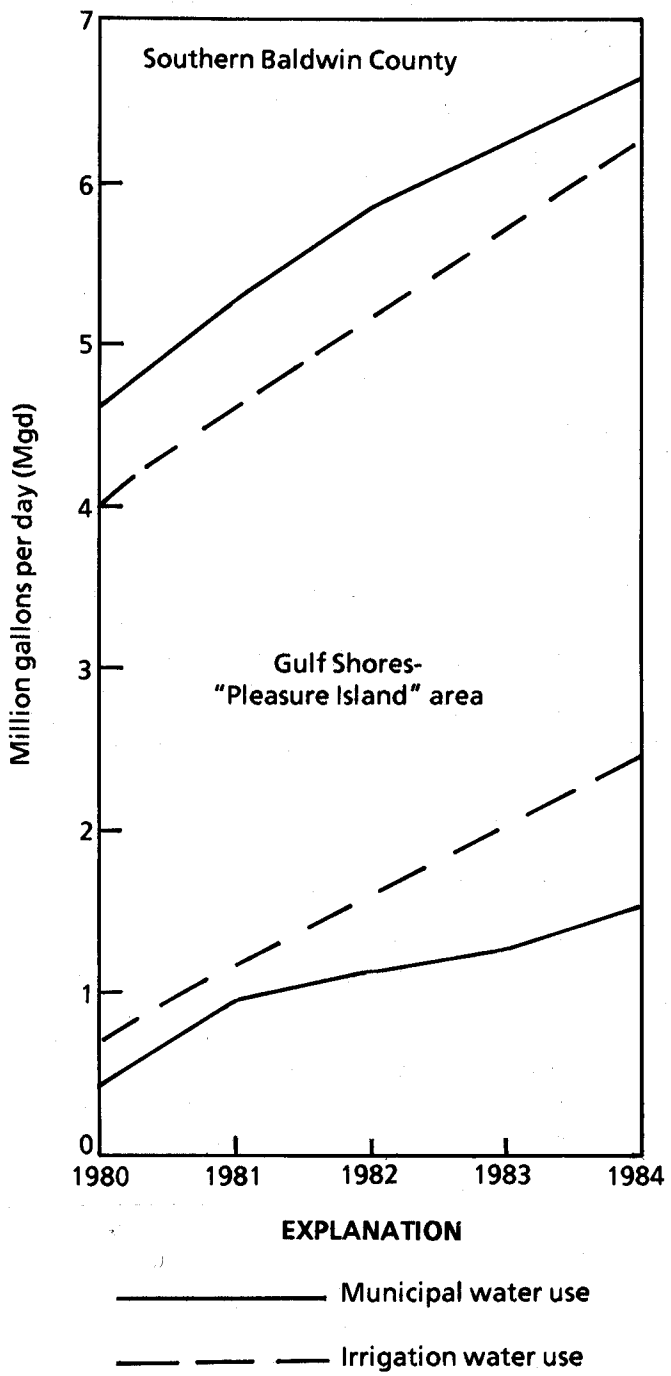
PREVIOUS STUDIES

Previous studies of ground-water chemistry in the southern Baldwin County area were limited to specific areas and problems (Geological Survey of Alabama, 1973; Walter and Kidd, 1979; Malatino, 1979). The most significant of these studies is that of Walter and Kidd (1979) for the coastal Gulf Shores/Orange Beach area. Management aspects for preventing salt-water encroachment and preserving the freshwater aquifer systems are, in part, identified in their report. The regional availability of ground and surface waters is presented in reports by Reed and McCain (1971) and Riccio and others (1973). The historic water-analysis data presented in this report are, in part, from those publications. Reports by Peterson (1947), the South Alabama Regional Planning Commission (1979), Chandler and Moore (1983), and Hinkle (1984) provide a general description of the mechanisms responsible for salt-water encroachment in the Alabama Gulf coastal aquifers.

The surface and subsurface geologic features of the area are described in reports by Reed (1971) and Raymond (1985), and specific details are provided on coastal geomorphology and sedimentation in reports of Ryan (1969), Boone (1973), Chermock (1974), Eleuterius (1974), Hardin and others (1976), Otvos (1982), Smith (1981), O'Neil and Mettee (1982), and O'Neil and others (1983). The deeper geologic section is described in reports by Alverson (1970), and structure maps are given in a series of Geological Survey of Alabama Special Maps (Nos. 199A-199D). Interpreted elevations for ground water containing 3,000 and 10,000 milligrams per liter (mg/l) of total dissolved solids (an indicator of water salinity) are shown on maps by Ellard (1977) and Epsman and others (1983). Water-use data for Alabama are presented in the reports of Peirce (1972), Baker and others (1982), Baker and Moore (1983), and Baker (1983) for the respective years 1970, 1980, 1981, and 1982. These data provide a basis for assessing water-use trends in the area.

METHODS OF STUDY

The water chemistry and hydrologic and geologic characteristics of aquifers were determined through a well survey; evaluation of the chemical analyses of water samples; the review of electric, sample, and driller's logs for wells; and other water-evaluation techniques.



Note: Irrigation water use projected from data available for 1980 and 1984.

Figure 4.--Municipal and irrigation water use in southern Baldwin County and the Gulf Shores/"Pleasure Island" area, Alabama, 1980-84.

WELL SURVEY

An inventory of 320 water wells and test wells was conducted as part of this study. The types and numbers of wells are summarized as follows:

Well type	Number of wells
municipal and public	74
industrial	33
irrigation	24
gas-test	4
water-test holes	38
private	147

The locations for these wells are shown on plate 1. Available information on the use, construction, water level, yield and/or flow, and access to driller's, sample, and electric logs for each well is presented in appendix A.

WATER SAMPLING AND ANALYSIS

Chemical analyses of samples of ground and surface water were made as part of the study. The chemical-analysis parameters measured (table 1) were selected on the basis of the known chemical character of coastal waters. Values for eight of the water-analysis parameters were determined in the field and the remaining parameters were determined by the Geochemistry Laboratory of the Geological Survey of Alabama (table 2). Over 2,350 analysis values were determined for 219 water samples as part of the study. Additionally, voluminous historic water-analysis data were collected as part of the study. The results of ground-water analyses are summarized in appendix B by source well; the results of surface-water analyses are summarized in appendix C.

WELL-NUMBERING SYSTEM

Identification numbers for wells include an abbreviation for the U.S. Geological Survey 7.5-minute topographic quadrangle sheet and a number for each well located within the quadrangle (plate 1). For example, wells 1, 2, and 3 located in the Gulf Shores Quadrangle are numbered Gul-1, Gul-2, and Gul-3 in consecutive order. Twenty-one quadrangle sheets indexing well numbers are shown on plate 1. For cross-reference, Geological Survey of Alabama Water Resources Division (WRD) file numbers are presented in appendix A. These numbers are assigned on the basis of the federal subdivision of land into townships and sections and appear in other WRD reports.

WATER SALINITY

Salinity is a common expression for the mineral content of water. High salinity inhibits water use for specific purposes. The classification of the U.S. Geological Survey (Swenson and Baldwin, 1965) was adopted for this report to describe the salinity of water. According to this classification, fresh water has a total dissolved solids (TDS) or mineral content of less than 1,000 mg/l; slightly saline water, a TDS content ranging from 1,000 to 3,000 mg/l; moderately saline water, a TDS content ranging from 3,000 to 10,000 mg/l; very saline water, a TDS content ranging from 10,000 to 35,000 mg/l; and brine, a TDS content over 35,000 mg/l. Some coastal ground and surface waters are very saline according to this classification. In this report, the distinction between fresh water and saline water is made on the basis of a 1,000 mg/l TDS content. Chloride content of water is also considered an indirect indicator of salinity. In this report, waters with a chloride content exceeding 250 mg/l are considered salty.

Table 1.--Water-analysis parameters determined for water samples from southern Baldwin County

Field determinations[1]	Laboratory analyses[1]
Temperature	Calcium (Ca)
pH (as units)	Chloride (Cl)
Alkalinity (as $CaCO_3$)	Potassium (K)
Specific conductance (µmhos/cm)[2]	Magnesium (Mg)
Color (Pt-Co)[3]	Sodium (Na)
Turbidity (NTU)[4]	Sulfate (SO_4)
Chloride	Trace metals (µg/l)[5] Iron (Fe) Strontium (Sr)

[1]Analysis values in milligrams per liter, except as noted.
[2]Micromhos per centimeter.
[3]Platinum-Cobalt scale units.
[4]Nephelometric Turbidity Units.
[5]Micrograms per liter.

WATER-ANALYSIS EVALUATION TECHNIQUES

A variety of techniques were used in the evaluation of the area's ground-water zones. Included were the mapping of major chemical constituent values of water and the use of water-analysis diagrams. For the present study, only recent (1983-85) water-analysis data were utilized. Chemical constituent concentrations are expressed in milligrams per liter (mg/l), or milliequivalents per liter (meq/l) for comparative purposes.

The diamond-shaped analysis diagram of Back (1961) can be used to compare relative amounts (as a percentage) of anion and cation species (with concentrations expressed in milliequivalents per liter) in water. (See fig. 5, for example.) The diagram was used to type water and to trace the transitional changes in the water chemistry that occur downdip and vertically in geologic units. The chemical ions identified on the diagram (calcium and magnesium, sodium and potassium, chloride and sulfate, and bicarbonate and carbonate) are those of major importance in evaluating ground-water zones. Forms of the diagram have been used previously to evaluate transitional chemical changes in coastal aquifer systems (Back, 1960; Morgan and Winner, 1962; Walter and Kidd, 1979).

To compare historic and recent water-analysis data, the modified Stiff diagram (Stiff, 1951) was used. This diagram features a characteristic polygon pattern that reflects the type and relative amounts of chemical elements in water. Figure 6 shows the preparation and utility of this diagram. In the illustration, the amounts of major chemical constituents, expressed in milliequivalents per liter, are plotted according to a predetermined scale. Plotted points are connected by lines that form a geometric pattern or polygon form. The polygon patterns identify specific types of water, as shown in figure 6. Saline water has a characteristic polygon reflecting a high sodium-chloride type water; fresh water has a polygon reflecting a low sodium-chloride or sodium-calcium bicarbonate type water. From prepared polygons, a comparison of water types at different locations and changes in water chemistry with time at specific locations can be made. Salt-water contamination of fresh ground water can be readily identified through the use of Stiff diagrams.

Table 2.--Results of chemical analyses of representative coastal waters (1984) in Baldwin County

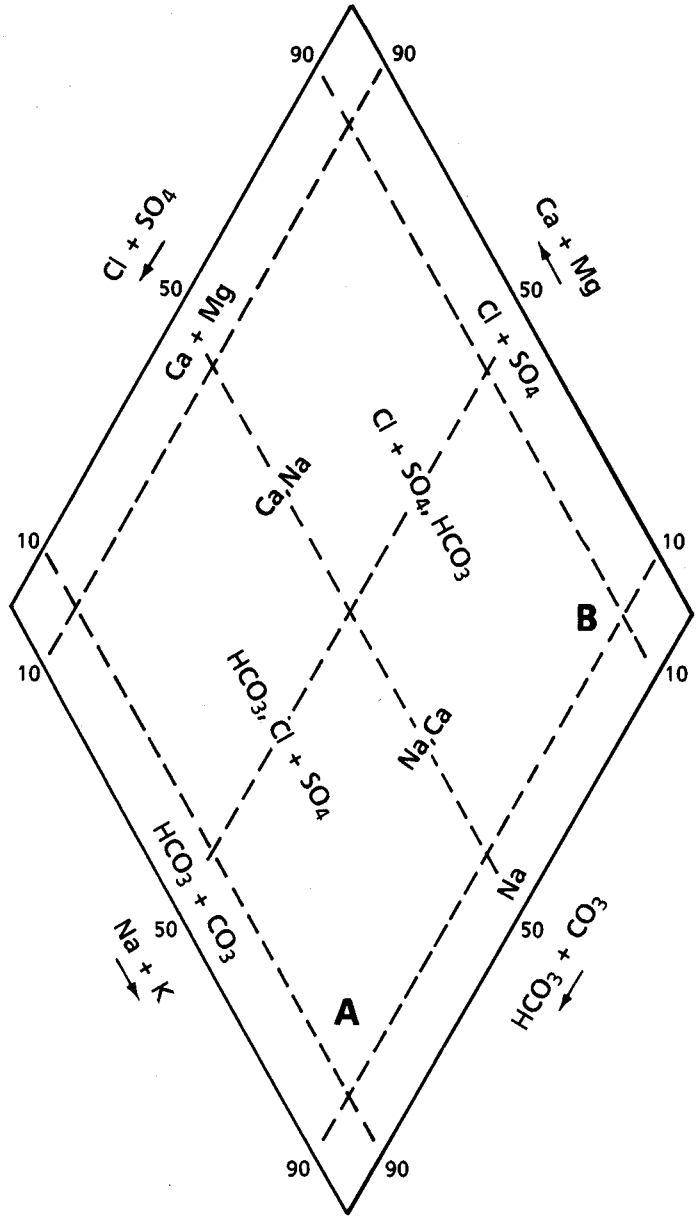
	Gulf of Mexico at Romar Beach (05/10/84)	Rainfall sample at West Beach (10/29/84)	Municipal water well at Gulf Shores (03/01/84)
Iron (Fe)	.07	.00	.08
Calcium (Ca)	340	.3	7.9
Magnesium (Mg)	1,100	.2	3.5
Sodium (Na)	9,500	2.1	7.7
Potassium (K)	360	.1	6.2
Bicarbonate (HCO_3)	102	0	0
Carbonate (CO_3)	0	0	0
Sulfate (SO_4)	2,400	.0	9.8
Chloride (Cl)	16,000	2.4	18
Dissolved solids (TDS)	30,610	2	54
Hardness (Ca, Mg)	5,380	2	34
Specific conductance (micromhos @ 25° C)	41,000	16	172
Turbidity (NTU)	0	--	0
Color (Pt-Co)	0	--	0
pH (units)	7.1	3.9	4.1
Temperature			
°C	24	--	20
°F	74	--	69

Note: Analysis values in milligrams per liter, except as noted.

The spontaneous potential (SP) method of electric-log interpretation (Schlumberger, 1979) was used to estimate formation-water salinity, or TDS content, of ground water for 29 gas-test wells. This method relies on a knowledge of the water chemistry of aquifer systems and on the assumption that the formation water being evaluated is of the sodium-chloride type and is saline. This condition apparently exists where SP values are less than zero (0) millivolts.

STRATIGRAPHY

The subsurface stratigraphy of coastal and offshore areas of Alabama is represented by a thick section of sedimentary rocks that range from Jurassic to Holocene in age (Tolson and others, 1983). Present in the shallow subsurface are interbedded sand, silt, gravel, and clay of middle Miocene to Holocene age that include the freshwater aquifer zones of the southern Baldwin County area (fig. 7). These sediments, which have a low regional dip towards the Gulf of Mexico, are part of three recognized geologic units (Reed, 1971): the Miocene Series undifferentiated; the Citronelle Formation; and alluvium, low terrace, and coastal deposits. The outcrop areas (recharge areas) of these geologic units are illustrated in figure 8.



Note: Numbers at edge of diamond-shaped diagram represent percent of total anion or cation species expressed as milliequivalents per liter. For example, the water represented by point "A" would be a $Na + K\text{-}HCO_3 + CO_3$ type fresh water and the water represented by point "B" would be a $Na + K\text{-}Cl + SO_4$ type saline water.

Figure 5.--Back diagram for water analyses (after Back, 1961).

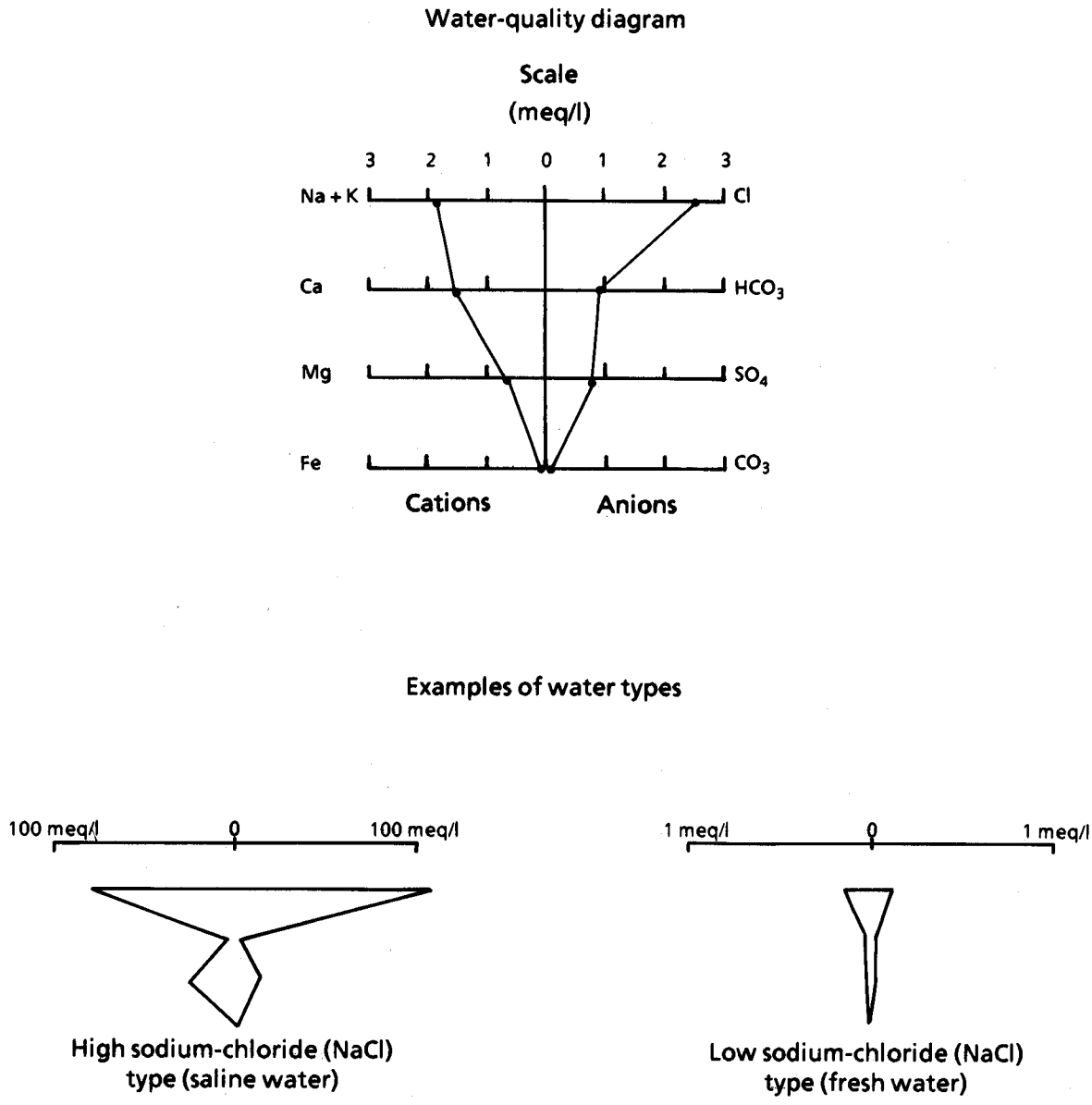


Figure 6.--Stiff diagram for water analyses (after Stiff, 1951).

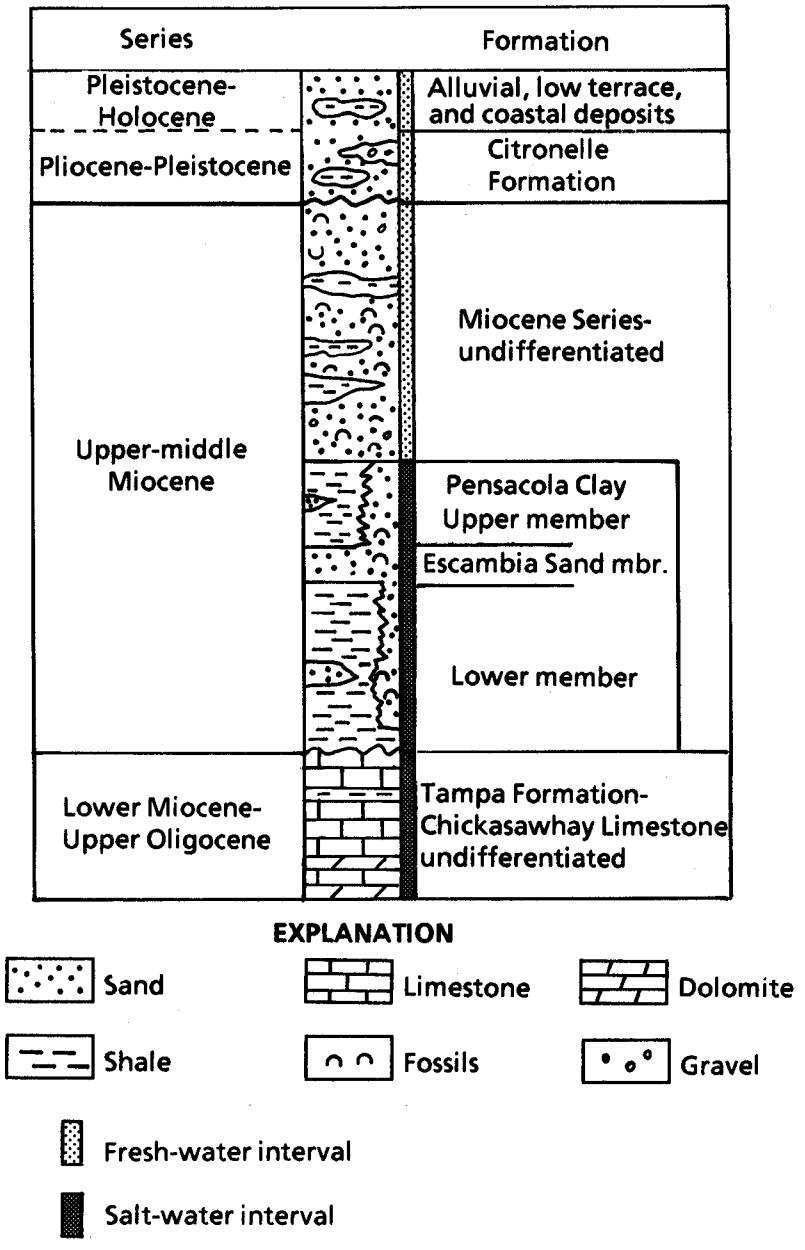


Figure 7.--Generalized shallow subsurface stratigraphy for southern Baldwin County, Alabama.

Figure 8.--Geologic map for southern Baldwin County, Alabama.

MIOCENE SERIES UNDIFFERENTIATED

The Miocene Series undifferentiated is primarily a regressive marine sequence of sediments. Siliciclastics of the unit overlie a distinctive marine clay, named the Pensacola Clay (Marsh, 1964), which is a major aquiclude in the area. The Miocene estuarine-marine siliciclastics were laid down as shallow seas retreated. The siliciclastics appear to be characterized by abrupt facies changes. The coarser fractions of the siliciclastics consist of fine- to very coarse-grained sand, granules, and quartz gravel. The sands in the unit range generally from 10 to 100 feet in thickness and comprise an estimated 50 percent of the upper section of the unit. Interbedded with the sands are sandy clays and silts and shell fragments (Walter and Kidd, 1979). The siliciclastics are micaceous and pyritic in part, and contain wood fragments, small mollusk shells, and heavy minerals. The microfossil *Rangia (Miorangia) microjohnsoni* Gardner is characteristic of the unit (Raymond, 1985). The upper limit of the Miocene Series undifferentiated is difficult to identify. Raymond (1985) indicates that some of the Miocene Series undifferentiated may actually be Pliocene in age.

CITRONELLE FORMATION

The Citronelle Formation consists essentially of nonfossiliferous clastic sediment and is Pliocene-Pleistocene in age. The unit is described by Reed (1971) as "reddish brown gravelly sand, which locally contains light-gray clay balls and partings, and lenticular beds of light-gray, orange, and brown sandy clay." In its inland outcrop area, the unit consists of a relatively thin layer (10 to 50 feet thick) of sediment over, and in unconformable contact with, the Miocene Series undifferentiated. The base of the unit is 50 to 100 feet above msl and slopes 2 to 10 feet per mile toward the Gulf of Mexico.

ALLUVIAL, LOW TERRACE, AND COASTAL DEPOSITS

Alluvial, low terrace, and coastal deposits represent complex beach, dune, lagoonal, estuarine, and deltaic sediments built up in lowland areas in late Pleistocene to Holocene times. Paleontological evidence (Wade Howat, 1985, personal communication) indicates that geologic units older than Pleistocene to Holocene in age occur along the Gulf coast at 60 to 110 feet below the land surface. Generally, the alluvial, low terrace and coastal deposits consist of fine to coarse sand, locally rich in heavy detrital minerals (Hsu, 1960), silt, sandy clay, and shell hash. Upper shoreface-beach deposits consist generally of well-sorted, medium-grained, quartzose sand.

THE HYDROLOGIC SYSTEM

The hydrologic system of the study area is a complex interaction between water and the physical environment. The area is bordered for the most part by brackish-to-saline bay and coastal waters. The source of fresh water for the area's aquifer systems is precipitation, which averages about 64 inches per year. Losses from the freshwater zones are by diffusion into the surrounding subsurface saline waters, by spring discharge, by evapotranspiration, and to a limited extent, by water-well production.

Key elements of the hydrologic system include precipitation, evaporation, transpiration, surface runoff, and ground-water recharge and discharge. Hydrologic research conducted in the Fish and Styx River basins by Walter (1976) suggests that about 55 percent, or 35 inches, of annual precipitation returns to the atmosphere through evapotranspiration. Surface runoff and streamflow account for an additional 33 percent, or 21.5 inches, of the 64 inches of precipitation. Ground-water recharge, roughly equal to dry-weather streamflow and estimated diffusion losses, is approximately 7.5 inches, or equivalent to 0.12 million gallons per day (mgd) per square mile of the recharge area of the aquifer systems.

HYDROGEOLOGIC UNITS

The hydrogeologic units described in this report have distinctive geologic and hydrologic characteristics. These units are shown on the hydrogeologic map (plate 2) and in the cross section on plate 3. Specific descriptions of the units are provided in table 3. The units include coarse siliciclastics, mainly sand and gravelly sand that contain sporadic clay lenses. They are marked by areally continuous lower aquicludes. The distinction of coastal hydrogeologic units used in this report follows that of Chandler and Moore (1983) in the study of the fresh ground-water resources of the Dauphin Island area, Mobile County, Alabama.

Table 3.--Hydrologic and geologic properties of aquifer zones

Hydrogeologic unit		Unit character		Previously recognized aquifers (source)
Aquifer zone	Geologic interval	Lithologic	Hydrologic	
A_1	Pleistocene (?)-Holocene	Sand, white to pale-orange, fine- to coarse-grained; silt; clay; and sea-shell hash. Finer grained sediments predominant in lower part of unit as discontinuous layers.	Predominantly medium-grained sands in upper 20 to 60 feet of unit comprise principal aquifer. The aquifer is a water-table aquifer and is a potential source of more than 100 gpm of water per well.	Beach sand aquifer (Walter and Kidd, 1979)
A_2	Pleistocene-shallow Miocene	Sand, white- to light-gray, fine- to very coarse-grained, gravelly and carbonaceous in places, interbedded with sandy silty clay.	Sand and gravel in unit comprise major aquifers. The lower aquifers are generally semiconfined. Potential source of 100 to more than 1,000 gpm of water per well.	Gulf Shores aquifer (Walter and Kidd, 1979)*
A_3	Deep Miocene	Same as A_2, except sediments form more persistent and traceable layers in the subsurface. The siliciclastics immediately overlie the Pensacola Clay.	Major aquifers are semi-confined or confined and yield water to wells under low-head artesian pressure. Potential source of more than 1,500 gpm of water per well.	350- and 500-foot aquifers (Walter and Kidd, 1979)*

*Pliocene-Miocene aquifer (Riccio and others, 1974)

PLEISTOCENE-HOLOCENE INTERVAL (AQUIFER ZONE A_1)

Aquifer zone A_1 corresponds to the alluvial, low terrace, and coastal deposits of Pleistocene-Holocene age in lowland areas (fig. 8). The aquifer zone consists of fine- to coarse-grained quartzose sand that contains varying fractions of heavy minerals and shell fragments, silt, and locally carbonaceous sandy clay. These sediments occur as sporadic and discontinuous layers, except for a coastal beach sand (the "Beach Sand aquifer" (Walter and Kidd, 1979)) that ranges from 20 to 60 feet or more in thickness along the coastline. A persistent layering of sand, silt, and clay that is locally fossiliferous, normally marks the lower limit of this aquifer zone. Aquifer zone A_1 is the source of water for a number of private and semipublic water wells in the Gulf Shores/"Pleasure Island" area. The yields of wells producing water from the aquifer zone typically range from 10 to 35 gallons per minute (gpm), and the potential yield is more than 100 gpm.

The aquifer zone receives recharge from rainfall infiltrating the surface sands and is classified as a water-table or unconfined aquifer. Fresh water is lost from the zone as the result of diffusion into surrounding surface and subsurface salt-water bodies. The diffusion of water is a function of the rate of recharge, hydraulic head, and effective permeability of the aquifer zone. The upper surface of the zone is represented by the water table, which conforms generally to topographic features. Available

information indicates that the water-table surface may fluctuate seasonally as much as 3 feet. The zone is subject to the effects of coastal flooding and salt-water spray, particularly in low-lying areas, and contamination from surface sources. The perennial yield of the aquifer zone between Gulf Shores and Fort Morgan is estimated to be 40 mgd (Alabama Coastal Area Board, 1978). Because of the potential for salt-water encroachment, only about half of this water is exploitable.

PLIOCENE-SHALLOW MIOCENE SILICICLASTIC INTERVAL (AQUIFER ZONE A_2)

The siliciclastics of Pliocene-late Miocene age comprise aquifer zone A_2. These sediments have a general thickness of 200 to 250 feet. The siliciclastics are part of the Citronelle Formation and the upper part of the Miocene Series undifferentiated. The aquifer zone is roughly equivalent to the upper part of the Miocene-Pliocene aquifer of Reed and McCain (1971). The aquifer zone is extensively developed throughout the southern Baldwin County area as a source of water for private, industrial, municipal, and irrigation supplies. The aquifer zone is a source of 100 to more than 1,000 gpm of water per well. The coarse siliciclastics include fine- to coarse-grained sand, granules, and pebbles and comprise approximately one-half of the zone. Clay layers in the unit separate the siliciclastics and produce semiconfined conditions in the aquifer zone. A bifurcated clay bed is present in the hydrogeologic unit in the Gulf Shores/Orange Beach area (plate 2). This clay bed appears to thicken appreciably westward.

Recharge to the aquifer zone is by rainfall infiltrating the land surface in the immediate area or in updip (generally northward) areas. For this reason, the zone is subject to the localized effects of excessive water-well production and variations in rainfall. The effects are evident in the hydrograph for well Fol-8 at Foley, Alabama (fig. 9), which illustrates cyclic patterns in ground-water levels.

In coastal areas where water levels are typically low, excessive water-well production may lower ground-water levels to below sea level, resulting in salt-water encroachment. An area of low water-table elevations is illustrated on the map of the Gulf Shores (Alabama) Quadrangle in figure 10. In this area, centered at the Gulf State Park golf course, water-well production rates are high.

DEEP MIOCENE SILICICLASTIC INTERVAL (AQUIFER ZONE A_3)

Hydrologic data for this aquifer zone are limited. The zone represents essentially the middle siliciclastic section of Miocene sediments. It is similar lithologically to aquifer zone A_2, except that it contains more persistent and laterally traceable sand and clay layers. The clay layers are recognizable on electric logs of deep wells for distances of tens of miles. The aquifer zone occupies the interval between the aquiclude marking the lower limit of aquifer zone A_2 (plate 2) and the top of the Pensacola Clay (700 to more than 1,000 feet below msl). It contains water generally under confined, or artesian, conditions. Wells developed in this zone in the coastal areas typically flow. The yields of wells may be more than 1,500 gpm of water per well. Recharge to the aquifer zone is by infiltrating water in the updip (northward) areas. The aquifer zone has an apparent low regional dip south-southwestward. The evaluation of water analyses and SP-electric log data indicates that salt water is present in the lower part of the aquifer zone in areas coastward (southward) of Summerdale, but inland the aquifer zone contains fresh water.

WATER CHEMISTRY

The principal water-quality problems identified in southern Baldwin County include high content of iron, sulfate, chloride, sodium, and total dissolved solids; excessive color, odor (hydrogen sulfide, H_2S) and excessive hardness; and low pH. These problems are common to coastal areas underlain by fluvial-to-marine sediments. Generally, the type and amount of constituents in ground water are a reflection of the depositional environments and the composition of the sediments with which water comes in contact.

Table 4 provides a comparison of the recent water-analysis data for the aquifer zones with the drinking water standards of the U.S. Public Health Service (USPHS) and U.S. Environmental Protection Agency (USEPA). In table 4, low, high, and median values for analysis parameters are listed. These

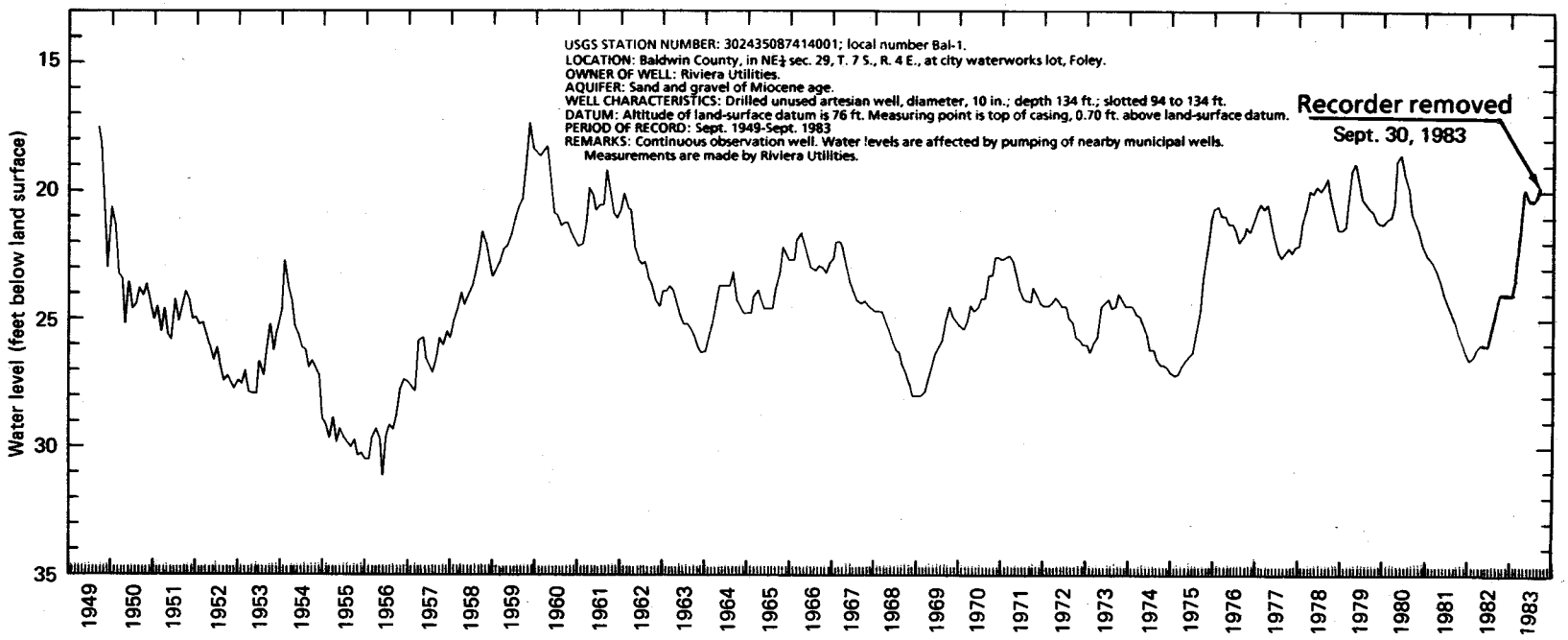
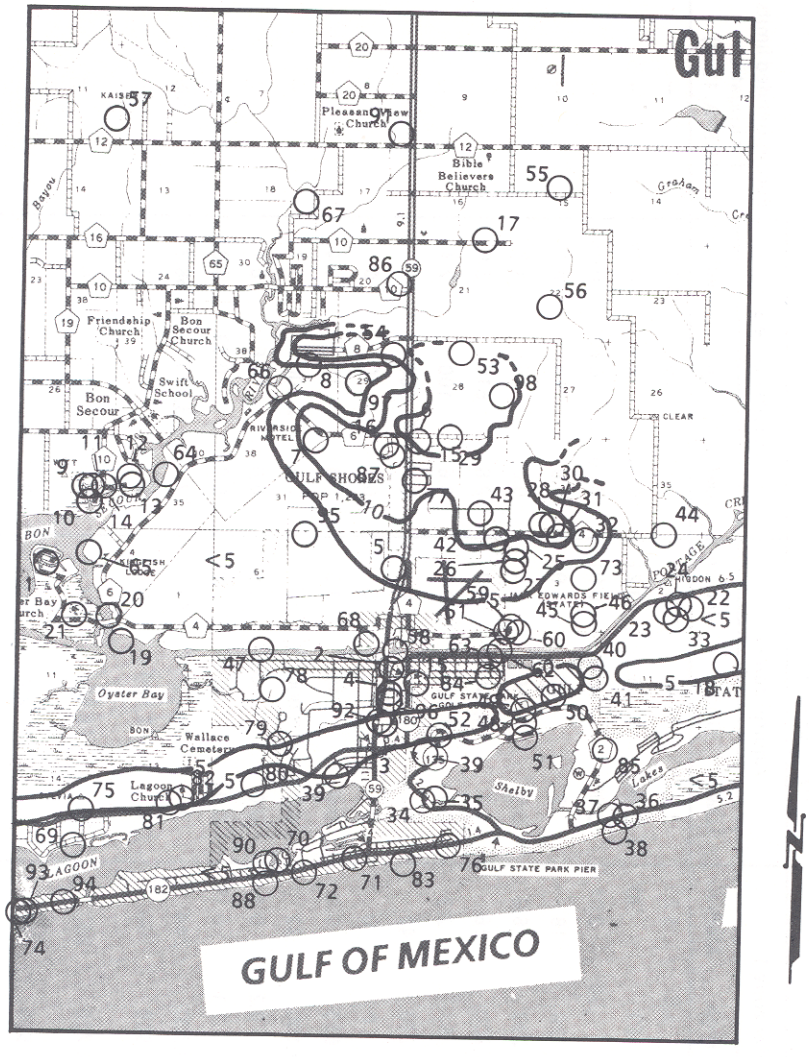


Figure 9.--Hydrograph of monthly low water levels for well Fol-8.



1 0 1 Mile

1 0 1 2 3 Kilometers

EXPLANATION

77 Well and number

5 or <5 Elevation in feet above mean sea level of water table in aquifer zone A_2.

0 Apparent area of depressed water levels.

Note: Map reflects 1984 water-level information.

Figure 10.--Water-table map for aquifer zone A_2, Gulf Shores Quadrangle.

Table 4.--Results of water analyses by hydrogeologic unit

EXPLANATION

Limits for public-water supplies; United States Public Health Service (USPHS) standards of 1962;
United States Environmental Protection Agency (USEPA) standards of 1983.
Recommended limits for irrigation: USEPA standrds of 1973.
Parameters in milligrams per liter, except as indicated.

Note: This table is based on recent water-analysis data and information.

Water analysis parameter (unit)	Limits for public water supplies		Hydrogeologic unit									Recommended limits for irrigation (USEPA, 1973)
			Aquifer zone 1			Aquifer zone 2			Aquifer zone 3			
	(USPHS, 1962)	(USEPA, 1983)	Low	High	Median	Low	High	Median	Low	High	Median	
Silica (SiO_2)	--	--	3.1	5.5	5.2	1.2	42	10	0.2	29	14.5	--
Iron (Fe)	0.30	0.30	0.02	69	.30	0.00	5.2	0.21	0.04	6.5	0.29	--
Manganese (Mn)	.05	.05	0.00	.39	0.01	0.00	8.3	0.01	0.00	0.60	0.00	--
Calcium (Ca)	--	--	0.1	120	18	.7	780	1.9	1.0	99	8.6	--
Magnesium (Mg)	--	--	0.5	290	6.8	0.0	450	1.1	0.0	16	1.8	--
Sodium (Na)	--	270	2.8	1,200	26	1.7	4,200	5.4	2.8	610	8.6	--
Potassium (K)	--	--	0.1	67	2.3	0.1	1,000	0.7	0.6	100	2.3	--
Bicarbonate (HCO_3)	--	--	0	270	42	0	204	0	0	180	27	--
Carbonate (CO_3)	--	--	0	0	0	0	0	0	0	0	0	--
Sulfate (SO_4)	250	250	.0	630	9.4	0.0	840	1.2	0.0	12	2.4	--
Chloride (Cl)	250	250	8.2	2,100	32	0.2	8,000	10	2.6	2,400	7.7	--
Fluoride (F)	1.2	1.8	.0	0.2	0.1	0.0	0.9	0.0	0.0	.6	0.1	1
Strontium (Sr)	--	--	0.05	1.1	0.15	0.01	5.3	.06	0.00	0.33	0.04	--
Dissolved solids	500	--	28	4,300	244	3	14,730	42	17	3,625	68.8	700
Calcium/magnesium hardness (as $CaCO_3$)	--	--	2	1,500	65	0	2,180	10	5	310	31	--
Specific conductance (micromhos @ 25°C)	--	--	43	4,700	267	19	18,200	53	26	770	96	--
Turbidity (NTU)[1]	5	--	0	500	15	0	260	0	0	230	2.5	--
Color (Pt-Co)[2]	15	75	0	760	60	0	760	0	--	430	10	--
pH	--	6.5-8.5	3.8	7.6	6.2	3.3	10.2	4.5	3.6	9.3	6.2	--
Water temperature (°F)	--	--	63	84	73	60	84	70	65	73	72	--

[1]NTU - Nephelometric Turbidity Units
[2]Pt-Co - Platinum-Cobalt scale units

values reflect the differences in the water chemistry of the specified aquifer zones. The median pH value of water in aquifer zone A_2, for example, is 4.5, and that of the deeper aquifer zone A_3 is 6.2. Water in aquifer zone A_3 also has higher values of iron, calcium, magnesium, sodium, potassium, bicarbonate, total dissolved solids, color, and turbidity. These differences in water quality may reflect a change in depositional environment from predominantly marine to fluvial-marine and/or other natural processes. The high iron content and low pH of water in aquifer zones A_1 and A_2 may be the result of the absorption of carbon dioxide (CO_2) as rainfall infiltrates the soil biosystem. The high chloride concentrations indicated for the aquifer zones may be the result of ancient sea-water entrapment. The effects of recent sea-water contamination are reflected by locally high sulfate values for water in aquifer zone A_1.

SALT WATER/FRESH WATER RELATIONSHIPS

INTERFACE ZONES

Salt water interfaces with fresh water along the coastal area of southern Baldwin County and projects inland along a concave interface in each aquifer zone. The interface for each aquifer is not sharply defined due to the mixing of fresh water and salt water along a zone of diffusion. The zone of diffusion in coastal areas may extend laterally for more than 1,000 feet.

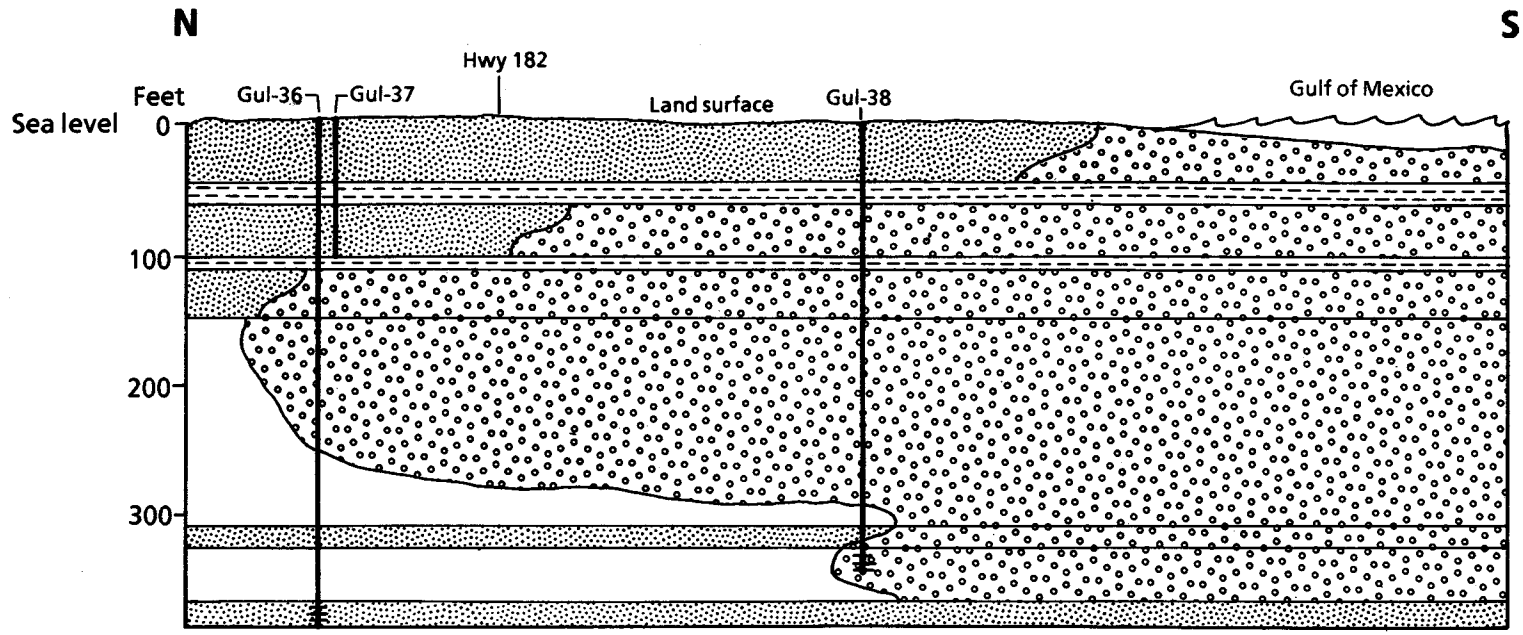
Figure 11 illustrates salt-water intrusion into coastal aquifer zones. The figure presents a cross sectional view of an area at the near sea level location of wells Gul-36, Gul-37, and Gul-38. At this location, the extent of salt-water intrusion is controlled by clay beds and hydrostatic pressures in the aquifer zones, producing a "layering" effect of fresh and saline ground waters. Inland of this interface zone, salt water underlies fresh water at progressively deeper horizons. At Gulf Shores, for example, salt water is at an estimated elevation of 500 feet below msl; near Interstate Highway 10, salt water is more than 750 feet below msl (plate 2), or 900 feet below the land surface.

HYDROCHEMICAL FACIES

A noticeable change in the chemical facies of ground water occurs between the areas of inland aquifer recharge (outcrop area) and downgradient discharge, in the direction of the salt water/fresh water interface. This change is principally a function of natural chemical and biochemical processes. Chemical analyses of water show the cation-anion facies of inland waters to be sodium chloride or sodium-calcium bicarbonate in type (fig. 12). The pH of water in these areas ranges from less than 4 to 6 (plate 4). The dissolved solids content is typically low, normally less than 100 mg/l. The low pH is attributed to the absorption of CO_2 from the soil-biosystem as rainfall infiltrates the land surface. Back (1960) indicates that low pH in combination with a low dissolved-solids in water is indicative of a highly leached soil zone.

As water moves through the subsurface and downdip (generally southward), it tends to become more mineralized, accumulating iron (plate 5) and increasing in calcium, sodium, and bicarbonate content and slightly in pH. An analogous condition seems to occur from shallow to deeper aquifer systems in the subsurface. Near coastal waters, the ground water tends to become more mineralized with sodium and chloride and has a generally high iron content. The downdip changes in hydrochemical facies as a function of chloride content of water in the aquifer zones are illustrated in figure 12.

In some instances, coastal ground water contains noticeably low levels of sulfate with respect to sea water. This may be due to the presence of organic or carbonaceous material in sediments that promotes a reducing environment in the subsurface, and the formation of HS and H_2S from the sulfate ion in that water (Freeze and Cherry, 1979). This is supported by the presence of H_2S in water from a number of coastal wells. Iron is a common element in the area's ground water. The "rust" color and high iron content of some water samples may be due to the presence of suspended ferric oxyhydroxides. Whittlemore and Langmuir (1975) indicate that this type of iron compound is present in coastal aquifer waters. Bicarbonate and chloride values of water from aquifer zones A_1, A_2, and A_3 are shown on plates 6, 7, and 8, respectively. Areas susceptible to salt-water contamination of



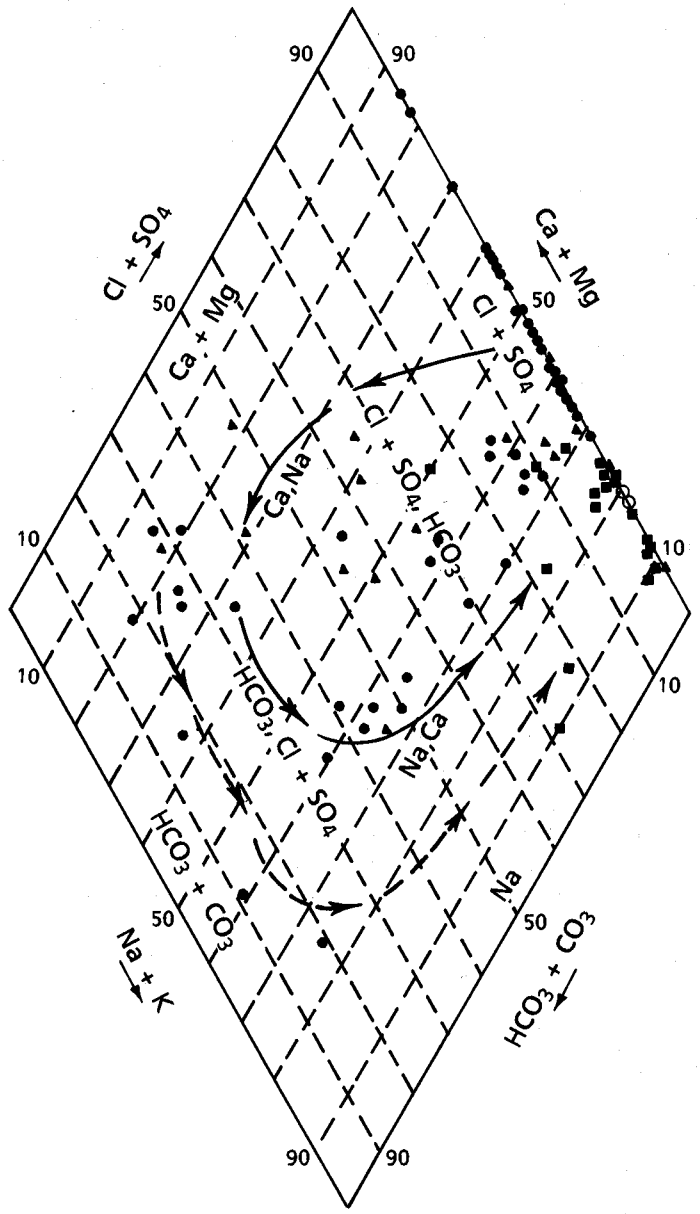
EXPLANATION

- Sand aquifer
- Clay aquiclude
- Extent of salt-water encroachment
- Sand, silt, clay aquitard
- Screened interval of wells
- Gul-38 Water well number (see appendices)

HORIZONTAL SCALE

0 100 200 FEET

Figure 11.--Cross section illustrating salt-water intrusion at the locations of wells Gul-36, Gul-37, and Gul-38.



EXPLANATION

Chloride content of water from wells

- ■ >250 milligrams per liter
- ▲ 25-250 milligrams per liter
- ● <25 milligrams per liter
- ○ Gulf of Mexico waters

Arrow indicates downdip hydrochemical changes that occur in aquifer zones A_1 and A_2

Arrow indicates downdip hydrochemical changes that occur in aquifer zone A_3

Note: Water-analysis diagram is based on 1984 data. Concentrations of anions and cations shown are expressed as percent of ion concentrations in milliequivalents per liter.

Figure 12.--Hydrochemical facies as a function of downdip movement and chloride content of water in the aquifer zones.

aquifer zones near the coastline are shown on the maps. As expected, these areas form a band along the Gulf of Mexico. In these areas, the chloride content of ground water normally exceeds 25 mg/l. Coastal flooding by sea water during storms or hurricanes can cause increases in the chloride content of water in aquifer zone A_1. Areas susceptible to flooding therefore correspond to the areas of potential salt-water encroachment shown on plate 6.

SALT-WATER ENCROACHMENT

The intrusion of salt water into coastal aquifers is generally recognized by an increase in chloride and TDS contents in water produced from wells. Also, changes in water-quality type in a well from a bicarbonate to chloride type may indicate local salt-water encroachment. Where TDS content of water is not determined by chemical analysis, it can be estimated from the measured specific conductance by multiplication with 0.7 (a conversion factor for 1,000 mg/l TDS) and equated to salinity.

MECHANISMS

In the southern Baldwin County area, salt-water encroachment can be the result of three factors:

1. Salt-water spray and coastal flooding of lowland areas, particularly as the result of hurricanes and tropical storms in the Gulf of Mexico,
2. High water-well production in combination with the presence of salt water in aquifer zones, and
3. Salt-water losses from retention ponds.

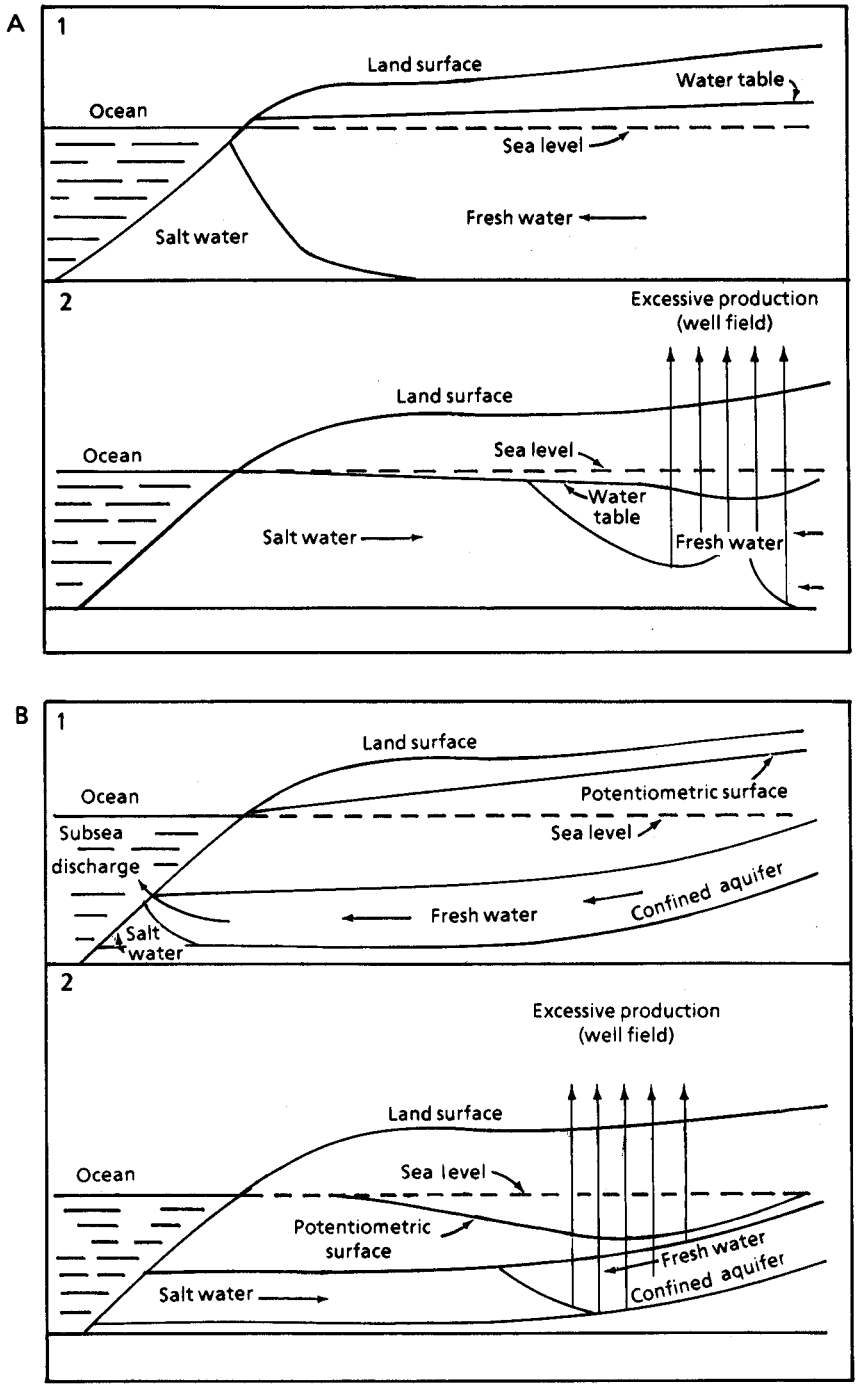
In the coastal areas, exploitable fresh ground water is near the salt-water interface. The position of the interface, therefore, is an important consideration when constructing water wells in these areas. Under natural conditions, the position of the salt water/fresh water interface is relatively stable and a function of natural factors. (See "Salt Water/Fresh Water Relationships.") Water-well production exceeding the freshwater recharge potential, however, can cause the migration of the salt water/fresh water interface toward the wells. The theoretical migration of the interface toward wells is illustrated in figure 13 for an unconfined and a confined coastal aquifer. The effect of the encroachment is the inland, and sometimes vertical, movement of salt water in the forms of "wedges" or "cones" toward points of ground-water withdrawal. Salt-water encroachment may be preceded by a noticeable lowering of ground-water levels to a point below sea level.

METHODS OF CONTROL

The chemical character of water controls the water's use for specific applications. Less than 2 percent of sea water in fresh water can render water unacceptable for drinking. To assist in the prevention of salt-water encroachment into the freshwater aquifer zones, it is necessary to formulate a strategy for the future mangement of the coastal aquifer systems.

Todd (1974) provides a list of methods that can be employed to control sea-water encroachment:

1. Controlling pumping patterns. The rate of pumpage and spacing of wells in an area can be altered to lower the potential for localized dewatering of an aquifer and control salt-water encroachment. Aquifer tests are necessary to establish proper well spacings and to determine proper pumpage rates for wells.
2. Direct artificial recharge. This method requires the surface application of water to recharge unconfined aquifers and the injection of water through wells to recharge confined aquifers.
3. Maintenance of a fresh-water ridge. A fresh-water ridge, inhibiting salt-water encroachment, can be established by artificial recharge of water in a seaward position of the freshwater zone in aquifers. Typically, a line of recharge wells is established parallel to the coastline. Where an induced fresh water/salt water interface has developed through pumping of inland wells, this interface may not parallel the coast. Instead, it may exist as a salient(s) extending toward wells of greatest withdrawal. A series of test wells may be necessary to adequately define the position of the salt water/fresh water interface.



EXPLANATION

A. Unconfined (water table) aquifer:
   1. Natural condition
   2. Affected by salt-water encroachment

B. Confined (artesian) aquifer:
   1. Natural condition
   2. Affected by salt-water encroachment

Figure 13.--Schematic of salt-water encroachment caused by excessive water-well production from (A) an unconfined coastal aquifer and (B) a confined coastal aquifer.

4. Extraction barrier. A line of water-extraction wells can be established parallel to the coast, forming a "trough" to remove both salt and fresh water from the subsurface. The objective is to maintain a subsurface seaward movement of fresh water in the aquifers. This effectively prevents salt-water encroachment inland of the extraction barrier, provided fresh-water movement rates in the subsurface equal or exceed the movement rate of salt water.
5. Combination injection-extraction barrier. Using the preceding two methods, a combination of an injection ridge and water-extraction barrier can be formed, protecting the aquifers from salt-water encroachment near the coast.
6. Impermeable subsurface barrier. A subsurface barrier of sheet piling, clay, emulsified asphalt, cement grout, etc., can be placed in an aquifer to prevent the intrusion of salt water. This type of barrier allows a greater utilization of inland waters without producing salt-water encroachment.

Some of the methods used to assist in the control of salt-water encroachment require approval from the Alabama Department of Environmental Management. The injection of water through wells to recharge an aquifer or to establish a fresh-water ridge must be approved by the Alabama Department of Environmental Management through the Underground Injection Control Program of the United States Environmental Protection Agency.

Of the methods mentioned, only the control of pumping patterns has proven to be practical and cost-effective (Freeze and Cherry, 1979). A modified form of this method of salt-water control has been used in the Gulf Shores/"Pleasure Island" area. Some public-supply wells have been established north of the Intracoastal Waterway in recent years to assist in the control of salt-water encroachment.

AREAS OF SALT-WATER CONTAMINATION

Three areas of apparent active salt-water contamination are shown on the hydrogeologic map (plate 2). They are the Gulf State Park golf course, western Fort Morgan peninsula, and the Claude Peteet Mariculture Center.

GULF STATE PARK GOLF COURSE

Wells Gul-49 and Gul-50 produce water from aquifer zone A_2 for irrigation purposes at the Gulf State Park golf course. These wells have estimated yields of 450 to 550 gpm. The wells have recently shown signs of increased levels of chloride and TDS in produced water, indicating salt-water contamination. Well Gul-49 is located near the inferred salt water/fresh water interface zone in aquifer zone A_2 shown on the hydrogeologic map (plate 2). This well had an initial chloride content of 50 mg/l when constructed in April 1971. On April 12, 1984, a water sample collected from the well had a measured chloride content of 410 mg/l. Water from well Gul-50, located further inland (northward) of the interface zone, has also increased in chloride content, but to a lesser extent. Present chloride levels in water from well Gul-50 are about 45 mg/l. A comparison of 1984 water-analysis data for wells Gul-49 and Gul-50, a salt-water test well (Gul-35), and Shelby Lake (coastward of the probable position of the salt-water interface zone) is provided in figure 14. A similarity in water chemistry is evident from the Stiff diagrams.

The increase in salt-water content of water produced at the golf course may be a result of the lateral movement of salt water (salt-water encroachment) in aquifer zone A_2. This hypothesis is supported by the comparison of well-pumpage time and chloride content data for well Gul-49, presented in figure 15. The chloride content of the water increases gradually with the time of well pumpage, a condition reflecting lateral movement of salt water. An increase in calcium and bicarbonate ions and depletion of sulfate ions relative to sea water in the area's ground water may reflect a transition between fresh and salt water (Walter and Kidd, 1979). Sulfate reduction is a natural process that takes place in coastal waters (Freeze and Cherry, 1979).

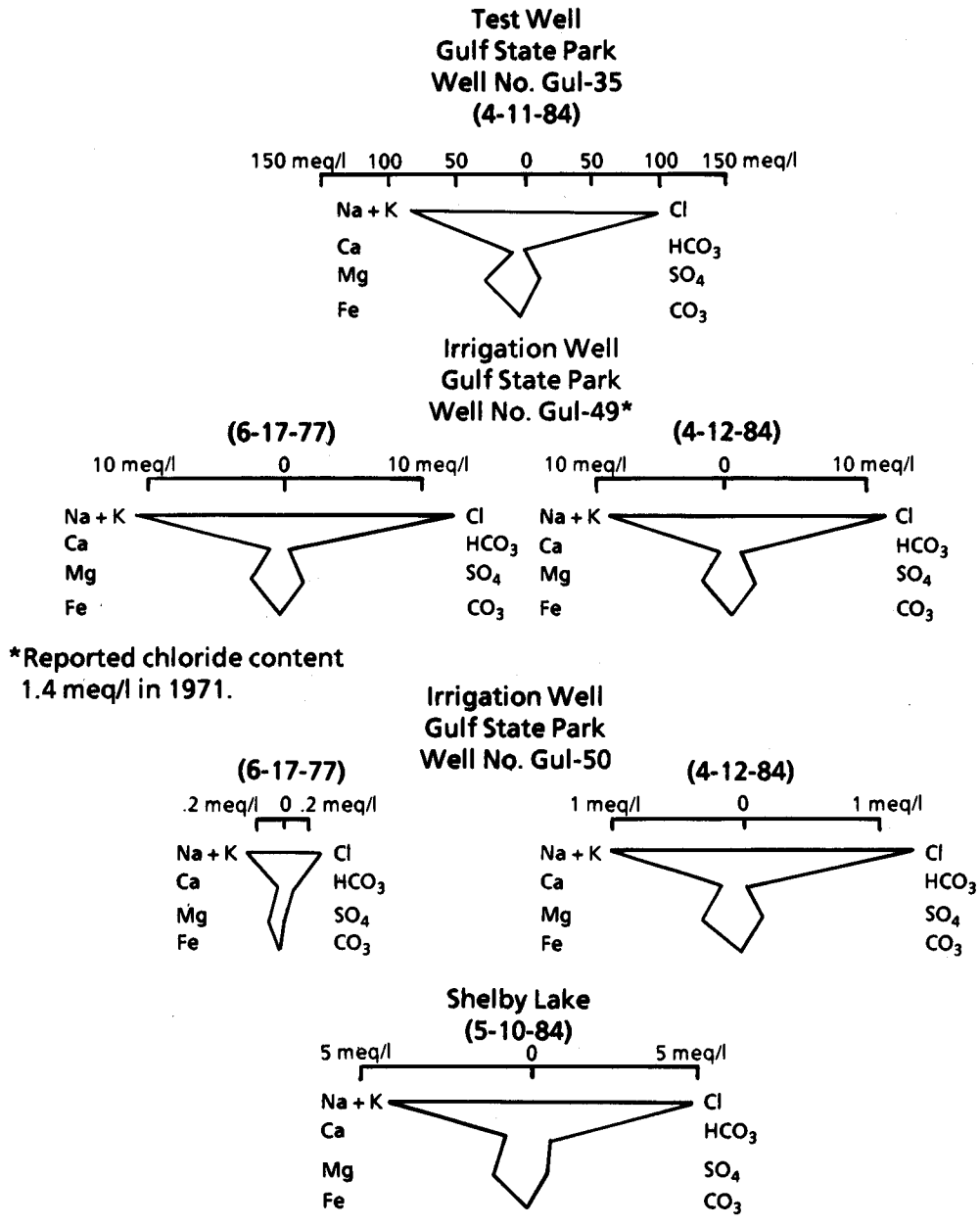


Figure 14.--Chemical-analysis diagrams (Stiff) for water produced from aquifer zone A_2 in the Gulf State Park golf course area.

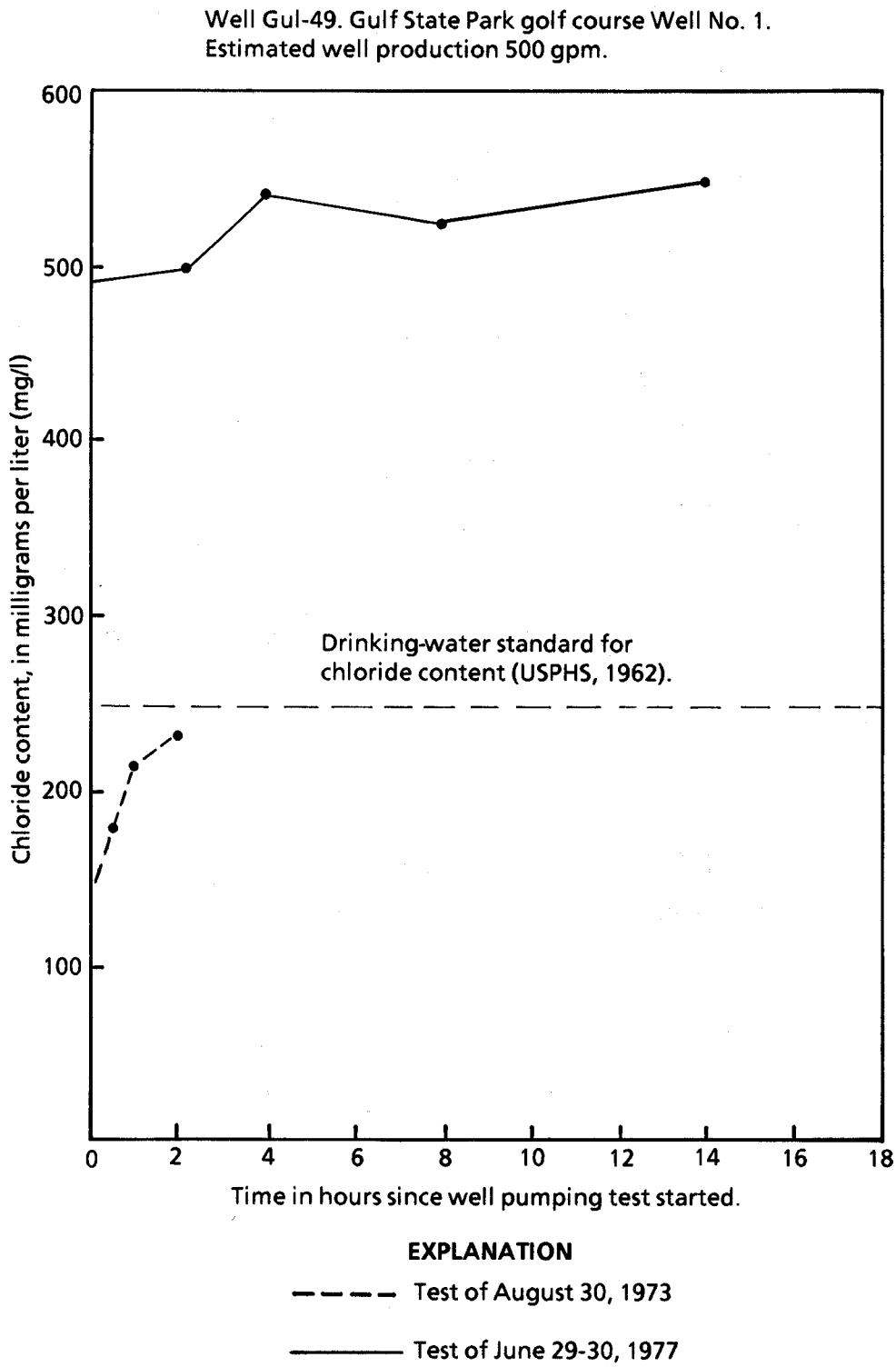


Figure 15.--Comparative graph of pumpage-time and chloride-test data for well Gul-49, August 30, 1973, and June 29-30, 1977.

WESTERN FORT MORGAN PENINSULA

In this area, aquifer zone A_1 is subject to the effects of coastal flooding, particularly during hurricanes, and to the natural effects of salt-water spray. The chloride content of water in the aquifer zone therefore is generally high. This aquifer zone contains brackish-to-saline water of the sodium-chloride and calcium-bicarbonate types. It is extensively developed throughout the peninsula area for private and semipublic supplies. The effects of sea-water contamination of aquifer zone A_1 are evident in the Stiff diagrams for surface water and water from wells in the area. Examples of Stiff diagrams are shown in figure 16 for the Gulf of Mexico, Bon Secour Bay, a test well (Sai-4), and water wells Sai-1 and Sai-8. The similarity in water chemistry is suggested by the similar shape of Stiff diagrams. Further indications of the effects of salt water on the aquifer zone are the reports of residents in the area on water quality. (See appendix A--Remarks.)

CLAUDE PETEET MARICULTURE CENTER

The Claude Peteet Mariculture Center immediately north of the Intracoastal Waterway utilizes a series of salt-water ponds to raise marine fish species. Water of high salinity is obtained from the Waterway for the salt-water ponds. Located at the center is a 191-foot deep utility well, Gul-59, developed in aquifer zone A_2. This well and other wells downgradient (southward) of the salt-water ponds produce water with high chloride contents. The water is similar in quality to water in the Intracoastal Waterway (fig. 17). Well Gul-59 produced salty water in January 1978, 5 years after its construction. In recent years, the chloride content of the water has increased dramatically. On February 27, 1978, for example, the chloride content of a water sample collected from the well was 1,900 mg/l; on May 10, 1980, the chloride content of a water sample was 7,200 mg/l. Available information suggests that the salt-water contamination is the result of loss of water from the salt-water ponds. This inference is supported by an observation on March 12, 1985, that the chloride content of water from well Gul-59 initially increased, then roughly stabilized with pumpage time. Stabilization of the chloride content may indicate that a persistent source of salt-water contamination occurs in the area of the salt-water ponds. Plans are being formulated (Walter Tatum, 1985, personal communication) to line the salt-water ponds with impermeable materials to prevent further contamination of aquifer zone A_2.

WATER-RESOURCES MANAGEMENT FACTORS

SAFE YIELD

Safe yield is generally defined as the amount of water that can be withdrawn during a given period of time from a ground-water basin without producing an undesirable result. Domenico (1972) identifies an undesirable result as the depletion of ground-water resources or the intrusion of poor-quality water (including salt water).

Using the concept of safe yield, it can be shown (Barksdale and Moore, 1976) that safe yield in the study area is a function of:

1. Fresh-water (precipitation) recharge,
2. Aquifer-storage capacity, and
3. Water transmission, withdrawal, and discharge rates for a given aquifer system.

Assuming a current water-use value of 1.6 mgd for public supplies in Gulf Shores, a calculated recharge rate of 0.12 mgd/mi^2, and a recharge area of 17 mi^2 for aquifer zone A_2 in the Gulf Shores area (plate 2), production from the aquifer for municipal water use alone is approximately 78 percent of the safe yield, which is estimated to be 2.0 mgd. If irrigation and other uses of ground water are included, withdrawals of water from aquifer zone A_2 may exceed the safe yield during some periods of the year.

Although ground-water discharge from aquifer zone A_2 may be exceeding the safe yield, major public water supplies apparently have not been affected by salt-water encroachment. This is indicated on plate 9, which shows water-analysis diagrams (Stiff) for water samples collected from

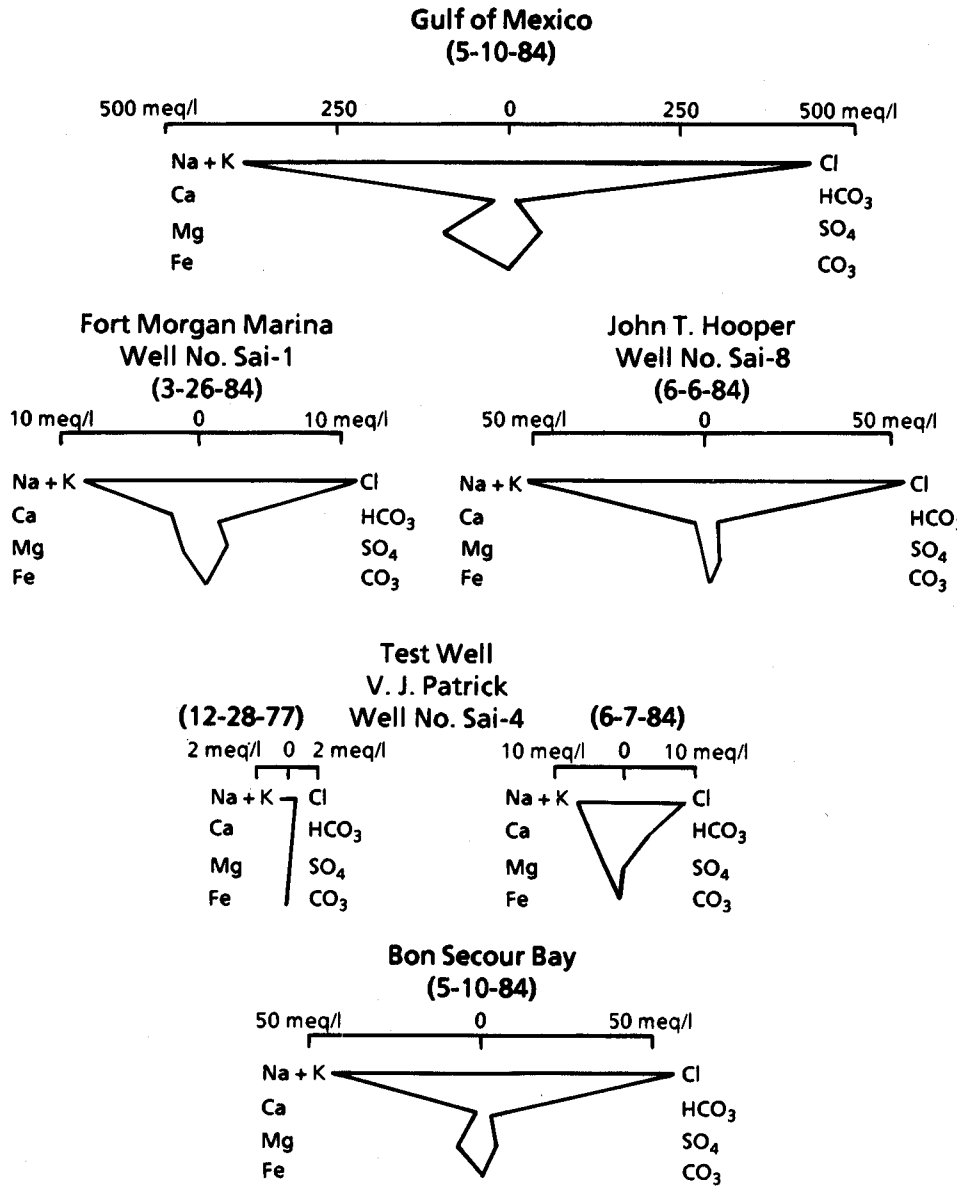


Figure 16.--Chemical-analysis diagrams (Stiff) for water produced from aquifer zone A_1 in the western Fort Morgan peninsula area.

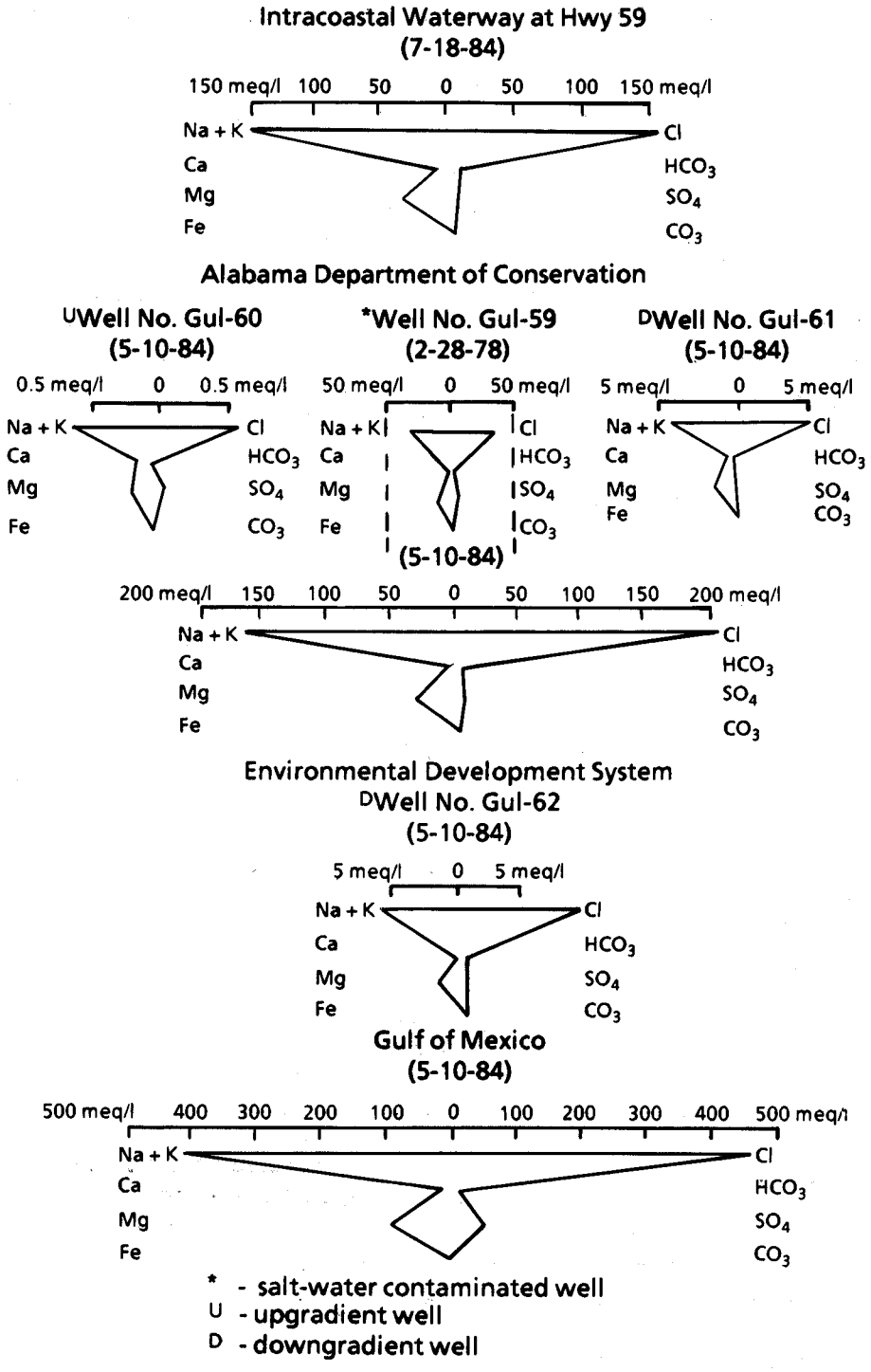


Figure 17.--Chemical-analysis diagrams (Stiff) for analyses of water produced from aquifer zone A_2 at the Claude Peteet Mariculture Center area.

selected municipal wells. The analysis diagrams reflect various fresh-water types, principally the low sodium chloride and calcium-bicarbonate types. For comparison, water-analysis diagrams for salt-water samples from selected wells and surface-water bodies are shown on plate 9. As the demand for ground water in the coastal areas increases, the continued production of water from aquifer zone A_2 has the potential to contribute to salt-water encroachment in this aquifer.

THE WATER-BUDGET CONCEPT

Changes in the hydrologic system of southern Baldwin County can be expressed by a simple equation where water income equals water losses plus changes in storage. In southern Baldwin County, water income is derived solely from precipitation and water losses occur as evaporation, transpiration, surface runoff, and water-well pumpage. Changes in storage are represented by changes in the quantity of ground water and are indicated by water-level fluctuations in wells. In the future, if the water income includes significant amounts of water transported by pipeline into the study area, the budget could be balanced simply by assuming that a corresponding loss, such as wastewater discharge, existed. If, however, the water in storage is subject to a continual drain by excessive pumpage, the water-budget equation can be temporarily imbalanced in general ratio to the magnitude of the drain. The overdraft of aquifers can result in declining ground-water levels, salt-water encroachment, decreased surface runoff, or a combination thereof. For the southern Baldwin County area, problems may be minimized through future prudent management and conservation of the ground-water resources.

WATER MANAGEMENT

Presently, ground water is the only source of the area's water supply, and the fresh ground-water resources of the area have the potential to be overdeveloped, leading to possible salt-water encroachment. The future management of the ground-water resources, therefore, is an essential consideration for the protection and preservation of this resource. The spacing and production of water wells in the Gulf Shores/"Pleasure Island" area is presently unregulated. The potential negative effects of this are:

1. Potential salt-water intrusion into the aquifer systems,
2. Excessive heavy ground-water demands that can lead to aquifer dewatering and localized depression in the water table, and
3. Mutual interference between irrigation and municipal wells.

RECOMMENDATIONS

Aquifer zone A_2 is extensively developed as a source of irrigation and public-water supplies in southern Baldwin County. Overproduction of the aquifer at the Gulf State Park golf course has resulted in apparent local salt-water encroachment. Continued development of the aquifer zone could result in additional salt-water encroachment. Therefore, it is recommended that a continuous ground-water monitoring program be considered for the collection of hydrologic data necessary for evaluating potential ground-water problems. The collection of information on water use, water levels, and water chemistry would be useful as part of the monitoring program.

Drilling and testing of wells in southern Baldwin County would be helpful in determining aquifer characteristics and in defining the ability of the aquifers to supply future water needs.

Computer modeling of flow characteristics and water-quality conditions of the aquifer systems should be considered for the future management of the ground-water resources of southern Baldwin County. The three-dimensional (3-D) finite difference ground-water flow model (McDonald and Harbaugh, 1984) and the computer program RESSQ (Javandel, Doughty, and Tsang, 1984) are specifically applicable to solving ground-water problems. The 3-D model simulates the effects of well production, recharge, and the influence of rivers, evaporation, general-head boundaries, and other hydrologic items on water-table and confined (artesian) aquifer systems. The computer program RESSQ determines two-dimensional contaminate (solute) transport in an aquifer where regional

flow, contamination sources, and ground-water withdrawals are well defined. These two models have the capabilities of examining general ground-water conditions and identifying potential problems of salt-water contamination or other forms of pollution of the aquifer systems. The models can be used to determine proper well spacing and pumping rates in order to control well interference, water-level declines, and salt-water encroachment. Other models may also be applicable to solving ground-water problems.

Information obtained from ground-water monitoring programs, aquifer testing, and computer modeling could be used in a feasibility study for the need of a management plan for the ground-water resources of southern Baldwin County.

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APPENDICES

APPENDIX A

Records of water wells and test wells in southern Baldwin County, Alabama.

Appendix A. Records of water wells and test wells in southern Baldwin County, Alabama

WRD: Water Resources Division, Geological Survey of Alabama.
Water-bearing unit: Qalt (A_1) - alluvial, low terrace, and beach deposits (aquifer zone A_1); Tci (A_2) - Citronelle Formation (aquifer zone A_2); Tmu (A_2) - Miocene Series undifferentiated (aquifer zone A_2); Tmu (A_2) - Miocene Series undifferentiated (aquifer zone A_3).

Production method: J - jet; N - none; T - turbine; S - submergible; C - centrifugal; F - flows.
Type of well: Ind. - industrial; Irr. - irrigation; Pvi - private supply (domestic); PS - public supply; S - special use or utility; T - test; U - unused; O - observation.
Remarks: gpm - gallons per minute; USGS - U.S. Geological Survey; WRD - Water Resources Division, Geological Survey of Alabama.

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Bon-1 (YY-2)	James Lipscomb	Alms Pump Service (1963)	50	Tmu (A_2)	43	--	--	J	Pvi	2-in casing from land surface to 46 ft; 2-in screen from 46 to 50 ft.
Bon-2 (YY-3)	James Lipscomb	J. Zaller (1963)	55	Tmu (A_2)	43	25 22.4 21.0	1953 06-27-66 03-27-84	N	U	3-in casing from land surface to 45 ft; 3-in screen from 45 to 55 ft.
Bon-3 (YY-07)	Amoco Oil Co.	Griner Drilling Service, Inc. (1982)	126	Tmu (A_2)	43	25	1982	N	U	3-in casing from land surface to 105 ft; 3-in screen from 105 to 126 ft. Test-pumped at 80 gpm for 3 hrs in 1982. 168-ft test hole made for well. Driller's report in WRD files. Abandoned gas test-well drilling supply well.
Bon-4 (XX-02)	Blanche Weeks	Alms Pump Service (1981)	65	Qalt (A_1)	3	8	1981	J	U	2-in casing from land surface to 60 ft; 2-in screen from 60 to 65 ft. Test-pumped at 9 gpm for 1 hr in 1981. Driller's report in WRD files.
Bon-5 (YY-015)	Robert Hood	John H. Davis (1976)	46	Tmu (A_2)	59	20	1976	J	Pvi	2-in casing from land surface to 41 ft; 2-in screen from 41 to 46 ft. Test-pumped at 10 gpm for 3 hrs in 1976. Driller's report in WRD files.
Bon-6 (YY-016)	B. E. Downs	Alms Pump Service (1975)	30	Tmu (A_2)	15	16	1975	J	Pvi	2-in casing from land surface to 25 ft; 2-in screen from 25 to 30 ft. Test-pumped at 7 gpm for 1 hr in 1975. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Bon-7 (YY-04)	William Cleverdon	Holland Well Co. (1978)	273	Tmu (A_3)	43	22	1978	T	Irr.	12-in casing from land surface to 160 ft; 6-in screens from 160 to 200 ft, and 233 to 273 ft. Reported drawdown 38 ft after 6 hrs pumping at 1,000 gpm in 1978. 274-ft test hole made for well. Driller's report in WRD files.
Bon-8 (YY-014)	S. C. Lipscomb Unit 7-9 no. 1	New and Hughes Drilling Co., Inc. (1983)	1,984	Tmu (-)	40	--	--	--	S	9-5/8-in casing from land surface to 1,018 ft; 5-1/2-in casing from land surface to 1,984 ft, perforated from 1,766 to 1,774 ft. 2,007-ft test hole made for well. Electric log in Oil and Gas Board files. Gas production well. Permit Number 3616.
Bon-9 (FFF-07)	J. A. Mullins	Alms Pump Service (1976)	15	Qalt (A_1)	10	6	1976	J	Pvi	2-in casing from land surface to 11 ft; 2-in screen from 11 to 15 ft. Test-pumped at 9.5 gpm for 1 hr in 1976. Driller's report in WRD files.
Bri-1 (CC-6)	Spanish Fort Water System	Layne Central Co. (1959)	378	Tmu (A_2, A_3)	160	165 149.2	1959 04-27-66	T	PS	18-in casing from land surface to 289 ft; 12-in casing from 239 to 289 ft; 8-in screens from 294 to 319 ft, and 348 ft to 368 ft. Reported drawdown 119 ft after 8 hrs pumping at 554 gpm in 1959. 414-ft test hole made for well. Driller's report in WRD files.
Bri-2 (CC-5)	Spanish Fort Water System	Layne Central Co. (1964)	309	Tmu (A_2)	150	111 109.6	1965 03-15-66	T	PS	16-in casing from land surface to 260 ft; 10-in casing from 210 to 265 ft; 8-in screen from 265 to 305 ft. Test-pumped at 200 gpm in 1964. 419-ft test hole made for well. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Bri-3 (LL-1)	Mrs. Elza McGadney	J. B. Cooper (1966)	273	Tmu (A_2)	40	26.7	06-16-66	J	U	2-in casing from land surface to 265 ft; 2-in screen from 265 to 273 ft. 373-ft test hole made for well. Sample log in WRD files.
Bri-4 (LL-013)	Gus McCovery	Alms Pump Service (1976)	84	Tmu (A_2)	70	30	1976	N	U	2-in casing from land surface to 79 ft; 2-in screen from 79 to 84 ft. Test-pumped at 9 gpm for ½ hr in 1976. Driller's report in WRD files. Well destroyed.
Bri-5 (LL-014)	Charles Wallace	J. A. Mosley (--)	78	Tmu (A_2)	70	60	1973	N	U	2-in casing from land surface to 73 ft; 2-in screen from 73 to 78 ft. Driller's report in WRD files. Well destroyed.
Bri-6 (LL-09)	Lake Forrest Utilities, Inc.	Layne Central Co. (1959)	315	Tmu (A_2)	140	48	1959	T	PS	12-in casing from land surface to 270 ft; 8-in casing from 220 to 275 ft; 6-in screen from 275 to 305 ft. Reported drawdown 23 ft after 8 hrs pumping at 319 gpm in 1959. 399-ft test hole made for well. Driller's report in WRD files.
Dap-1 (LL-010)	Town of Daphne	Acme Drilling Co. (1974)	780	Tmu (A_3)	125	--	--	N	T	Test well no. 8. Driller's report and Widco well log in WRD files.
Dap-2 (LL-04)	Town of Daphne	Layne Central Co. (1983)	430	Tmu (A_3)	152	132	1957	T	PS	12-in casing from land surface to 380 ft; 6-in screen from 380 to 430 ft. Reported drawdown 22 ft after 16 to 18 hrs pumping at 400 gpm in 1983. Reconstructed from 442-ft well completed in 1957. Driller's report for original well in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Dap-3 (LL-6)	Town of Daphne	Layne Central Co. (1964)	452	Tmu (A_3)	155	136 130.5 138.4 144.7 148.3 161.05 142.3 167.0 162.0 153.8 143.1 147.7 154.0 144.7	1965 03-08-66 05-03-66 02-14-68 10-23-68 04-22-69 10-29-69 04-06-77 11-08-78 04-28-80 11-05-80 04-05-81 04-14-82 11-03-82	T	PS	12-in casing from land surface to 397 ft; 6-in casing from 347 to 397 ft; 6-in screen from 402 to 442 ft. Test-pumped at 250 gpm in 1964. 666-ft test hole made for well. Driller's report in WRD files. Once served as semi-annual water-level monitoring well.
Dap-4 (LL-5)	Town of Daphne	A. W. Williams Inspection Co. (1953)	436	Tmu (A_3)	160	132	1953	N	U	12-in casing from land surface to 380 ft; 6-in casing from 340 to 380 ft; 6-in screen from 380 to 430 ft. Test-pumped at 300 gpm for ½ hr in 1953. Driller's report in WRD files. Abandoned public supply well.
Dap-5 (LL-08)	Town of Daphne	Layne Central Co. (1963)	--	--	143	--	--	N	U	Constructed with 60-ft screen. Reportedly pumped at 900 gpm in 1966. Abandoned public supply well. Well destroyed.
Dap-6 (LL-05)	Town of Daphne	Griner Drilling Service, Inc. (1983)	210	Tmu (A_2)	140	49	1983	N	T	Test well no. 1. Reported drawdown 74 ft after 23 hrs pumping at 75 gpm in 1983. 614-ft test hole made for well. Driller's report and electric log in WRD files.
Dap-7 (LL-8)	Dr. Sara J. Daniel	J. Ponder (1956)	218	Tmu (A_2)	18	+15 +11	1956 1966	N	S	2-in casing from land surface to 210 ft; 2-in screen from 210 to 218 ft. Estimated flow 3 gpm in 1966, and 3 gpm in 1984. Lawn scenic attraction.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Dap-8 (LL-4)	J. D. Trione, Jr.	Holland Well Co. (1963)	110	Tmu (A_2)	155	90 61.2 (est.) 60.5	1963 05-03-66 01-31-84	N	U	2-in casing from land surface to 106 ft; 2-in screen from 106 to 110 ft. Abandoned farm supply well.
Dap-9 (NN-3)	Town of Fairhope	Layne Central Co. (1964)	510	Tmu (A_3)	115	106	1963	T	U	20-in casing from land surface to 360 ft; 12-in casing from 300 to 360 ft; 12-in screens from 365 to 390 ft, and 455 to 500 ft. Reported drawdown 80 ft after 8 hrs pumping at 752 gpm in 1964. 523-ft test hole made for well. Driller's report in WRD files.
Dap-10 (NN-4)	Town of Fairhope	Layne Central Co. (1956)	480	Tmu (A_3)	102	75 78.2 76.1	1956 03-15-66 02-02-84	T	U	16-in casing from land surface to 330 ft; 10-in casing from 271 to 335 ft; 10-in screens from 335 to 365 ft, and 440 to 470 ft. Reported drawdown 35 ft after 8 hrs pumping at 614 gpm in 1956. 513-ft test hole made for well. Driller's report in WRD files. Abandoned public supply well.
Dap-11 (NN-5)	Town of Fairhope	Layne Central Co. (1952)	479	Tmu (A_3)	100	53	1952	T	U	16-in casing from land surface to 326 ft; 10-in casing from 266 to 326 ft; 10-in screens from 331 to 356 ft, and 444 to 469 ft. Reported drawdown 55 ft after 8 hrs pumping at 608 gpm in 1952. 484-ft test hole made for well. Driller's report in WRD files. Abandoned public water supply.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Dap-12 (NN-6)	Town of Fairhope	Layne Central Co. (1944)	389	Tmu (A_3)	125	98	1949	N	U	16-in casing from land surface to 292 ft; 8-in casing from 230 to 295 ft; 8-in screens from 295 to 315 ft, and 355 to 385 ft. Reported drawdown 79 ft after 5 hrs pumping at 440 gpm in 1944. 420-ft test hole made for well. Driller's report in WRD files. Abandoned public supply well.
Dap-13 (NN-2)	Auburn University	Deep Well Drilling Co. (1948)	403	Tmu (A_3)	125	76	1949	N	U	6-in casing from land surface to 320 ft; 6-in screen from 320 to 383 ft, none below. Reportedly pumped at 120 gpm in 1949. Driller's log and sample-sieve analysis in WRD files. Abandoned irrigation well.
Elb-1 (TT-010)	Berean Baptist Church	Alms Pump Service (1978)	60	Tmu (A_2)	82	24	1978	J	Pvi	2-in casing from land surface to 55 ft; 2-in screen from 55 to 60 ft. Test-pumped at 13 gpm for 1 hr in 1978. Driller's report in WRD files.
Elb-2 (TT-06)	Trump Industries	Alms Pump Service (1982)	116	Tmu (A_2)	89	28	1982	S	Ind.	4-in casing from land surface to 96 ft; 4-in screen from 96 to 116 ft. Test-pumped at 55 gpm for 2 hrs in 1982. Driller's report in WRD files.
Elb-3 (TT-07)	Trump Industries	Alms Pump Service (1983)	116	Tmu (A_2)	89	30	1983	S	Ind.	4-in casing from land surface to 111 ft; 4-in screen from 111 to 116 ft. Test-pumped at 33 gpm for 1 hr in 1983. Driller's report in WRD files. Heat-pump and cooling-water well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Elb-4 (TT-04)	Michael Kaiser	Alms Pump Service (1982)	170	Tmu (A_2)	82	30	1982	T	Irr.	6-in casing from land surface to 130 ft; 6-in screen from 130 to 170 ft. Test-pumped at 800 gpm for 10 hrs in 1982. Driller's report in WRD files.
Elb-5 (SS-4)	J. M. Kiefer	Bradley Pump Co. (1960)	181	Tmu (A_2)	95	30 49	1949 1966	J	Pvi	2-in casing from land surface to 177 ft; 2-in screen from 177 to 181 ft.
Elb-6 (TT-6)	Town of Elberta	Spillers Well and Pump Supply Co. (1964)	102	Tmu (A_2)	75	26 23.5	1964 03-28-84	T	PS	8-in casing from land surface to 72 ft; 6-in casing from 69 to 72 ft; 6-in screen from 72 to 102 ft. Test-pumped at 335 gpm for 2 hrs in 1964.
Elb-7 (TT-7)	Town of Elberta	Unknown	80	Tmu (A_2)	75	--	--	S	PS	Auxiliary public water supply.
Elb-8 (TT-02)	Frank Koehler	Alms Pump Service (1978)	93	Tmu (A_2)	85	30	1978	T	Irr.	6-in casing from land surface to 63 ft; 6-in screen from 63 to 93 ft. Test-pumped at 500 gpm for 4 hrs in 1978. Driller's report in WRD files.
Elb-9 (TT-09)	International Paper Corp.	Alms Pump Service (1980)	49	Tmu (A_2)	75	23	1980	J	S	2-in casing from land surface to 44 ft; 2-in screen from 44 to 49 ft. Test-pumped at 12 gpm for 1 hr in 1980. Driller's report in WRD files. Office supply well.
Elb-10 (TT-08)	Ken Heil	Alms Pump Service (1982)	210	Tmu (A_2)	92	35	1982	T	Irr.	6-in casing from land surface to 170 ft; 6-in screen from 170 to 210 ft. Test-pumped at 800 gpm for 10 hrs in 1982. Driller's report in WRD files.
Elb-11 (TT-01)	Richard Warriner	Holland Well Co. (1978)	320	Tmu (A_3)	79	42	1978	T	Irr.	12-in casing from land surface to 208 ft; 6-in screen from 220 to 320 ft. Reported drawdown 78 ft after 6 hrs pumping at 1,000 gpm in 1978. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Elb-12 (AAA-1)	Tony Leiterman	Campbell Hardware and Supply Co. (1965)	69	Tmu (A_2)	69	34	1965	J	S	4-in casing from land surface to 64 ft; 4-in screen from 64 to 69 ft. Reportedly pumped at 60 gpm in 1966.
Elb-13 (TT-5)	Town of Elberta	Layne Central Co. (1954)	102	Tmu (A_2)	75	23 20.2 20.6	1954 03-17-66 03-28-84	N	U	8-in casing from land surface to 70 ft; 6-in casing from 68 to 70 ft; 6-in screen from 70 to 100 ft; no record below. Reported drawdown 21 ft after 8 hrs pumping at 150 gpm in 1954. Driller's report in WRD files. Abandoned public supply well.
Elb-14 (QQ-01)	Major Charles Cain	John H. Davis (1980)	82	Tmu (A_2)	39	30	1980	J	S	2-in casing from land surface to 77 ft; 2-in screen from 77 to 82 ft. Test-pumped at 10 gpm for 4 hrs in 1980. Driller's report in WRD files. Home and heat-pump well.
Els-1 (JJ-05)	Baldwin County Board of Education	J. A. Mosley (1973)	47	Tci (A_2)	138	40	1973	J	PS	Driller's report in WRD files. One of two wells serving Elsanor School.
Els-2 (QQ-02)	Leonard Foley	Alms Pump Service (1974)	155	Tmu (A_2)	154	40	1974	J	Pvi	2-in casing from land surface to 150 ft; 2-in screen from 150 to 155 ft. Test-pumped at 8 gpm for 1 hr in 1974. Driller's report in WRD files.
Els-3 (QQ-2)	Clay Cooper	Campbell Hardware and Supply Co. (1966)	110	Tmu (A_2)	131	48.0 46.0 50.0 52.6 46.8	09-30-57 05-19-66 02-15-68 10-22-68 04-14-71	J	Pvi	4-in casing from land surface to 115 ft; 4-in screen from 115 to 120 ft. Well log in WRD files. Once served as semi-annual water-level monitoring well.
Els-4 (II-2)	Mrs. Tunstal Weekly	Alms Pump Service (1977)	134	Tmu (A_2)	154	--	--	J	Pvi	Replacement for 96-ft well at same location (USGS no. II-2).

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Els-5 (II-02)	Mrs. Carolyn Merchant	John H. Davis (1978)	127	Tmu (A_2)	148	52	1978	J	Pvi	2-in casing from land surface to 122 ft; 2-in screen from 122 to 127 ft. Test-pumped at 11 gpm for 4 hrs in 1978. Driller's report in WRD files.
Els-6 (II-03)	Fletcher Boyington	John H. Davis (1982)	107	Tmu (A_2)	154	78	1982	J	Pvi	2-in casing from land surface to 102 ft; 2-in screen from 102 to 107 ft. Test-pumped at 8 gpm for 4 hrs in 1982. Drillers' report in WRD files.
Fol-1 (PP-5)	Town of Summerdale	Layne Central Co. (1955)	146	Tmu (A_2)	115	20 8.7 11.0	1955 03-14-66 03-01-84	T	PS	16-in casing from land surface to 71 ft; 10-in casing from land surface to 75 ft; 10-in screens from 75 to 95 ft, and 120 to 140 ft. Reported drawdown 20 ft after 8 hrs pumping at 503 gpm in 1955. Driller's report in WRD files.
Fol-2 (VV-013)	Gulf Farms, Inc.	Holland Well Co. (1972)	200	Tmu (A_2)	59	33	1972	S	Irr.	4-in casing from land surface to 180 ft; 4-in screen from 180 to 200 ft. Well log in WRD files.
Fol-3 (UU-9)	Riviera Utilities	Layne Central Co. (1954)	148	Tmu (A_2)	82	20 24 29.0	1954 1966 08-30-83	T	PS	16-in casing from land surface to 94 ft; 10-in casing from 64 to 98 ft; 10-in screen from 98 to 138 ft; no record below. Reported drawdown 32 ft after 8 hrs pumping at 503 gpm in 1954. Driller's report in WRD files.
Fol-4 (UU-01)	WHEP Radio Station	Alms Pump Service (1975)	25	Tci (A_2)	89	11	1975	J	Pvi	2-in casing from land surface to 20 ft; 2-in screen from 20 to 25 ft. Test-pumped at 7.5 gpm for 1 hr in 1975. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Fol-5 (UU-17)	Riviera Utilities	Carloss Well Supply Co. (1971)	138	Tmu (A_2)	76	22 25.0	1971 08-30-83	T	PS	36-in casing from land surface to 20 ft; 24-in casing from land surface to 98 ft; 16-in casing from land surface to 95 ft; 12-in screen from 98 to 138 ft. Reported drawdown 44 ft after 12 hrs pumping at 625 gpm in 1971. Driller's report in WRD files.
Fol-6 (UU-6)	Riviera Utilities	Layne Central Co. (1962)	155	Tmu (A_2)	75	18 21.5	1962 03-14-66	T	PS	30-in casing from land surface to 10 ft; 24-in casing from land surface to 103 ft; 16-in casing from land surface to 108 ft; 12-in screens from 108 to 133 ft, and 137 to 147 ft; no record below. Reported drawdown 48 ft after 8 hrs pumping at 578 gpm in 1962. Driller's report in WRD files.
Fol-7 (VV-5)	C. L. Rhodes	J. Zaller (1963)	71	Tmu (A_2)	82	--	--	C	Pvi	4-in casing from land surface to 61 ft; 4-in screen from 61 to 71 ft.
Fol-8 (UU-7)	Riviera Utilities	Gray Artesian Well Co. (1939)	135	Tmu (A_2)	76	26 31.2 15.0 19.8	1945 06-22-56 10-13-59 03-01-84	N	O	10-in casing from land surface to 134 ft; slotted between 94 and 134 ft. Reported drawdown 2 ft after 5 hrs pumping 120 gpm in 1939. Well log and gamma-ray log in WRD files. Continuous water-level recording well no. Bal-1 (see Figure 10).
Fol-9 (VV-012)	Gaylord Brisbon	Alms Pump Service (1982)	105	Tmu (A_2)	79	26	1982	J	Pvi	4-in casing from land surface to 85 ft; 4-in screen from 85 to 105 ft. Test-pumped at 70 gpm for 6 hrs in 1982. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Fol-10 (ZZ-032)	Swift Presbyterian Church	John H. Davis (1977)	97	Tmu (A_2)	23	28	1977	J	Pvi	2-in casing from land surface to 92 ft; 2-in screen from 92 to 97 ft. Test-pumped at 6 gpm for 3 hrs in 1977. Driller's report in WRD files.
Fol-11 (PP-01)	Eugene Mikkelsen	Holland Well Co. (1977)	498	Tmu (A_3)	95	8	1977	S	Irr.	8-in casing from land surface to 130 ft; 4-in screens from 139 to 179 ft, and 435 to 498 ft. Reported drawdown 81 ft after 6 hrs pumping at 750 gpm in 1977. Driller's report in WRD files.
Fol-12 (UU-012)	Foley Dairy	Alms Pump Service (1978)	164	Tmu (A_3)	75	--	--	T	Irr.	--
Fol-13 (UU-015)	Foley Dairy unit 31-11 no. 1	-- (1981)	2,021	Tmu (-)	73	--	--	--	S	9-5/8-in casing from land surface to 1,005 ft; 5-1/2-in casing from land surface to 2,006 ft, perforated between 1,662 and 1,672 ft. Electric log in Oil and Gas Board files. Gas production well. Permit Number 2967.
Fol-14 (UU-8)	Riviera Utilities	Deep Well Drilling Co. (1949)	137	Tmu (A_2)	82	19.8 20	07-23-49 1966	N	U	12-in casing from land surface to 81 ft; 10-in casing from 70 to 92 ft; 10-in screen from 93 to 133 ft; no record below. Reported drawdown 37 ft after 24 hrs pumping at 712 gpm in 1946. 642-ft test hole made for well. Driller's report and sample log in WRD files. Abandoned public supply well.
For-1 (HHH-1)	Fort Morgan Historical Society	Bryan Oil Co. (1909)	1,513	Tmu	20	+14.0 +1.2	03-21-46 02-01-84	F	S	Multiple cased. Reported flow 15 gpm in 1949; estimated flow 6 to 8 gpm in 1984. Flows salty water. Well log in WRD files. Public scenic attraction; "flaming well." Abandoned oil and gas test well. Fitzhugh no. 1, B-125.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
For-2 (HHH-01)	Fort Morgan Historical Society	Alms Pump Service (1982)	20±	Qalt (A_1)	--	--	--	S	PS	Serves Fort Morgan restaurant.
For-3 (HHH-02)	Fort Morgan Historical Society	Alms Pump Service (1965)	20±	Qalt (A_2)	--	--	--	J	PS	--
For-4 (HHH-03)	Fort Morgan Historical Society	Alms Pump Service (1965)	20±	Qalt (A_1)	--	--	--	J	PS	--
For-5 (HHH-04)	Fort Morgan Historical Society	J. Zaller (1960)	20±	Qalt (A_1)	--	--	--	J	Pvi, O	Manager's home well; WRD water-quality monitoring well.
Gat-1 (JJ-3)	H. L. Lechner	Campbell Hardware and Supply Co. (1961)	97	Tmu (A_1)	120	55.6 57.0	08-28-57 05-18-66	J	Pvi	2-in casing from land surface to 92 ft; 2-in screen from 92 to 97 ft.
Gul-1 (EEE-01)	Bon Bay Shores Subdivision	Alms Pump Service (1983)	219	Tmu (A_2)	8	+2.0 +0.8	03-03-84 06-19-84	F,C	PS	4-in casing from land surface to 199 ft; 4-in screen from 199 to 219 ft. Test-pumped at 38 gpm for 8 hrs in 1983. Measured flow 8.3 gpm on 03-03-84; estimated flow less than 1 gpm on 06-19-84. Driller's report in WRD files.
Gul-2 (DDD-013)	White Knight Seafoods	Alms Pump Service (1983)	106	Tmu (A_2)	6	14	1983	J	Ind.	4-in casing from land surface to 86 ft; 4-in casing from 86 to 106 ft. Test-pumped at 100 gpm for 3 hrs in 1983. Driller's report in WRD files.
Gul-3 (DDD-3)	Town of Gulf Shores	Layne Central Co. (1955)	98	Tmu (A_2)	16	11 12.7	1955 03-14-66	T	PS	16-in casing from land surface to 64 ft; 10-in casing from land surface to 72 ft; 10-in screen from 72 to 93 ft; no record below. Reported drawdown 15 ft after 8 hrs pumping at 150 gpm in 1955. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-4 (DDD-21)	Town of Gulf Shores	Layne Central Co. (1967)	138	Tmu (A_2)	11	11 7.5	1967 03-26-84	T	PS	20-in casing from land surface to 100 ft; 12-in casing from 2 to 102 ft; 10-in screen from 103 to 128 ft; no record below. Reported drawdown 11 ft after 8 hrs pumping at 503 gpm in 1967. Driller's report in WRD files.
Gul-5 (DDD-010)	Town of Gulf Shores	Layne Central Co. (1975)	225	Tmu (A_2)	16	11 11	1975 1983	--	PS	20-in casing from land surface to 170 ft; 12-in casing from 118 to 183 ft; 10-in screen from 185 to 215 ft; no record below. Reported drawdown 58 ft after 11 hrs pumping at 754 gpm in 1976. 451-ft test hole made for well. Driller's report and Widco well log in WRD files.
Gul-6 (ZZ-02)	Town of Gulf Shores	Layne Central Co. (1979)	215	Tmu (A_2)	36	26 19.2	1979 03-26-84	--	PS	20-in casing from land surface to 170 ft; 12-in casing from 120 to 170 ft; 10-in screen from 175 to 201 ft; no record below. Reported drawdown 132 ft after 24 hrs pumping at 750 gpm in 1979. 234-ft test hole made for well. Driller's report and Widco well log in WRD files.
Gul-7 (ZZ-025)	Town of Gulf Shores	Alsay, Inc. (1984)	195	Tmu (A_2)	39	10.0	04-11-84	T	PS	20-in casing from land surface to 145 ft; 12-in casing from 90 to 145 ft; 10-in screen from 145 to 190 ft. 528-ft test hole made for well. Driller's report and electric log in WRD files.
Gul-8 (ZZ-013)	Mrs. G. M. Smitherman	Alms Pump Service (1975)	63	Tmu (A_2)	20	8	1975	J	Pvi	2-in casing from land surface to 58 ft; 2-in screen from 58 to 63 ft. Test-pumped at 9 gpm for 1 hr in 1975. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-9 (YY-08)	Carson and King, Inc.	Alms Pump Service (1983)	80	Tmu (A_2)	8	+2	1983	S	Ind.	8-in casing from land surface to 50 ft; 8-in screen from 50 to 80 ft. Test-pumped at 300 gpm for 1 hr in 1983. Driller's report in WRD files.
Gul-10 (YY-09)	Carson and King, Inc.	Alms Pump Service (1981)	80	Tmu (A_2)	8	+2	1981	C	Ind.	4-in casing from land surface to 60 ft; 4-in screen from 60 to 80 ft. Test-pumped at 230 gpm for 6 hrs in 1981. Driller's report in WRD files.
Gul-11 (YY-010)	Carson and King, Inc.	Alms Pump Service (1979)	70	Tmu (A_2)	8	5	1979	N	U	4-in casing from land surface to 50 ft; 4-in screen from 50 to 70 ft. Test-pumped at 65 gpm for 1 hr in 1979. Driller's report in WRD files. Well destroyed.
Gul-12 (YY-011)	Aquila Seafoods	Alms Pump Service (1979)	106	Tmu (A_2)	7	6	1979	S	Ind.	4-in casing from land surface to 91 ft; 4-in screen from 91 to 106 ft. Test-pumped at 48 gpm for 2 hrs in 1979. Driller's report in WRD files.
Gul-13 (YY-013)	Aquila Seafoods	Alms Pump Service (1975)	46	Tmu (A_2)	5	5	1975	J	Ind.	2-in casing from land surface to 41 ft; 2-in screen from 41 to 46 ft. Test-pumped at 14 gpm for ½ hr in 1975. Driller's report in WRD files.
Gul-14 (YY-012)	Bon Secour Inn Cottages	Alms Pump Service (1979)	55	Tmu (A_2)	7	7	1979	J	PS	2-in casing from land surface to 50 ft; 2-in casing from 50 to 55 ft. Test-pumped at 16 gpm for 1 hr in 1979. Driller's report in WRD files.
Gul-15 (DDD-040)	Town of Gulf Shores	Dwight Steele (1967)	100	Tmu (A_2)	10	--	--	N	T	Water-quality test well. Well destroyed.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-16 (ZZ-014)	Pleasure Isle Veterinary Hospital	Alms Pump Service (1978)	81	Tmu (A_2)	33	19	1978	J	S	2-in casing from land surface to 76 ft; 2-in screen from 76 to 81 ft. Test-pumped at 13 gpm for 1 hr in 1978. Driller's report in WRD files.
Gul-17 (ZZ-09)	J. J. Martin	Alms Pump Service (1978)	44	Tmu (A_2)	49	--	--	J	Pvi	--
Gul-18 (DDD-021)	Wade Ward	Griner Drilling Service, Inc. (1984)	84	Tmu (A_2)	33	8.8	06-05-84	N	U	4-in casing from land surface to 84 ft, slotted from 74 to 84 ft. Test-pumped at 45 to 50 gpm in 1984. Abandoned gas test-well drilling supply well.
Gul-19 (EEE-07)	Woodrow Steiner	Alms Pump Service (1982)	201	Tmu (A_2)	7	flowing	1982	J	Pvi	2-in casing from land surface to 196 ft; 2-in screen from 196 to 201 ft. Test-pumped at 12 gpm for 1 hr in 1982. Driller's report in WRD files.
Gul-20 (EEE-06)	V. H. Nelson	Alms Pump Service (--)	35	Qalt (A_2)	7	--	--	N	U	--
Gul-21 (EEE-08)	Oyster Bay Baptist Church	Alms Pump Service (1981)	210	Tmu (A_2)	10	flowing	1981	J	Pvi	2-in casing from land surface to 205 ft; 2-in screen from 205 to 210 ft. Test-pumped at 16 gpm for 1 hr in 1981. Driller's report in WRD files.
Gul-22 (DDD-018)	Town of Orange Beach	Graves Well Drilling (1981)	120	Tmu (A_2)	10	6 3.3 2.3 4.1	1981 11-08-83 04-26-84 11-27-84	T	PS, O	18-in casing from land surface to 100 ft; 10-in casing from land surface to 100 ft; 10-in screen from 100 to 120 ft. Reported drawdown 25 ft after 29 hrs pumping at 503 gpm in 1981. Driller's report in WRD files. WRD semiannual water-level and water-quality monitoring well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-23 (DDD-03)	Alabama Gulf Utilities	Acme Drilling Co. (1983)	408	Tmu (A_3)	10	+1.5	04-09-84	--	PS	16-in casing from land surface to 331 ft; 10-in casing from 292 to 331 ft; 8-in screen from 331 to 407 ft. Reported drawdown 132 ft after 72 hrs pumping 830 gpm in 1983. 496-ft test hole made for well. Driller's report in WRD files.
Gul-24 (DDD-02)	Town of Orange Beach	Graves Well Drilling (1979)	496	Tmu (A_3)	10	flowing 4.55	04-09-84 06-22-84	--	T	8-in casing from land surface to 330 ft(?); 6-in screen from 330 to 380 ft. Reported drawdown 146 ft after 51 hrs pumping at 465 gpm in 1979. Driller's report in WRD files. Abandoned test well.
Gul-25 (DDD-04)	Town of Orange Beach	Carloss Well Supply Co. (1975)	144	Tmu (A_2)	26	16 3.5	1975 04-09-84	T	PS	12-in casing from land surface to 100 ft; 8-in casing from 60 to 120 ft; 8-in screen from 120 to 140 ft. Reported drawdown 36 ft after 24 hrs pumping at 350 gpm in 1975. Driller's report in WRD files.
Gul-26 (DDD-045)	Town of Orange Beach	Alms Pump Service (1976)	200	Tmu (A_2)	26	9.8 8.0 14.5	12-02-76 04-09-84 06-22-84	N	T	2-in casing from land surface to 185 ft; 2-in screen from 185 to 200 ft. Driller's report and sample log in WRD files.
Gul-27 (DDD-046)	Town of Orange Beach	Alms Pump Service (1976)	140	Tmu (A_2)	26	--	--	N	T	Driller's report in WRD files. WRD project observation well (Walter and Kidd, 1979). Well destroyed.
Gul-28 (ZZ-019)	Town of Orange Beach	Graves Well Drilling (1980)	186	Tmu (A_2)	20	--	--	N	T	Well log in WRD files. Well abandoned.
Gul-29 (ZZ-020)	Town of Orange Beach	Graves Well Drilling (1980)	220	Tmu (A_2)	39	--	--	N	T	Well log in WRD files. Well abandoned.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-30 (ZZ-021)	Town of Orange Beach	Alms Pump Service (1977)	140	Tmu (A_2)	20	2.9	04-09-84	N	T	Well abandoned.
Gul-31 (ZZ-028)	Town of Orange Beach	Alms Pump Service (1976)	255	Tmu (A_2)	20	--	--	N	T	Sample log in WRD files. Well destroyed.
Gul-32 (ZZ-022)	Town of Orange Beach	Carloss Well Supply Co. (1975)	163	Tmu (A_2)	16	5	1975	N	T	6-in casing from land surface to 142 ft; 6-in screen from 142 to 162 ft. Reported specific capacity 1.5 gpm/ft drawdown. 199-ft test hole made for well. Driller's report in WRD files. Well destroyed.
Gul-33 (DDD-20)	Town of Orange Beach	Layne Central Co. (1970)	120	Tmu (A_2)	10	3	1970	N	T	8-in casing from land surface to 100 ft; 8-in screen from 100 to 120 ft. Reported drawdown 22 ft after 16 hrs pumping at 212 gpm in 1970. Driller's report in WRD files. Well destroyed.
Gul-34 (DDD-031)	Gulf State Park	Geotechnical Engineering-Testing, Inc. (1977)	165	Tmu (A_2)	2.06	2.5	04-11-84	N	T	2-in casing from land surface to 165 ft, slotted from 145 to 165 ft. Sample, gamma-ray, and neutron logs in WRD files. WRD project test well no. T-1. Well abandoned.
Gul-35 (DDD-032)	Gulf State Park	Geotechnical Engineering-Testing, Inc. (1977)	90	Tmu (A_2)	1.78	1.4 2.2	04-11-84 06-08-84	N	T	2-in casing from land surface to 90 ft, slotted from 70 to 90 ft. WRD project test well no. T-1A.
Gul-36 (DDD-06)	Gulf State Park	Graves Well Drilling (1977)	415	Tmu (A_3)	8.32	0.6 1.6	04-11-84 06-08-84	N	T	Sample, electric, and gamma-ray logs in WRD files. Pumped well for study of salt-water encroachment (Walter and Kidd, 1979). WRD project test well no. P-1.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-37 (DDD-022)	Gulf State Park	Graves Well Drilling (1977)	140	Tmu (A_2)	6.50	3.8 4.3	04-11-84 06-08-84	N	T	2-in casing from land surface to 140 ft; slotted from 120 to 140 ft. WRD project test well no. T-4.
Gul-38 (DDD-09)	Gulf State Park	Geotechnical Engineering-Testing, Inc. (1977)	648	Tmu (A_3)	7.39	0.8 2.8 2.2	04-11-84 06-08-84 06-22-84	N	T	2-in casing from land surface to 648 ft; slotted from 628 to 648 ft. Sample, electric, and gamma-ray logs in WRD files. WRD project well no. T-8.
Gul-39 (DDD-11)	Gulf State Park	--	33	Qalt (A_1)	10	6.9 8.4	04-11-84 06-05-84	N	U	2-in casing from land surface to 29 ft; 2-in screen from 29 to 33 ft.
Gul-40 (DDD-015)	Alabama Gulf Utilities	Acme Drilling Co. (1983)	315	Tmu (A_3)	8	1.7 3.1	04-12-84 06-05-84	N	T	4-in casing from land surface to 280 ft; 4-in screen from 280 to 315 ft.
Gul-41 (DDD-016)	Alabama Gulf Utilities	Acme Drilling Co. (1983)	130	Tmu (A_2)	8	6 6.0 7.3	1983 04-12-84 06-05-84	N	T	4-in casing from land surface to 100 ft; 4-in screen from 100 to 130 ft. Test-pumped at 60 gpm in 1983; reported specific capacity 5 gpm/ft drawdown. Driller's report in WRD files.
Gul-42 (ZZ-024)	R. C. Craft Co.	Alms Pump Service (1975)	40	Tmu (A_2)	30	12	1975	J	S	2-in casing from land surface to 35 ft; 2-in screen from 35 to 40 ft. Test-pumped at 12 gpm for 1 hr in 1975. Driller's report in WRD files. Office-shop well.
Gul-43 (ZZ-03)	R. C. Craft Co.	Holland Well Co. (1975)	428	Tmu (A_3)	30	17	1975	T	Irr.	12-in casing from land surface to 195 ft; 6-in casing from 190 to 324 ft; 6-in screens from 324 to 366 ft, and 386 to 428 ft. Reported drawdown 26 ft after 8 hrs pumping at 1,200 gpm in 1975. Driller's report in WRD files. Grass irrigation well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-44 (ZZ-05)	R. C. Craft Co.	--	500	Tmu (A_3)	16	--	--	T	Irr.	Estimated flow 25 gpm on 04-10-84. Flows high iron-content water.
Gul-45 (DDD-01)	Alabama Gulf Utilities	Acme Drilling Co. (1983)	220	Tmu (A_2)	10	5	1983	T	PS	Screen from 180 to 215 ft. Reported drawdown 145 ft after 166½ hrs pumping at 205 gpm in 1983. Stand-by well.
Gul-46 (DDD-017)	Alabama Gulf Utilities	Acme Drilling Co. (1983)	150	Tmu (A_2)	10	6	1983	T	PS	6-in casing from land surface to 100 ft; 6-in screen from 100 to 150 ft. Reported drawdown 39 ft after 168 hrs pumping 680 gpm in 1983. 800-ft test hole made for well. Driller's report and electric log in WRD files. Stand-by well.
Gul-47 (DDD-047)	Harold King	Alms Pump Service (1980)	233	Tmu (A_2)	7	2	1982	J	Pvi	2-in casing from land surface to 228 ft; 2-in screen from 228 to 233 ft. Test-pumped at 10 gpm for 1 hr in 1980. Driller's report in WRD files.
Gul-48 (DDD-036)	Gulf State Park	Geotechnical Engineering-Testing, Inc. (1977)	110	Tmu (A_2)	5.63	3.3 7.2	04-13-84 06-08-84	N	T	2-in casing from land surface to 110 ft; slotted from 90 to 110 ft. Sample, electric, gamma-ray, and neutron porosity logs in WRD files. WRD project test well no. T-3.
Gul-49 (DDD-23)	Gulf State Park	Carloss Well Supply Co. (1971)	142	Tmu (A_2)	21	18 20.7 19.7	1971 04-13-84 06-22-84	T	Irr.	20-in casing from land surface to 100 ft; 12-in casing from land surface to 110 ft; 10-in screen from 110 to 128 ft; no record below. 159-ft test hole made for well. Driller's report in WRD files. Golf course irrigation well. No. 1 (south well).

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-50 (DDD-22)	Gulf State Park	Carloss Well Supply Co. (1971)	153	Tmu (A_2)	23	21 22.5 23.5	1971 04-13-84 06-22-84	T	Irr.	20-in casing from land surface to 102 ft; 12-in casing from land surface to 120 ft; 10-in screen from 120 to 148 ft; no record below. 157-ft test hole made for well. Driller's report in WRD files. Golf course irrigation well. Well no. 2 (north well).
Gul-51 (DDD-035)	Gulf State Park	Geotechnical Engineering-Testing, Inc. (1977)	508	Tmu (A_3)	2.7	flowing	1977	N	T	Sample log and electric log in WRD files. Well destroyed by accident in 1979. WRD project test well no. T-5A.
Gul-52 (DDD-034)	Gulf State Park	--	32	Qalt (A_1)	24.99	10.9 10.7 13.4	10-27-76 04-11-84 06-08-84	N	U	--
Gul-53 (ZZ-023)	Town of Gulf Shores	Alsay, Inc. (1984)	345	Tmu (A_3)	39	13.8 29.2 16	05-08-84 06-20-84 08-07-84	T	PS	20-in casing from land surface to 265 ft; 10-in casing from 210 to 270 ft; 10-in screen from 270 to 320 ft. Reported drawdown 106 ft after 72 hrs pumping at 1,499 gpm in 1984. 591-ft test hole made for well. Driller's report in WRD files. Well no. 5.
Gul-54 (ZZ-027)	Alabama Gulf Utilities	Acme Drilling Co. (1983)	350	Tmu (A_3)	36	12 5.6 19.4	1983 05-09-84 06-18-84	N	T	4-in casing from land surface to 310 ft; 4-in screen from 310 to 350 ft. Test-pumped at 50 gpm in 1983; reported specific capacity 7 gpm/ft drawdown. 600-ft test hole made for well. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-55 (ZZ-06)	Heartland Properties, Inc.	Holland Well Co. (1974)	317	Tmu (A_3)	56	27	1974	T	Irr.	12-in casing from land surface to 235 ft; 8-in casing from 205 to 267 ft; 8-in screen from 267 to 317 ft. Reported drawdown 63 ft after 8 hrs pumping at 1,200 gpm in 1974. 440-ft test hole made for well. Driller's report in WRD files.
Gul-56 (ZZ-01)	Heartland Properties, Inc.	Holland Well Co. (1977)	307	Tmu (A_3)	51	25	1977	T	Irr.	12-in casing from land surface to 160 ft; 6-in casing from 155 to 220 ft; 6-in screens from 220 to 260 ft, and 267 to 307 ft. Reported drawdown 90 ft after 6 hrs pumping at 1,000 gpm in 1977. Driller's report in WRD files.
Gul-57 (YY-01)	George Kaiser	Holland Well Co. (1978)	520	Tmu (A_3)	62	50	1978	T	Irr.	12-in casing from land surface to 272 ft; 6-in casing from 272 to 420 ft; 6-in screen from 420 to 500 ft. Reported drawdown 62 ft after 10 hrs pumping at 1,000 gpm in 1978. Driller's report in WRD files.
Gul-58 (DDD-039)	Southport Seafoods	Alms Pump Service (1980)	140	Tmu (A_2)	13	12	1980	J	Ind.	2-in casing from land surface to 135 ft; 2-in screen from 135 to 140 ft. Test-pumped at 22 gpm for 1 hr in 1980. Driller's report in WRD files.
Gul-59 (DDD-012)	Alabama Department of Conservation	Graves Well Drilling (1973)	191	Tmu (A_2)	13	5 13.5	1973 07-29-78	S	S	6-in casing from land surface to 114 ft; 4-in screen from 114 to 144 ft; no record below. Test-pumped at 250 gpm in 1973; reported specific capacity 12.5 gpm/ft drawdown. Driller's report in WRD files. Well used for priming salt-water line at marine research center.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-60 (DDD-026)	Alabama Department of Conservation	Alms Pump Service (1978)	201	Tmu (A_2)	14	6	1978	J	S	2-in casing from land surface to 196 ft; 2-in screen from 196 to 201 ft. Test-pumped at 9 gpm for 24 hrs in 1978. Driller's report in WRD files. Marine research center utility well.
Gul-61 (DDD-042)	Alabama Department of Conservation	Alms Pump Service (1980)	102	Tmu (A_2)	16	11	1980	J	S	2-in casing from land surface to 97 ft; 2-in screen from 97 to 102 ft. Test-pumped at 9 gpm for 1 hr in 1980. Office supply well.
Gul-62 (DDD-043)	Environmental Development Systems	John H. Davis (1983)	62	Tmu (A_2)	16	--	--	J	S	2-in casing from land surface to 57 ft; 2-in screen from 57 to 62 ft. Office supply well.
Gul-63 (DDD-044)	Environmental Development Systems	White Well Co. (1984)	80	Tmu (A_2)	16	10	1984	S	Ind.	4-in casing from land surface to 70 ft; 4-in screen from 70 to 80 ft. Process water supply well.
Gul-64 (YY-10)	Riverside Motel	J. Zaller (1962)	184	Tmu (A_2)	7	+1.8	06-27-66	J	PS	2-in casing from land surface to 176 ft; 2-in screen from 176 to 184 ft. Estimated flow 2 gpm on 06-27-66.
Gul-65 (EEE-2)	King Fish Lodge	Deep Well Drilling Co. (1945)	173	Tmu (A_2)	5	+7.6 +6.3	03-25-46 06-27-66	N	U	6-in screen from land surface to 70 ft; 3-in casing from land surface to 165 ft; 3-in screen from 165 to 193 ft. Estimated flow 10 gpm on 06-22-66. Well log in WRD files. Well abandoned.
Gul-66 (ZZ-4)	W. R. Allen	Self (1962)	60	Tmu (A_2)	7	12	1962	J	Pvi	1¼-in casing from land surface to 57 ft; 1¼-in screen from 57 to 60 ft.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-67 (ZZ-08)	Wilson Morse unit 18-9 no. 2	New and Hughes Drilling Co., Inc. (1982)	1,978	Tmu (-)	19	--	--	--	U	8-5/8-in casing from land surface to 818 ft; 5½-in casing from land surface to 1,957 ft; no record below. Perforated from 1,689 to 1,693 ft. Electric log in Oil and Gas Board files. Gas production well. Permit Number 3483.
Gul-68 (DDD-038)	Meyer Foundation unit 8-2 no. 1	Quitman Well Service (1980)	2,206	Tmu (-)	20	--	--	--	U	8-5/8-in casing from land surface to 1,000 ft; 5½-in casing from land surface to 1,537 ft; perforated from 1,326 to 1,336 ft; no record below. Electric log in Oil and Gas Board files. Gas production well. Permit Number 3068.
Gul-69 (EEE-09)	Ronnie McDaniel	Dwight Steele (1973)	19	Qalt (A_1)	3	--	--	J	Pvi	1¼-in casing from land surface to 16½ ft; 1¼-in screen from 16½ to 19 ft.
Gul-70 (DDD-027)	Joe Moss	Alms Pump Service (1979)	22	Qalt (A_1)	7	4	1979	J	S	2-in casing from land surface to 17 ft; 2-in screen from 17 to 22 ft. Test-pumped at 9 gpm for 1 hr in 1979. Driller's report in WRD files. Heat-pump well.
Gul-71 (DDD-025)	Shrimpboat Restaurant	Alms Pump Service (1980)	25	Qalt (A_1)	8	7	1980	J	S	2-in casing from land surface to 20 ft; 2-in screen from 20 to 25 ft. Test-pumped at 16 gpm for 1 hr in 1980. Driller's report in WRD files. Heat-pump well.
Gul-72 (DDD-16)	Paradise Isle Resort	Deep Well Drilling Co. (1946)	369	Tmu (A_3)	3	+2.5	12-31-46	N	U	8-in casing from land surface to 274 ft; 6-in casing from land surface to 349 ft; 6-in screen from 349 to 369 ft. Measured flow 30 gpm on 12-31-46. Driller's report and gamma-ray log in WRD files. Well destroyed.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-73 (DDD-011)	R. C. Craft Co.	Alms Pump Service (1980)	150	Tmu (A_2)	11	--	--	T	Irr.	--
Gul-74 (EEE-010	Sea Oats Condominium	Alms Pump Service (1984)	132	Tmu (A_2)	7	5	1984	C	S	2-in casing from land surface to 127 ft; 2-in screen from 127 to 132 ft. Driller's report in WRD files. Utility well.
Gul-75 (EEE-02)	Fort Morgan Authority Sewer Service, Inc.	Shumock Well Co. (1984)	36	Qalt (A_1)	15	8	1984	N	T,O	6-in casing from land surface to 16 ft; 6-in screen from 16 to 36 ft. Reported drawdown 12 ft after 48 hrs pumping at 135 gpm in 1984. Driller's report and engineer's report in WRD files. Special project test well. Water-quality monitoring well.
Gul-76 (DDD-023)	Town of Gulf Shores	W. R. Mitchell Co. (1984)	10	Qalt (A_1)	7	3-4	1984	C	S	Dewatering well system for construction.
Gul-77 (ZZ-018)	Mrs. Jessie Clark	Alms Pump Service (1973)	82	Tmu (A_2)	33	20	1973	J	Pvi	4-in casing from land surface to 77 ft; 4-in screen from 77 to 82 ft. Test-pumped at 15 gpm for 1 hr in 1973. Driller's report in WRD files.
Gul-78 (DDD-12)	Gulf Shores Golf Club, Inc.	Alms Pump Service (1965)	61	Qalt (A_1)	7	12	1965	C	Irr.	4-in casing from land surface to 51 ft; 4-in screen from 51 to 61 ft. Golf course irrigation well.
Gul-79 (DDD-13)	Gulf Shores Golf Club, Inc.	Alms Pump Service (1965)	90	Tmu (A_2)	7	30	1965	C	Irr.	4-in casing from land surface to 80 ft; 4-in screen from 80 to 90 ft. Golf course irrigation well.
Gul-80 (DDD-029)	Frank Mulack	Alms Pump Service (1980)	79	Qalt (A_1)	16	12	1980	J	S	2-in casing from land surface to 69 ft; 2-in casing from 69 to 79 ft. Test-pumped at 28 gpm for 1 hr in 1980. Driller's report in WRD files. Utility well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-81 (EEE-011)	Mrs. Susie Burgess	Dwight Steele (1967)	100	Tmu (A_2)	16	--	--	J	Pvi	--
Gul-82 (EEE-012)	Mrs. Lillian Callaway	Alms Pump Service (1975)	24	Qalt (A_1)	16	--	--	J	Pvi	2-in casing from land surface to 19 ft; 2-in screen from 19 to 24 ft. Driller's report in WRD files.
Gul-83 (DDD-024)	Youngs-By-The-Sea	Pensacola Testing Laboratories, Inc. (1977)	61	Qalt (A_1)	8	6	1977	N	T	Driller's report in WRD files. Test hole for foundation evaluation (no. 2).
Gul-84 (DDD-041)	R. P. White	D. L. Fuqua (1982)	30	Qalt (A_1)	10	--	--	J	Pvi	1¼-in casing from land surface to 27 ft; 1¼-in screen from 27 to 30 ft.
Gul-85 (DDD-020)	Gulf State Park	Geotechnical Engineering-Testing, Inc. (1977)	423	Tmu (A_3)	7.69	--	--	N	T	2-in casing from land surface to 423 ft; slotted from 413 to 423 ft. Driller's report and electric, gamma-ray and neutron-porosity logs in WRD files. WRD project test well no. T-7.
Gul-86 (ZZ-012)	Dixieland	Alms Pump Service (1984)	60	Tmu (A_2)	41	24	1984	J	Pvi	2-in casing from land surface to 55 ft; 2-in screen from 55 to 60 ft. Test-pumped at 14 gpm for 1 hr in 1984. Driller's report in WRD files.
Gul-87 (ZZ-017)	Johnston Furniture	Alms Pump Service (1984)	97	Tmu (A_2)	36	24	1984	J	Pvi	2-in casing from land surface to 92 ft; 2-in screen from 92 to 97 ft. Test-pumped at 20 gpm for 1 hr in 1984. Driller's report in WRD files.
Gul-88 (DDD-15)	Beachside Resort Motel	J. Zaller (1951)	108	Tmu (A_2)	10	--	--	N	U	1½-in casing from land surface to 104 ft; 1½-in screen from 104 to 108 ft. Well destroyed.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-89 (DDD-030)	Johnny Sims	Alms Pump Service (1980)	23	Qalt (A_1)	13	8	1980	C	S	2-in casing from land surface to 18 ft; 2-in screen from 18 to 23 ft. Test-pumped at 35 gpm for 1 hr in 1980. Driller's report in WRD files. Lawn irrigation well.
Gul-90 (DDD-028)	B. G. Burke	Self (1984)	18	Qalt (A_1)	7	--	--	J	S	1½-in casing from land surface to 15 ft; 1½-in screen from 15 to 17½ ft. Test-pumped at 15 gpm for 1 hr in 1984. Lawn irrigation well.
Gul-91 (ZZ-033)	Kastrups Beverly Motel	Alms Pump Service (1980)	61	Tmu (A_2)	49	14	1980	J	PS	2-in casing from land surface to 56 ft; 2-in screen from 56 to 61 ft. Test-pumped at 16 gpm for 1 hr in 1980. Driller's report in WRD files.
Gul-92 (DDD-037)	Jeannies Clean-up Service	Alms Pump Service (1980)	86	Tmu (A_2)	16	8	1980	C	U	2-in casing from land surface to 76 ft; 2-in screen from 76 to 86 ft. Test-pumped at 55 gpm for 2 hrs in 1980. Driller's report in WRD files.
Gul-93 (EEE-03)	Sea Oats Condominium	Shumock Well Co. (1984)	120	Tmu (A_2)	7	4	1984	S	S	4-in casing from land surface to 110 ft; 4-in screen from 110 to 120 ft. Reported drawdown 24 ft after 3 hrs pumping at 87 gpm in 1984. Driller's report in WRD files. Grass irrigation well.
Gul-94 (EEE-04)	Sea Oats Condominium; Sawgrass Project	Shumock Well Co. (1984)	120	Tmu (A_2)	7	2	1984	S	S	4-in casing from land surface to 115 ft; 4-in screen from 115 to 120 ft. Reported drawdown 32 ft after 3 hrs pumping at 125 gpm in 1984. Driller's report in WRD files. Grass irrigation well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Gul-95 (ZZ-016)	Fort Morgan Authority Water Service, Inc.	Alsay, Inc. (1984)	360	Tmu (A_3)	15	--	--	T	T	16-in casing from land surface to 18 ft; 8-in from land surface to 150 ft; 8-in screens from 300 to 320 ft, and 340 to 360 ft. 497-ft test hole made for well. Well log, electric and gamma-ray logs in WRD files. Test well for public-water supply.
Gul-96 (DDD-019)	Winn-Dixie Shopping Center	Alms Pump Service (1984)	107	Tmu (A_2)	10	12	1984	S	S	4-in casing from land surface to 84 ft; 4-in screen from 84 to 104 ft. Test-pumped at 85 gpm for 1 hr in 1984. Driller's report in WRD files. Grass irrigation well.
Gul-97 (ZZ-031)	Oyster Bay Water, Sewage, and Fire Protection Authority	Shumock Well Co. (1984)	345	Tmu (A_3)	26	11	1984	C	T	2-in casing from land surface to 340 ft; 2-in screen from 340 to 345 ft. Test-pumped at 8 gpm for 1 hr in 1984. 357-ft test hole made for well. Driller's report in WRD files. Stratigraphic and water-quality test well. No. 1.
Gul-98 (ZZ-026)	R. C. Craft Co.	Griner Drilling Service, Inc. (1984)	95	Tmu (A_2)	39	22	1984	S	Irr.	6-in casing from land surface to 60 ft; 6-in screen from 60 to 95 ft. Reported drawdown 38 ft after 5 hrs pumping at 230 gpm in 1984. 140-ft test hole made for well. Driller's report in WRD files.
Lil-1 (SS-02)	John Keifer	Alms Pump Service (1972)	96	Tmu (A_2)	83	34	1972	T	Irr.	6-in casing from land surface to 66 ft; 6-in screen from 66 to 96 ft. Test-pumped at 600 gpm for 1 hr in 1972.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Lil-2 (BBB-04)	Perdido Bay Water, Sewer and Fire Protection District	Layne Central Co. (1977)	300	Tmu (A_2)	67	50 42.0	1977 03-28-84	T	PS	18-in casing from land surface to 255 ft; 10-in casing from 205 to 260 ft; 10-in screen from 260 to 300 ft. Reported drawdown 71 ft after 3 hrs pumping at 754 gpm in 1977. 330-ft test hole made for well. Driller's report in WRD files.
Lil-3 (SS-03)	Spanish Cove Corp.	Layne Central Co. (1974)	280	Tmu (A_2)	66	31 27.5	1974 03-28-84	T	PS	18-in casing from land surface to 235 ft; 10-in casing from 180 to 240 ft; 10-in screen from 240 to 270 ft; no record below. Reported drawdown 37 ft after 4 hrs pumping at 457 gpm in 1974. 318-ft test hole made for well. Driller's report in WRD files.
Lil-4 (SS-2)	S. W. Carter	Wilson Pump Co. (1953)	59	Tmu (A_2)	95	26	1953	N	U	2-in casing from land surface to 55 ft; 2-in screen from 55 to 59 ft.
Lil-5 (SS-10)	J. F. Graff	Alms Pump Service (1966)	110	Tmu (A_2)	7	--	--	J	S	2-in casing from land surface to 106 ft; 2-in screen from 106 to 110 ft. Utility well.
Mag-1 (00-02)	Town of Fairhope	Layne Central Co. (1981)	196	Tmu (A_2)	105	81	1981	J	PS	20-in casing from land surface to 126 ft; 14-in casing from land surface to 131 ft; 12-in screen from 131 to 186 ft; no record below. Reported drawdown 21 ft after 24 hrs pumping at 750 gpm in 1981. 511-ft test hole made for well. Driller's report in WRD files.
Mag-2 (00-03)	David Miller	Alms Pump Service (1975)	107	Tmu (A_2)	82	35	1975	J	Pvi	2-in casing from land surface to 102 ft; 2-in screen from 102 to 107 ft. Test-pumped at 11 gpm for 1 hr in 1975. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Mag-3 (00-01)	Harold Sellers	John H. Davis (1977)	56	Tmu (A_2)	46	32	1977	J	Pvi	2-in casing from land surface to 51 ft; 2-in screen from 51 to 56 ft. Test-pumped at 9 gpm for 4 hrs in 1977. Driller's report in WRD files.
Mag-4 (WW-06)	Barnhill Volunteer Fire Dept.	Alms Pump Service (1977)	82	Tmu (A_2)	72	28	1977	N	U	2-in casing from land surface to 77 ft; 2-in screen from 77 to 82 ft. Test-pumped at 11 gpm for 1 hr in 1977. Driller's report in WRD files. Well destroyed.
Mag-5 (WW-4)	Scenic View Ranch	Holland Well Co. (--)	145	Tmu (A_2)	59	35	1957	T	S	Farm shop well.
Mag-6 (WW-5)	Scenic View Ranch	Holland Well Co. (--)	300	Tmu (A_3)	16	+10 +3.5	1957 06-23-66	N	U	2-in casing from land surface to 280 ft; 2-in screen from 280 to 300 ft. Estimated flow 10 gpm in 1957, and 3 gpm in 1966. Well inundated by farm pond.
Mag-7 (WW-08)	Wilsey Nursery	Alms Pump Service (1983)	55	Tmu (A_2)	30	--	--	J	Irr.	2-in casing from land surface to 50 ft; 2-in screen from 50 to 55 ft. Driller's report in WRD files.
Mag-8 (VV-09)	Ralph Draifus	Windham and Sons (1984)	87	Tmu (A_2)	10	13	1984	S	S	4-in casing from land surface to 77 ft; 4-in screen from 77 to 89 ft. Reported drawdown 8 ft after 2 hrs pumping at 130 gpm in 1984. Driller's report in WRD files. Utility well.
Mag-9 (WW-07)	Wards Poultry Farm	Alms Pump Service (1976)	66	Tmu (A_2)	75	34	1976	S	Ind.	4-in casing from land surface to 56 ft; 4-in screen from 56 to 66 ft. Test-pumped at 30 gpm for 2 hrs in 1976. Driller's report in WRD files. Stand-by well.
Mag-10 (WW-2)	Wards Poultry Farm	Ponder Co., Inc. (--)	70	Tmu (A_2)	89	--	--	N	U	2-in casing from land surface to 66 ft; 2-in screen from 66 to 70 ft. Well destroyed.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Mag-11 (WW-01)	Clarence Johnson	Alms Pump Service (1975)	125	Tmu (A_2)	85	59.6	03-14-84	N	U	2-in casing from land surface to 120 ft; 2-in screen from 120 to 125 ft. Test-pumped at 12 gpm for 1 hr in 1975. Driller's report in WRD files.
Mag-12 (XX-6)	Mrs. L. C. Boutwell	Alms Pump Service (1963)	117	Tmu (A_2)	7	5	1963	J	S	2-in casing from land surface to 112 ft; 2-in screen from 112 to 117 ft. Water at 13 ft and 30 ft reported to be brackish. Utility well.
Mag-13 (XX-4)	H. B. Bentley	Ponder Co., Inc. (1956)	155	Tmu (A_2)	5	--	--	J	S	2-in casing from land surface to 137 ft; 2-in screen from 137 to 155 ft. Utility well.
Mag-14 (XX-01)	John Steadman	Alms Pump Service (1977)	125	Tmu (A_2)	3	0	1977	J	S	2-in casing from land surface to 120 ft; 2-in screen from 120 to 125 ft. Test-pumped at 16 gpm for 1 hr in 1977. Driller's report in WRD files. Utility well.
Mag-15 (OO-04)	Frank Townser	John H. Davis (1980)	107	Tmu (A_2)	112	60	1980	J	Pvi	2-in casing from land surface to 102 ft; 2-in screen from 102 to 107 ft. Test-pumped at 11 gpm for 4 hrs in 1980. Driller's report in WRD files.
Mag-16 (VV-015)	Baldwin County Commission	Alms Pump Service (1981)	125	Tmu (A_2)	69	79	1981	N	O	4-in casing from land surface to 120 ft; 4-in screen from 120 to 125 ft. Driller's report in WRD files. Water-quality monitoring well for Magnolia Landfill. No. 4.
Mag-17 (VV-07)	Robert Norris	Alms Pump Service (1977)	192	Tmu (A_2)	75	45	1977	T	Irr.	8-in casing from land surface to 132 ft; 6-in screen from 132 to 192 ft. Test-pumped at 810 gpm for 9 hrs in 1977. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Mag-18 (VV-016)	John Hudson	Alms Pump Service (1983)	79	Tmu (A_2)	59	31	1983	J	Pvi	2-in casing from land surface to 74 ft; 2-in screen from 74 to 79 ft. Test-pumped at 7.5 gpm for 1 hr in 1983. Driller's report in WRD files.
Mag-19 (VV-6)	Gulf Telephone Co.	J. Zaller (1963)	110	Tmu (A_2)	16	--	--	N	U	3-in casing from land surface to 104 ft; 3-in screen from 104 to 110 ft. Well destroyed.
Mag-20 (YY-017)	St. Johns Catholic Church	Alms Pump Service (1979)	50	Tmu (A_2)	39	25	1979	J	Pvi	2-in casing from land surface to 45 ft; 2-in screen from 45 to 50 ft. Test-pumped at 13 gpm for 1 hr in 1979. Driller's report in WRD files.
Mag-21 (VV-014)	Moore Brothers Store	Alms Pump Service (1980)	35	Tmu (A_2)	16	11	1980	J	S	2-in casing from land surface to 30 ft; 2-in screen from 30 to 35 ft. Test-pumped at 9 gpm for 1 hr in 1980. Driller's report in WRD files. Utility well.
Ora-1 (CCC-04)	Ted Ray	--	20	Qalt (A_1)	7	--	--	J	S	Utility well.
Ora-2 (CCC-9)	W. G. Gilcrist	Miller Braden Drilling Co. (1963)	750±	Tmu (A_3)	3	+16 +6.0 +9.0	1963 07-11-66 1977	N	U	2-in casing with 14 ft lower screen. 1,030-ft test hole made for well. Well log in WRD files. Salt water reported at 130, 205, 280 and 768 to 776 ft. Well abandoned.
Ora-3 (CCC-13)	Town of Orange Beach	Layne Central Co. (1970)	770	Tmu (A_3)	16	10	1970	--	T	812-ft test hole made for test well. Driller's report in WRD files. Test well no. 1. Salt water reported at 100 to 140 ft, and 726 to 770 ft. Well destroyed.
Ora-4 (CCC-6)	R. F. Hall	Miller (1956)	22	Qalt (A_1)	5	--	--	J	S	1½-in casing from land surface to 195 ft; 1½-in screen from 19.5 to 22 ft. Boat house well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Ora-5 (CCC-4)	R. F. Hall	Rogers (1957)	20	Qalt (A_1)	16	--	--	J	S	1½-in casing from land surface to 16 ft; 1½-in screen from 16 to 20 ft. Utility well.
Ora-6 (CCC-10)	State of Alabama	Alms Pump Service (1964)	13	Qalt (A_1)	10	--	--	N	U	2-in casing from land surface to 8 ft; 2-in screen from 8 to 13 ft. Reportedly yielded salt water in 1966. Well destroyed.
Ora-7 (CCC-7)	The Outrigger	Alms Pump Service (1964)	39	Qalt (A_1)	13	13.2 (est.)	07-11-66	N	U	1½-in casing from land surface to 35 ft; 1½-in screen from 35 to 39 ft. Well abandoned.
Ora-8 (CCC-11)	F. R. Gossman	Redmon Pump Co. (1965)	24	Qalt (A_1)	10	--	--	--	U	1½-in casing from land surface to 20 ft; 1½-in screen from 20 to 24 ft.
Ora-9 (CCC-05)	Stars-By-The-Sea	--	20	Qalt (A_1)	--	--	--	J	PS	Trailer park well. Well reportedly affected by foundation jetting activities.
Ora-10 (CCC-2)	Gulf State Park	Alms Pump Service (1963)	30	Qalt (A_1)	10	--	--	N	U	2-in casing from land surface to 27 ft; 2-in screen from 27 to 30 ft.
Ora-11 (CCC-01)	Broadmoor Group	Acme Drilling Co. (1983)	320	Tmu (A_3)	10	4	1983	N	T	4-in casing from land surface to 280 ft; 4-in screen from 280 to 320 ft. 800-ft test hole made for well. Driller's report in WRD files. Test well. Reportedly yielded salt water.
Ora-12 (CCC-06)	Gulf State Park	L. R. Johnston Co. (1978)	500	--	3.5	--	--	N	T	Sample log, gamma-ray and electric logs in WRD files. WRD project test hole no T-2.
Ora-13 (BBB-16)	Fred Hagendorfer	Bradley Pump Co. (1961)	185	Tmu (A_2)	3	+9.1 +9.3	06-17-66 05-07-84	J,F	Pvi	Estimated flow 6 gpm on 06-17-66. Water had sulfurous odor.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Ora-14 (BBB-03)	Dr. D. L. McCall	Alms Pump Service (1974)	45	Tmu (A_2)	7	6	1974	J	S	2-in casing from land surface to 40 ft; 2-in screen from 40 to 45 ft. Test-pumped at 16 gpm for 1 hr in 1974. Driller's report in WRD files. Utility well.
Ora-15 (BBB-13)	H. T. Baskin	Self (1956)	25	Tmu (A_2)	10	--	--	N	U	1¼-in casing from land surface to 21 ft; 1¼-in screen from 21 to 25 ft.
Ora-16 (AAA-06)	Josephine Baptist Church	John H. Davis (1977)	77	Tmu (A_2)	30	25.5	05-08-84	N	U	2-in casing from land surface to 72 ft; 2-in screen from 72 to 77 ft. Driller's report in WRD files.
Ora-17 (AAA-05)	Robert Donaldson	Alms Pump Service (1980)	48	Tmu (A_2)	13	--	--	J	Pvi	2-in casing from land surface to 43 ft; 2-in screen from 43 to 48 ft.
Ora-18 (AAA-11)	George Ward	J. Zaller (1961)	62	Tmu (A_2)	12	12	1961	J	Pvi	2-in casing from land surface to 57 ft; 2-in screen from 57 to 62 ft.
Ora-19 (AAA-12)	E. L. Johnson	-- (1962)	45	Tmu (A_2)	5	5	1962	N	U	Reportedly yielded salty water. Well abandoned.
Ora-20 (AAA-8)	Mrs. S. A. Graham	S. A. Graham (1963)	22	Tmu (A_2)	7	4	1963	J	Pvi	2-in casing from land surface to 18 ft; 2-in screen from 18 to 22 ft.
Ora-21 (AAA-02)	Harbor Gate Seafood, Inc.	Alms Pump Service (1981)	94	Tmu (A_2)	39	28	1981	S	Ind.	4-in casing from land surface to 74 ft; 4-in screen from 74 to 94 ft. Test-pumped at 58 gpm for 1 hr in 1981. Driller's report in WRD files.
Ora-22 (AAA-2)	Jeff Green	Deep Well Drilling Co. (1946)	152	Tmu (A_2)	5	+19.0 +10.8 +12.1	08-23-47 06-23-66 05-08-84	F	S	4-in casing from land surface to 142 ft; 4-in screen from 142 to 152 ft. Reported flow 50 gpm in 1949; measured flow 2.6 gpm on 06-23-66. Driller's report in WRD files. Home garden well. Water has sulfurous odor.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Ora-23 (AAA-04)	Wolf Bay Lodge	Alms Pump Service (1983)	65	Tmu (A_2)	7	12	1983	S	PS	4-in casing from land surface to 65 ft; 4-in screen from 55 to 65 ft. Test-pumped at 32 gpm for 1 hr in 1983. Driller's report in WRD files.
Ora-24 (CCC-12)	Gulf State Park	State of Alabama (1955)	16	Qalt (A_1)	13.27	10 9.4	1966 10-27-76	N	U	1¼-in casing from land surface to 13 ft; 1¼-in screen from 13 to 16 ft. Reportedly yielded salty water in 1966. Well destroyed in 1984.
Ora-25 (CCC-1)	Gulf Telephone Co.	J. Zaller (--)	40	Qalt (A_1)	16	--	--	C	S	3-in casing from land surface to 34 ft; 3-in screen from 34 to 36 ft. Lawn irrigation well. Water had sulfurous odor.
Ora-26 (AAA-07)	Roy Hughes	Alms Pump Service (1976)	65±	Qalt (A_1)	20	17	1976	J	Pvi	--
Ora-27 (AAA-08)	Roy Hughes	Deep Well Drilling Company (1948)	742	Tmu (A_3)	16	+5.5	12-06-48	N	U	2½-in casing from land surface to 147 ft; 2-in casing from 147 to 734 ft; 2-in screen from 734 to 742 ft. Reported flow 5 gpm in 1948. Driller's report in WRD files. Well yielded salt water. Well destroyed.
Ora-28 (AAA-09)	Frank Aulick	Alms Pump Service (1981)	55	Qalt (A_1)	10	14	1981	C	S	2-in casing from land surface to 45 ft; 2-in screen from 45 to 55 ft. Test-pumped at 28 gpm for 2 hrs in 1981. Driller's report in WRD files. Private park well.
Ora-29 (AAA-14)	Sunset Circle Resort Cottages	Alms Pump Service (1966)	41	Qalt (A_1)	23	23	1966	J	PS	2-in casing from land surface to 37 ft; 2-in screen from 37 to 41 ft.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Ora-30 (AAA-6)	Selma Thompson	A. Holz (1965)	93	Tmu (A_2)	3	+5.4	07-13-66	J	S	1½-in casing from land surface to 89 ft; 1½-in screen from 89 to 93 ft. Measured flow 2 gpm on 07-13-66. No flow on 06-18-84. Utility well. Water has slight sulfurous odor.
Ora-31 (CCC-07)	Seaside Condominiums	Shumock Well Co. (1984)	15	Qalt (A_1)	13	--	--	C	S	Grass irrigation well.
Ora-32 (BBB-05)	Jeff Friedman	Shumock Well Co. (1984)	30	Qalt (A_1)	7	4	1984	S	S	4-in casing from land surface to 20 ft; 4-in screen from 20 to 30 ft. Reported drawdown 10 ft after 3 hrs pumping 120 gpm in 1984. 105-ft test hole made for well. Driller's report in WRD files. Lawn irrigation well. Water had sulfurous odor. Salt water reported in lower horizons.
Ora-33 (CCC-08)	Jim Mattei	Alms Pump Service (1984)	28	Qalt (A_1)	15	14	1984	J	S	2-in casing from land surface to 23 ft; 2-in screen from 23 to 28 ft. Test-pumped at 23 gpm for 2 hrs in 1984. Driller's report in WRD files. Lawn irrigation well.
Ora-34 (CCC-09)	Romar House--Phase II	Shumock Well Co. (1984)	360	Tmu (A_3)	16	13	1984	N	T	4-in casing from land surface to 340 ft; 4-in screen from 340 to 360 ft. Test-pumped at 25 gpm for 3 hrs in 1984. Driller's report in WRD files. Test well for lawn irrigation well. No. 3. Well destroyed. Produced salt water with a high iron content. A shallower zone tested at 115 to 125 ft contained water of similar chemical character.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Ora-35 (CCC-03)	Sea Chase	Shumock Well Co. (1984)	83	Tmu (A_2)	13	11	1984	S	S	4-in casing from land surface to 73 ft; 4-in screen from 73 to 83 ft. Reported drawdown 11 ft after 7 hrs pumping at 87 gpm in 1984. Driller's report in WRD files. Grass irrigation well.
Ora-36 (CCC-010)	Sea Scape	Alms Pump Service (1984)	35	Qalt (A_1)	15	12	1984	C	S	2-in casing from land surface to 25 ft; 2-in screen from 25 to 35 ft. Test-pumped at 40 gpm for 1 hr in 1984. Driller's report in WRD files. Lawn irrigation well.
Per-1 (BBB-01)	Forrest Cook	Alms Pump Service (1983)	49	Tmu (A_2)	25	22	1983	J	Pvi	2-in casing from land surface to 44 ft; 2-in screen from 44 to 49 ft. Test-pumped at 10 gpm for 1 hr in 1983. Driller's report in WRD files.
Per-2 (BBB-02)	Fred Scott	Alms Pump Service (1970)	33	Tmu (A_2)	6	--	--	J	Pvi	2-in casing from land surface to 29 ft; 2-in screen from 29 to 33 ft. Well log in WRD files.
Per-3 (BBB-8)	C. W. Bear	Alms Pump Service (1966)	197	Tmu (A_2)	4	+3.8	06-16-66	S,F	S	4-in casing from land surface to 188 ft; 4-in screen from 188 to 197 ft. Measured flow 3.5 gpm on 06-16-66. Lawn irrigation well. Water had sulfurous odor. Water reportedly salty at 50 ft.
Pin-1 (EEE-013)	Chuck and Harold Speir	Alms Pump Service (1980)	11	Qalt (A_1)	7	6	1980	N	U	2-in casing from land surface to 8 ft; 2-in screen from 8 to 11 ft. Well apparently destroyed in 1981.
Pin-2 (FFF-01)	Mrs. W. C. Kelly	W. C. Kelly (1974)	40	Qalt (A_1)	16	--	--	J	S	Water tea-colored with a sulfurous odor. Utility well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Pin-3 (FFF-3)	Dr. Marion Dodson	Holland Well Co. (1957)	105	Tmu (A_2)	7	6	1957	J	Pvi	2-in casing from land surface to 100 ft; 2-in screen from 100 to 105 ft. Water had a high iron content.
Pin-4 (EEE-014)	Stanley Galle	Alms Pump Service (1975)	20	Qalt (A_1)	10	6	1975	J	Pvi	2-in casing from land surface to 16 ft; 2-in casing from 16 to 20 ft. Test-pumped at 17 gpm for 1 hr in 1975. Driller's report in WRD files.
Pin-5 (EEE-015)	Mrs. H. S. Southworth	Alms Pump Service (1974)	18	Qalt (A_1)	3	3	1974	N	U	2-in casing from land surface to 14 ft; 2-in screen from 14 to 18 ft. Test-pumped at 7 gpm for 1 hr in 1974. Driller's report in WRD files. Well produced salt water.
Pin-6 (EEE-8)	T. E. Muldoon	Windham and Sons (1960)	32	Qalt (A_1)	10	--	--	J	Pvi	2-in casing from land surface to 29 ft; 2-in screen from 29 to 32 ft. Water at 16 to 18 ft reportedly brackish.
Pin-7 (EEE-016)	J. R. Maumenee	Alms Pump Service (1979)	23	Qalt (A_1)	10	--	--	J	S	Well produced brackish water following Hurricane Fredric (September 1979). Lawn and garden irrigation well.
Pin-8 (FFF-5)	R. L. Smith	J. Zaller (1957)	17	Qalt (A_1)	13	--	--	P	S	1¼-in casing from land surface to 14.5 ft; 1¼-in screen from 14.5 to 17 ft. Water at 32 ft reportedly brackish.
Pin-9 (FFF-4)	D. W. Ewing	Holland Well Co. (1961)	121	Tmu (A_2)	23	16.0+	06-20-84	N	U	2-in casing from land surface to 117 ft; 2-in screen from 117 to 121 ft. Well produced water with a high iron content and odor. Salt water reported at 132 ft.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Pin-10 (EEE-017)	Mrs. L. H. Gaynor	Alms Pump Service (1979)	45	Qalt (A_1)	13	--	--	J	Pvi	2-in casing from land surface to 40 ft; 2-in screen from 40 to 45 ft. Well produced salt water following Hurricane Fredric (September 1979); present water quality is poor.
Pin-11 (FFF-02)	R. O. Dreifus	Alms Pump Service (1974)	25	Qalt (A_1)	13	11	1974	J	S	2-in casing from land surface to 20 ft; 2-in screen from 20 to 25 ft. Test-pumped at 10.5 gpm for 1 hr in 1974. Driller's report in WRD files. Utility well.
Pin-12 (EEE-018)	Sonny Stirling	--	9	Qalt (A_1)	10	--	--	J	Pvi	--
Pin-13 (EEE-019)	Davenport Smith	--	17	Qalt (A_1)	23	--	--	--	S	Utility well.
Poi-1 (NN-04)	Town of Fairhope	Layne Central Co. (1981)	230	Tmu (A_2)	85	61	1981	T	PS	20-in casing from land surface to 105 ft; 14-in casing from land surface to 110 ft; 12-in screens from 110 to 120 ft, 129 to 154 ft, and 195 to 220 ft; no record below. Reported drawdown 13 ft after 8 hrs pumping at 750 gpm in 1981. 383-ft test hole made for well. Driller's report in WRD files.
Poi-2 (NN-06)	Marriott's Grand Hotel	Windham and Sons (1976)	162	Tmu (A_2)	12	9	1976	J	S	4-in casing from land surface to 152 ft; 4-in screen from 152 to 162 ft. Test-pumped at 65 gpm for 1 hr in 1976. Driller's report in WRD files. Golf course well.
Poi-3 (NN-08)	Marriott's Grand Hotel	Shumock Well Co. (1975)	125	Tmu (A_2)	12	--	--	J	S	4-in casing from land surface to 115 ft; 4-in screen from 115 to 125 ft. Driller's report in WRD files. Golf course well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Poi-4 (MM-01)	Marriott's Grand Hotel	--	162	Tmu (A_2)	4	+0.5	03-13-84	S,F	S	Tennis court well.
Poi-5 (MM-1)	Marriott's Grand Hotel	Layne-Central Co. (1940)	336	Tmu (A_3)	5	+20 87.5	1948 10-17-66	N	U	12-in casing from land surface to 305 ft; 8-in casing from 271 to 311 ft; 8-in screen from 311 to 331 ft. Reported flow 50 gpm in 1948. Test-pumped at 250 gpm for 24 hrs in 1948. Well log in WRD files. Well destroyed.
Poi-6 (WW-02)	Rae Crowe	John H. Davis (1980)	65	Tmu (A_2)	9	8	1980	J	S	2-in casing from land surface to 60 ft; 2-in screen from 60 to 65 ft. Test-pumped at 20 gpm for 1 hr in 1980. Driller's report in WRD files. Utility well.
Poi-7 (WW-03)	W. A. Jones	Dawes Well (1977)	72	Tmu (A_2)	6	3	1977	N	U	2-in casing from land surface to 67 ft; 2-in screen from 67 to 72 ft. Driller's report in WRD files.
Poi-8 (WW-04)	Mike Petruis	Alms Pump Service (1981)	80	Tmu (A_2)	3	8	1981	J	S	2-in casing from land surface to 75 ft; 2-in casing from 75 to 80 ft. Test-pumped at 14 gpm for 1 hr in 1981. Driller's report in WRD files. Utility well.
Poi-9 (WW-3)	T. A. Bishop	Spillers Well and Supply Co. (1956)	120	Tmu (A_2)	85	45	1966	N	U	4-in casing from land surface to 100 ft; 4-in screen from 100 to 120 ft.
Poi-10 (WW-05)	W. A. Little	Alms Pump Service (1983)	68	Tmu (A_2)	65	28	1983	J	Pvi	2-in casing from land surface to 63 ft; 2-in screen from 63 to 68 ft. Test-pumped at 14 gpm for 1 hr in 1983. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Poi-11 (NN-07)	George DuBrock	Alms Pump Service (1981)	76	Tmu (A_2)	12	11	1981	J	S	2-in casing from land surface to 71 ft; 2-in screen from 71 to 76 ft. Test-pumped at 13.5 gpm for 1 hr in 1981. Driller's report in WRD files. Garden and lawn irrigation well.
Poi-12 (MM-3)	Marriott's Grand Hotel	Layne Central Co. (1947)	341	Tmu (A_3)	7	+10 59 7.0	1947 1957 10-17-66	N	U	18-in casing from land surface to 277 ft; 10-in casing from 193 to 291 ft; 10-in screen from 291 to 341 ft; no record below. Reported flow 80 gpm in 1947. Test-pumped at 1,000 gpm for 24 hrs in 1947. Driller's report in WRD files. Well destroyed in 1976.
Rob-1 (JJ-01)	Baldwin County Board of Education	J. H. Mosley (1973)	93	Tci (A_2)	158	40	1973	J	PS	One of two twin wells serving Rosinton School.
Rob-2 (WW-02)	Baldwin County Board of Education	J. H. Mosley (1973)	93	Tci (A_2)	158	40	1973	J	PS	One of two twin wells serving Rosinton School.
Rob-3 (JJ-03)	Mrs. Mary Childress	John H. Davis (1978)	82	Tci (A_2)	148	40	1978	J	Pvi	2-in casing from land surface to 77 ft; 2-in screen from 77 to 82 ft. Test-pumped at 9 gpm for 4 hours in 1978. Driller's report in WRD files.
Rob-4 (JJ-04)	B. C. Stanton	John H. Davis (1979)	47	Tci (A_2)	171	30	1979	J	Pvi	2-in casing from land surface to 42 ft; 2-in screen from 42 to 47 ft. Test-pumped at 11 gpm for 4 hours in 1979. Driller's report in WRD files.
Rob-5 (JJ-06)	E. D. Penton	John H. Davis (1978)	75	Tmu (A_2)	105	30	1978	J	PS	2-in casing from land surface to 70 ft; 2-in screen from 70 to 75 ft. Test-pumped at 12 gpm for 3 hours in 1978. Driller's report in WRD files. Trailer park well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Rob-6 (PP-2)	Town of Robertsdale	Layne Central Co. (1958)	260	Tmu (A_2)	148	32.0	09-15-49	T	PS	20-in casing from land surface to 220 ft; 10-in screen from 220 to 260 ft. Reported drawdown 16 ft after 4 hrs pumping at 349 gpm in 1977. Semiannual water-level monitoring well. Driller's report in WRD files. Well reconstructed from 171-ft well in 1958.
						42.1	02-15-68			
						51.9	10-23-68			
						49.9	04-23-69			
						39.0	10-22-69			
						38.2	04-03-74			
						37.3	10-25-74			
						44	01-28-75			
						36.1	04-03-75			
						37.1	11-03-76			
						41.7	04-06-77			
						44	10-28-77			
						37.0	11-09-77			
						46.7	11-08-78			
						51.4	11-20-79			
						44.8	04-28-80			
						38.4	11-05-80			
						50.4	04-15-81			
						40.4	08-28-81			
						40.0	04-14-82			
						39.4	11-02-82			
						34.8	11-08-83			
						36.1	04-26-84			
						34.8	11-16-84			
Rob-7 (PP-1)	Town of Robertsdale	Layne Central Co. (1958)	203	Tmu (A_2)	141	36	1958	T	PS	18-in casing from land surface to 150 ft; 12-in casing from 110 to 153 ft; 10-in screen from 153 to 193 ft; no record below. Reported drawdown 41 ft after 3 hrs pumping at 503 gpm in 1958. Driller's report in WRD files.
						37.7	05-09-66			
Rob-8 (JJ-4)	W. B. Cooper	Campbell Hardware and Supply Co. (1965)	133	Tmu (A_2)	164	63	1965	J	Pvi	2-in casing from land surface to 130 ft; 2-in screen from 130 to 133 ft.
Rob-9 (00-06)	Town of Silverhill	Acme Drilling Co. (1973)	186	Tmu (A_2)	141	47	1973	T	PS	12-in casing from land surface to 153 ft; 8-in casing from 111 to 153 ft; 6-in screen from 153 to 184 ft; no record below.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Rob-10 (PP-4)	Stewart Harms	Campbell Hardware and Supply Co. (1956)	60	Tci (A_2)	121	34.3 33	10-25-56 1966	J	S	3-in casing from land surface to 55 ft; 3-in screen from 55 to 60 ft. Farm shop well.
Rob-11 (PP-05)	Federal Land Bank Association	Alms Pump Service (1979)	65	Tci (A_2)	65	28	1979	S	S	4-in casing from land surface to 50 ft; 4-in screen from 50 to 65 ft. Test-pumped at 36 gpm for 2 hrs in 1979. Driller's report in WRD files. Lawn irrigation well.
Rob-12 (00-010)	Couch, Inc.	John H. Davis (1983)	82	Tmu (A_2)	125	40	1983	S	Ind.	4-in casing from land surface to 67 ft; 4-in screen from 67 to 82 ft. Reported drawdown 20 ft after 4 hrs pumping 50 gpm in 1983. Driller's report in WRD files.
Rob-13 (KK-04)	A. A. Corte and Sons	E. C. White (1984)	99	Tci (A_2)	167	33	1984	S	Ind.	8-in casing from land surface to 79 ft; 8-in screen from 79 to 99 ft. 260-ft test hole made for well. Driller's report in WRD files. Cooling-water well.
Sai-1 (GGG-01)	Fort Morgan Surf and Marina Club	Shumock Well Co. (1982)	37	Qalt (A_1)	23	14	1982	S	PS	6-in casing from land surface to 22 ft; 6-in screen from 22 to 37 ft. Reported drawdown 11 ft after 3 hrs pumping at 55 gpm. 45-ft test hole made for well. Driller's report in WRD files.
Sai-2 (FFF-03)	Governor's Mansion	--	40	Qalt (A_1)	13	--	--	J	S	Utility well.
Sai-3 (FFF-04)	Governor's Mansion	Alms Pump Service (1977)	19	Qalt (A_1)	20	12	1977	J	S	2-in casing from land surface to 14 ft; 2-in screen from 14 to 19 ft. Test-pumped at 15 gpm for 2 hrs in 1977. Driller's report in WRD files. Utility well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Sai-4 (GGG-02)	V. B. Patrick	Alms Pump Service (1978)	43	Qalt (A_1)	20	8 7.1	1978 06-07-84	N	T	2-in casing from land surface to 39 ft; 2-in screen from 39 to 43 ft. Test-pumped at 12 gpm for 24 hrs in 1978. Driller's report in WRD files. Water-quality test well. Water had a sulfurous odor and is salty. Affected by Hurricane Fredric (September 1979).
Sai-5 (GGG-03)	V. P. Patrick	--	37	Qalt (A_1)	26	--	--	J	Pvi	--
Sai-6 (GGG-04)	E. P. Davis	Holland Well Co. (1962)	386	Tmu (A_3)	1	--	--	N	T	2-in casing from land surface to 386 ft; slotted from 366 to 386 ft. Reportedly flowed in 1982. Water-quality test well. Well destroyed in 1962. Water reported to be salty.
Sai-7 (GGG-5)	F. W. Graves	Self (1965)	8	Qalt (A_1)	3	--	--	N	U	1¼-in casing from land surface to 5 ft; 1¼-in casing from 5 to 8 ft. Water reported to be brackish and had sulfurous odor. Water at 10, 12, and 30 ft of similar chemical character.
Sai-8 (GGG-05)	John Hopper	Self (1984)	7	Qalt (A_1)	7	--	--	J	S	1¼-in casing from land surface to 4.5 ft; 1¼-in screen from 4.5 to 7 ft. Water reported to be brackish. 30-ft well at same location reportedly affected by sea-water overwash in fall of 1983.
Sai-9 (GGG-06)	Bill Sessons	D. L. Fuqua (1984)	13	Qalt (A_1)	7	--	--	J	S	1¼-in casing from land surface to 10 ft; 1¼-in screen from 10 to 13 ft. Well produces brackish water. Utility well.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Sai-10 (GGG-07)	O. E. Snow	Alms Pump Service (1974)	15	Qalt (A_1)	10	4	1974	J	S	2-in casing from land surface to 10 ft; 2-in screen from 10 to 15 ft. Test-pumped at 11 gpm for 2 hrs in 1974. Driller's report in WRD files. Utility well.
Sai-11 (FFF-2)	Mrs. A. S. Blalack	Alms Pump Service (1963)	41	Qalt (A_1)	7	--	--	J	S	1¼-in casing from land surface to 38 ft; 1¼-in casing from 38 to 41 ft. Water reported to have a high iron content. Utility well.
Sai-12 (FFF-05)	Buck Green	-- (1977)	27	Qalt (A_1)	10	8.7	06-20-84	N	U	Well produced salty water following Hurricane Fredric (September 1979). Well abandoned thereafter.
Sai-13 (FFF-06)	Buck Green	Dwight Steele (1980)	52	Qalt (A_1)	7	--	--	J	S	1¼-in casing from land surface to 49 ft; 1¼-in screen from 49 to 52 ft. Water at shallower depth reportedly salty. Utility well.
Sai-14 (GGG-4)	W. M. Apple	Dwight Steele (1965)	15	Qalt (A_1)	7	--	--	N	U	1½-in casing from land surface to 12 ft; 1½-in casing from 12 to 15 ft. Water reportedly had creasote taste and was salty. Well destroyed by Hurricane Fredric (September 1979).
Sai-15 (FFF-6)	W. M. Arledge	Alms Pump Service (1962)	31	Qalt (A_1)	13	--	--	J	S	2-in casing from land surface to 28 ft; 2-in screen from 28 to 31 ft. Utility well.
Sem-1 (RR-03)	Anthony Boyett	John H. Davis (1976)	147	Tmu (A_2)	98	96	1976	J	Pvi	2-in casing from land surface to 142 ft; 2-in screen from 142 to 147 ft. Test-pumped at 6 gpm for 6 hrs in 1976. Driller's report in WRD files.
Sem-2 (RR-3)	Oscar Wells	John H. Davis (1982)	34	Tci (A_2)	95	16.5	02-28-84	J	Pvi	Replacement for well no. RR-3.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Sem-3 (RR-02)	Dennis Fillingim	Windham and Sons (1978)	40	Tmu (A_2)	10	8	1978	J	Pvi	2-in casing from land surface to 37 ft; 2-in screen from 37 to 42 ft. Test-pumped at 25 gpm for ¼ hr in 1978. Driller's report in WRD files. Water reportedly had a high iron content.
Sil-1 (KK-3)	Town of Loxley	Layne Central Co. (1959)	184	Tmu (A_2)	170	40 45.4 50 46	1959 05-09-66 1972 1976	T	PS	12-in casing from land surface to 140 ft; 8-in casing from 100 to 144 ft; 8-in screen from 144 to 174 ft; no record below. Reported drawdown 33 ft after 8 hrs pumping 305 gpm in 1959. 214-ft test hole made for well. Driller's report in WRD files.
Sil-2 (00-1)	Town of Silverhill	Acme Drilling Co. (1962)	197	Tmu (A_2)	145	50 60	1962 1966	T	PS	10-in casing from land surface to 153 ft; 4-in casing from 112 to 155 ft; 4-in screen from 156 to 196 ft. Reportedly pumped at 157 gpm in 1962. Driller's report in WRD files.
Sil-3 (LL-01)	Town of Daphne	Acme Drilling Co. (1974)	184	Tmu (A_2)	147	53 51.0 50.0	1974 01-30-84 02-03-84	T	PS	12-in casing from land surface to 141 ft; 8-in casing from 98 to 139 ft; 6-in screen from 140 to 182 ft. 181-ft test hole made for well. Driller's report in WRD files.
Sil-4 (LL-2)	E. G. Manci, Jr.	Holland Well Co. (1965)	60	Tci (A_2)	159	--	--	S	U	4-in casing from land surface to 50 ft; 4-in screen from 50 to 60 ft. Well inoperative.
Sil-5 (LL-9)	E. G. Manci, Sr.	J. Ponder (1963)	108	Tmu (A_2)	139	26	1966	T	U	4-in casing from land surface to 88 ft; 4-in screen from 88 to 108 ft. Well inoperative.
Sil-6 (LL-7)	Viola Bertolla	Deep Well Drilling Co. (1948)	777	Tmu (A_3)	142	89.0	08-20-48	J	Pvi	3-in casing from land surface to 756 ft; 3-in screen from 756 to 777 ft. Sample log and sieve analysis of selected samples in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Sil-7 (NN-09)	Tony Davis	John H. Davis (1977)	57	Tci (A_2)	105	40	1977	J	Pvi	2-in casing from land surface to 52 ft; 2-in screen from 52 to 57 ft. Test-pumped at 10 gpm for 4 hrs in 1977. Driller's report in WRD files.
Sil-8 (KK-02)	Robuh Bell	John H. Davis (1976)	65	Tmu (A_2)	95	40	1976	J	Pvi	2-in casing from land surface to 60 ft; 2-in screen from 60 to 65 ft. Test-pumped at 10 gpm for 6 hrs in 1976. Driller's report in WRD files.
Sil-9 (KK-4)	G. J. Peturis	Alms Pump Service (1974)	106	Tmu (A_2)	155	62	1974	J	Pvi	2-in casing from land surface to 101 ft; 2-in screen from 101 to 106 ft. Test-pumped at 6.5 gpm for 1½ hrs in 1974. Driller's report in WRD files.
Sil-10 (KK-010)	Herbert Warren	John H. Davis (1976)	72	Tci (A_2)	145	55	1976	J	Pvi	2-in casing from land surface to 67 ft; 2-in screen from 67 to 72 ft. Test-pumped at 10 gpm for 3 hrs in 1976. Driller's report in WRD files.
Sil-11 (NN-02)	Town of Fairhope	Carloss Well Supply Co. (1975)	223	Tmu (A_2)	115	72 57.0	1975 02-02-84	T	PS	20-in casing from land surface to 158 ft; 12-in screen from 158 to 218 ft. Reported drawdown 40 ft after 24 hrs pumping at 750 gpm in 1975. 609-ft test hole made for well. Driller's report and electric log in WRD files.
Sil-12 (NN-01)	Town of Fairhope	Carloss Well Supply Co. (1975)	265	Tmu (A_2)	95	51 22.0	1975 02-02-84	T	PS	20-in casing from land surface to 192 ft; 12-in screen from 201 to 261 ft. Reported drawdown 50 ft after 24 hrs pumping at 750 gpm in 1975. 699-ft test hole made for well. Driller's report and electric log in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Sil-13 (00-05)	Jerry Johnson	Alms Pump Service (1981)	104	Tmu (A_2)	115	40 56.7	1981 02-02-84	J	Pvi	2-in casing from land surface to 99 ft; 2-in screen from 99 to 104 ft. Test-pumped at 10 gpm for 1 hr in 1981. Driller's report in WRD files.
Sil-14 (00-09)	Charles Thomas Estate	John H. Davis (1979)	47	Tci (A_2)	120	32	1979	J	Pvi	2-in casing from land surface to 42 ft; 2-in screen from 42 to 47 ft. Test-pumped at 12 gpm for 4 hrs in 1979. Driller's report in WRD files.
Sil-15 (KK-05)	Town of Loxley	Holland Well Co. (1984)	180	Tmu (A_2)	165	55	1984	T	PS	16-in casing from land surface to 139 ft; 8-in screen from 140 to 180 ft. Reported drawdown 61 ft after 24 hrs pumping at 1,125 gpm in 1984. 200-ft test hole made for well. Driller's log, electric, and gamma-ray logs in WRD files.
Sta-1 (CC-06)	Malbis Plantation	Holland Well Co. (1983)	258	Tmu (A_2)	195	135	1983	T	PS	16-in casing from land surface to 190 ft; 8-in screen from 190 to 240 ft; no record below. Well log in WRD files.
Sta-2 (CC-11)	Malbis Plantation	L. R. Johnson Drilling and Inspection Co. (--)	265	Tmu (A_2)	195	--	--	N	U	Abandoned public supply well. Water reportedly had a sulfurous odor and a high iron content.
Sta-3 (CC-10)	Malbis Plantation	Carloss Well Supply Co. (1945)	498	Tmu (A_2), (A_3)	195	140.6	05-13-66	N	U	Screened intervals at 200 and 400 ft. Well log in WRD files. Abandoned public supply well. Water reported to have sulfurous odor.
Sta-4 (CC-12)	Malbis Plantation	Carloss Well Supply Co. (--)	265	Tmu (A_2)	195	--	--	N	U	Screened intervals at 125 and 250 ft. Public-supply well. Well destroyed.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Sta-5 (KK-2)	D. W. Fields	Campbell Hardware and Supply Co. (1957)	82	Tmu (A_2)	110	28.0	05-24-57	J	U	3-in casing from land surface to 77 ft; 3-in screen from 77 to 82 ft. Well inoperative.
Sta-6 (KK-09)	H. P. Jenkins	John H. Davis (1976)	62	Tci (A_2)	160	50	1976	J	Pvi	2-in casing from land surface to 57 ft; 2-in screen from 57 to 62 ft. Test-pumped at 11 gpm for 6 hrs in 1976. Driller's report in WRD files.
Sta-7 (KK-08)	SARS, Inc.	Alms Pump Service (1979)	46	Tmu (A_2)	105	28	1979	T	Ind.	4-in casing from land surface to 36 ft; 4-in screen from 36 to 46 ft. Test-pumped at 18 gpm for 1 hr in 1979. Driller's report in WRD files. Reworked well.
Sta-8 (KK-07)	Mrs. Shirley Peterson	John H. Davis (1979)	87	Tci (A_2)	175	40	1979	J	Pvi	2-in casing from land surface to 82 ft; 2-in screen from 82 to 87 ft. Test-pumped at 12 gpm for 4 hrs in 1979. Driller's report in WRD files.
Sta-9 (KK-1)	Flowerwood Nursery	Holland Well Co. (1963)	188	Tmu (A_2)	180	44.6	05-16-66	T	Irr.	4-in casing from land surface to 168 ft; 4-in screen from 168 to 188 ft. Test-pumped at 150 gpm in 1963. Nursery well.
Sta-10 (CC-07)	Steve Stevens	Alms Pump Service (1983)	50	Tci (A_2)	190	18	1983	J	Pvi	2-in casing from land surface to 45 ft; 2-in screen from 45 to 50 ft. Test-pumped at 23 gpm for 1 hr in 1983. Driller's report in WRD files.
Sta-11 (LL-02)	Lake Forest Utilities, Inc.	Graves Well Drilling (1977)	155	Tmu (A_2)	155	79.5	08-02-77	T	PS	6-in casing from land surface to 140 ft; 6-in screen from 140 to 155 ft. Reported drawdown 15.5 ft after 216 hrs pumping at 230 gpm in 1977. Driller's report in WRD files.

Appendix A. (cont'd)

Project no. and WRD file no.	Owner	Driller and year completed	Depth of well (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level: Above(+) or below land surface (ft)	Water level: Date of measurement	Production method	Type of well	Remarks
Sta-12 (LL-03)	Lake Forest Utilities, Inc.	Powell Drilling Co., Inc. (1982)	176	Tmu (A_2)	115	63	1982	T	PS	16-in casing from land surface to 131 ft; 10-in casing from 101 to 131 ft; 8-in screen from 131 to 171 ft; no record below. Reported drawdown 26 ft after 24 hrs pumping at 400 gpm in 1982. 204-ft test hole made for well. Driller's report in WRD files.
Sta-13 (KK-03)	Roger Barnhill, Jr.	Alms Pump Service (1983)	160	Tmu (A_2)	175	43	1983	S	Irr.	4-in casing from land surface to 130 ft; 4-in screen from 130 to 160 ft. Test-pumped at 90 gpm for 1 hr in 1983. Driller's report in WRD files. "Strawberry Patch" well.
Sta-14 (KK-06)	Town of Loxley	Holland Well Co. (1984)	260	Tmu (A_2)	165	--	--	--	T	Test hole for public-supply well; location abandoned. Electric and gamma-ray logs in WRD files.
Ste-1 (JJ-07)	Theodore Smith	John H. Davis (1977)	54	Tci (A_2)	171	34	1977	J	Pvi	2-in casing from land surface to 49 ft; 2-in screen from 49 to 54 ft. Test-pumped at 11 gpm for 3 hrs in 1977. Driller's report in WRD files.
Ste-2 (JJ-08)	Mrs. Gladys Powell	John H. Davis (1979)	54	Tci (A_2)	171	25	1979	J	Pvi	2-in casing from land surface to 49 ft; 2-in screen from 49 to 54 ft. Test-pumped at 8 gpm for 4 hrs in 1979. Driller's report in WRD files.
Ste-3 (JJ-09)	Douglas Roelafs	John H. Davis (1979)	40	Tci (A_2)	164	25	1979	--	Pvi	2-in casing from land surface to 35 ft; 2-in screen from 35 to 40 ft. Driller's report in WRD files.
Ste-4 (JJ-010)	Larry Boutwell	Alms Pump Service (1975)	44	Tci (A_2)	164	28	1979	J	Pvi	2-in casing from land surface to 39 ft; 2-in screen from 39 to 44 ft. Test-pumped at 10 gpm for 1 hr in 1979. Driller's report in WRD files.

APPENDIX B

Results of chemical analyses of water from selected wells in southern Baldwin County, Alabama.

Well number corresponds to that shown on plate 1 and in appendix A.

Water-bearing unit: Tmu - Miocene Series undifferentiated of Tertiary age; Tci - Citronelle Formation of Tertiary age; Qalt - alluvium, low terrace deposits, and coastal deposits of Quternary age.

Suffix terms (A_1, A_2 and A_3) identify aquifer zones (see report).

Analysis values in milligrams per liter (mg/l), except as noted.

Appendix B. Results of chemical analyses of water from selected wells in southern Baldwin County, Alabama

Well number	Bon-1	Bon-1	Bon-2	Bon-5	Bon-8	Bri-1	Bri-1	Bri-1
Date of collection	06-27-66	03-27-84	10-10-57	03-27-84	06-05-84	04-28-59[4]	04-27-66	01-26-67[5]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (--)	Tmu (A_2,A_3)	Tmu (A_2,A_3)	Tmu (A_2,A_3)
Depth of interval sampled (ft)	46-50	46-50	45-55	41-46	1,766-1,774	294-319, 348-368	294-319, 348-368	294-319, 348-368
Silica (SiO_2)	--	--	--	--	--	31	--	--
Iron (Fe)	.02	--	--	--	690	.38	.26	>.70
Manganese (Mn)	--	--	--	--	--	--	--	.05
Calcium (Ca)	--	--	--	--	5,800	2.1	--	4.0
Magnesium (Mg)	--	--	--	--	1.5	1.2	--	1.0
Sodium (Na)	--	--	--	--	41,300	5.0	--	.0
Potassium (K)	--	--	--	--	4,300	--	--	--
Bicarbonate (HCO_3)	2	6	--	5	310	25	12	0
Carbonate (CO_3)	0	0	--	0	0	0	0	0
Sulfate (SO_4)	--	--	--	--	.0	3.4	--	3.0
Chloride (Cl)	5.6	20	18	10	89,000	4.0	4.4	6.0
Fluoride (F)	--	--	--	--	--	.0	--	.0
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	520	--	--	--
Dissolved solids	--	--	--	--	147,100	81	--	183
Hardness (as $CaCO_3$) Calcium, magnesium	8	--	--	--	14,490[3]	10[3]	10	14[3]
Specific conductance (micromhos at 25°C)	29	108	--	39	115,200	--	36	--
Turbidity (NTU)[1]	--	0	--	0	--	--	--	--
Color (Pt-Co)[2]	--	0	--	0	--	--	--	--
pH	5.6	4.9	6.0	4.8	6.2	6.4	6.3	6.5
Temperature								
°C	21	22	--	--	29	--	22	--
°F	70	71	--	--	84	--	71	--

Appendix B. (cont'd)

Well number	Bri-1	Bri-1	Bri-2	Bri-2	Bri-2	Bri-2	Bri-2	Bri-2
Date of collection	12-22-70[5]	01-16-84	08-04-64[5]	01-08-65[5]	01-11-65[6]	03-15-66	01-26-67[5]	01-26-68[5]
Water-bearing unit	Tmu (A_2,A_3)	Tmu (A_2,A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	294-319, 348-368	294-319, 348-368	265-305	265-305	265-305	265-305	265-305	265-305
Silica (SiO_2)	--	--	--	--	42	--	--	--
Iron (Fe)	1.9	0.39	1.0	2.0	1.8	2.7	.50	.74
Manganese (Mn)	.07	--	.05	.08	.00	--	.03	.05
Calcium (Ca)	--	2.7	--	4.7	3.6	--	4.0	4.4
Magnesium (Mg)	--	1.2	--	1.3	2.7	--	2.8	1.8
Sodium (Na)	--	6.9	--	--	1.2	--	.0	--
Potassium (K)	--	1.7	--	--	--	--	--	--
Bicarbonate (HCO_3)	27[3]	19	39[3]	28[3]	29[3]	28	35[3]	26[3]
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	3.6	--	5.7	6.0	--	8.0	4.0
Chloride (Cl)	--	3.6	--	1.5	7.0	4.4	1.0	6.0
Fluoride (F)	--	--	--	.3	.0	--	.0	.0
Carbon dioxide (CO_2)	--	--	--	--	11	--	19	9.7
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	61	--	105	139	--	166	94
Hardness (as $CaCO_3$) Calcium, magnesium	--	12[3]	--	18[3]	24[3]	21	25[3]	19[3]
Specific conductance (micromhos at 25°C)	--	63	--	--	--	78	--	--
Turbidity (NTU)[1]	--	2	--	--	--	--	--	--
Color (Pt-Co)[2]	--	5	--	--	--	--	--	--
pH	6.6	5.4	6.6	6.7	6.6	6.8	6.5	6.5
Temperature								
°C	--	22	--	--	--	22	--	--
°F	--	71	--	--	--	71	--	--

Appendix B. (cont'd)

Well number	Bri-2	Bri-2	Bri-6	Bri-6	Bri-6	Bri-6	Bri-6	Dap-1
Date of collection	07-26-82[5]	01-16-84	09-02-59[4]	12-07-59[4]	04-26-62[7]	04-19-67[5]	01-18-84	10-10-74[8]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)
Depth of interval sampled (ft)	265-305	265-305	275-305	275-305	275-305	275-305	275-305	780
Silica (SiO_2)	--	--	70	52	15	--	--	--
Iron (Fe)	.15	--	.80	.63	2.0	.36	1.9	1.8
Manganese (Mn)	.02	--	.00	.00	--	.02	--	--
Calcium (Ca)	3.6	--	3.8	3.0	--	4.0	3.5	--
Magnesium (Mg)	.9	--	5.0	2.2	--	1.6	1.5	--
Sodium (Na)	7.0	--	.7	5.4	--	--	6.8	--
Potassium (K)	--	--	--	--	--	--	2.7	--
Bicarbonate (HCO_3)	28[3]	30	24[3]	23[3]	26[3]	21[3]	20	--
Carbonate (CO_3)	0	0	0	0	0	0	0	--
Sulfate (SO_4)	6.0	--	8.4	10	--	9.0	7.9	--
Chloride (Cl)	2.0	12	2.0	2.0	77	4.0	2.6	2,400
Fluoride (F)	.0	--	.2	.2	.8	.1	--	--
Carbon dioxide (CO_2)	--	--	12	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	100	78	121	124	84	--
Hardness (as $CaCO_3$) Calcium, magnesium	20[3]	--	30[3]	17[3]	--	17[3]	14[3]	--
Specific conductance (micromhos at 25°C)	60	88	--	--	--	--	78	--
Turbidity (NTU)[1]	--	3	--	--	--	--	5	--
Color (Pt-Co)[2]	5	5	--	--	--	--	25	--
pH	6.7	5.8	6.4	6.4	6.4	6.6	5.9	--
Temperature								
°C	--	22	--	--	--	--	22	--
°F	--	71	--	--	--	--	72	--

Appendix B. (cont'd)

Well number	Dap-2	Dap-2	Dap-2	Dap-3	Dap-3	Dap-3	Dap-3	Dap-3
Date of collection	09-06-57	07-29-69[5]	01-30-84	08-17-64[6]	03-08-66	10-17-66	04-23-69	10-22-69
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)
Depth of interval sampled (ft)	402-442	402-442	380-430	402-442	402-442	402-442	402-442	402-442
Silica (SiO_2)	--	--	--	31	--	25	--	--
Iron (Fe)	--	.19	--	.22	.10	.17	.35	.59
Manganese (Mn)	--	.00	--	.00	--	--	--	--
Calcium (Ca)	--	--	--	2.8	--	2.4	--	--
Magnesium (Mg)	--	--	--	2.2	--	1.0	--	--
Sodium (Na)	--	--	--	8.2	--	6.3	--	--
Potassium (K)	--	--	--	--	--	1.4	--	--
Bicarbonate (HCO_3)	--	0	22	20[3]	13	14	17	18
Carbonate (CO_3)	--	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	11	--	7.6	--	--
Chloride (Cl)	11	5.0	10	8.4	5.2	3.4	3.8	3.4
Fluoride (F)	--	--	--	.0	--	.1	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	92	--	54	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	16[3]	15	10[3]	12	11
Specific conductance (micromhos at 25°C)	--	--	88	--	46	48	71	70
Turbidity (NTU)[1]	--	--	0	--	--	--	--	--
Color (Pt-Co)[2]	--	--	0	--	--	--	--	--
pH	5.7	6.3	5.2	6.0	6.4	6.2	6.1	6.2
Temperature								
°C	22	--	22	--	22	--	22	22
°F	72	--	72	--	72	--	72	72

Appendix B. (cont'd)

Well number	Dap-3	Dap-3	Dap-6	Dap-7	Dap-7	Dap-7	Dap-8	Dap-9
Date of collection	04-21-81[7]	01-30-84	02-03-83[7]	10-08-57	05-03-66	01-31-84	05-03-66	01-20-64[6]
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)
Depth of interval sampled (ft)	402-442	402-442	210	210-218	210-218	210-218	106-110	365-390, 455-500
Silica (SiO_2)	--	--	--	--	--	--	--	33
Iron (Fe)	.04	.04	.13	--	1.3	.93	.41	2.0
Manganese (Mn)	.00	--	<.01	--	--	--	--	.00
Calcium (Ca)	.6	3.3	1.3	--	--	1.1	--	10
Magnesium (Mg)	.8	1.7	.8	--	--	.7	--	3.6
Sodium (Na)	3.6	8.6	3.3	--	--	2.8	--	--
Potassium (K)	--	2.3	--	--	--	1.6	--	--
Bicarbonate (HCO_3)	3[3]	20	4[3]	--	4	0	6	51[3]
Carbonate (CO_3)	0	0	0	--	0	0	0	0
Sulfate (SO_4)	<1.0	2.1	<1.0	--	--	2.6	--	.0
Chloride (Cl)	5.8	2.6	5.6	18	3.4	.2	5.0	9.0
Fluoride (F)	--	--	--	--	--	--	--	.0
Carbon dioxide (CO_2)	29	--	31	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	.11	--	--
Dissolved solids	35	66	14	--	--	48	--	135
Hardness (as $CaCO_3$) Calcium, magnesium	5[3]	15[3]	6[3]	--	8	6[3]	8	40[3]
Specific conductance (micromhos at 25°C)	42	77	34	--	35	42	29	--
Turbidity (NTU)[1]	--	0	.7	--	--	0	--	--
Color (Pt-Co)[2]	.5	0	1	--	--	0	--	--
pH	5.0	5.1	5.2	5.5	5.4	4.0	5.5	6.7
Temperature								
°C	--	22	--	22	20	20	21	--
°F	--	72	--	71	70	69	70	--

Appendix B. (cont'd)

Well number	Dap-9	Dap-9	Dap-9	Dap-10	Dap-12	Dap-12	Dap-12	Elb-1
Date of collection	02-13-64[5]	02-14-64[6]	03-15-66	03-15-66	05-23-44[9]	08-17-45	01-17-51[5]	03-28-84
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)
Depth of interval sampled (ft)	365-390, 455-500	365-390, 455-500	365-390, 455-500	335-365, 440-470	295-315, 355-385	295-315, 355-385	295-315, 355-385	55-60
Silica (SiO_2)	--	15	--	--	29	--	--	--
Iron (Fe)	.75	.50	.96	1.5	.60	--	.50	--
Manganese (Mn)	.12	.00	--	--	--	--	.00	--
Calcium (Ca)	8.0	9.2	--	--	4.1	--	8.0	--
Magnesium (Mg)	.8	4.0	--	--	1.6	--	.0	--
Sodium (Na)	--	15	--	--	4.8	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	51[3]	49[3]	46	45	18	18	15[3]	0
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	6.6	.0	--	--	5.8	4.0	4.0	--
Chloride (Cl)	5.5	9.0	4.2	4.4	16	6.0	5.0	12
Fluoride (F)	.0	.0	--	--	--	.0	.2	--
Carbon dioxide (CO_2)	--	24	--	--	28	--	12	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	115	155	--	--	79.5	--	38	--
Hardness (as $CaCO_3$) Calcium, magnesium	24[3]	38[3]	32	30	17[3]	--	20[3]	--
Specific conductance (micromhos at 25°C)	--	--	98	96	--	--	--	79
Turbidity (NTU)[1]	--	--	--	--	--	--	--	5
Color (Pt-Co)[2]	--	--	--	--	--	--	--	5
pH	6.8	6.5	6.8	7.2	5.9	--	6.6	4.2
Temperature								
°C	--	--	22	22	--	--	--	22
°F	--	--	72	72	--	--	--	71

Appendix B. (cont'd)

Well number	Elb-3	Elb-5	Elb-5	Elb-6	Elb-6	Elb-6	Elb-6	Elb-6
Date of collection	03-28-84	06-22-66	03-28-84	11-07-64[5]	03-18-66	06-30-82[5]	03-28-84	03-12-85
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	111-116	177-181	177-181	72-102	72-102	72-102	72-102	72-102
Silica (SiO_2)	--	--	--	--	--	--	--	7.2
Iron (Fe)	--	1.8	--	.07	.14	.80	.08	.02
Manganese (Mn)	--	--	--	.00	--	.02	--	.01
Calcium (Ca)	--	--	--	2.1	--	1.0	2.7	2.2
Magnesium (Mg)	--	--	--	.9	--	2.0	2.2	2.2
Sodium (Na)	--	--	--	--	--	11	5.1	6.4
Potassium (K)	--	--	--	--	--	--	.4	.4
Bicarbonate (HCO_3)	0	2	14	12	3	13	0	--
Carbonate (CO_3)	0	0	0	0	0	0	0	--
Sulfate (SO_4)	--	--	--	.0	--	.0	.0	--
Chloride (Cl)	12	5.8	7.5	6.5	6.0	11	7.0	6.0
Fluoride (F)	--	--	--	.0	--	.0	--	.0
Carbon dioxide (CO_2)	--	--	--	--	--	10.1	--	--
Strontium (Sr)	--	--	--	--	--	--	.05	.03
Dissolved solids	--	--	--	31	--	--	34	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	8	--	9[3]	22	21[3]	16[3]	15[3]
Specific conductance (micromhos at 25°C)	126	34	51	--	37	--	64	79
Turbidity (NTU)[1]	10	--	10	--	--	--	5	--
Color (Pt-Co)[2]	15	--	15	--	--	5	5	--
pH	4.2	7.1	5.2	5.8	5.8	6.2	4.3	--
Temperature								
°C	25	21	--	--	21	--	21	22
°F	77	69	--	--	69	--	70	72

Appendix B. (cont'd)

Well number	Elb-9	Elb-12	Elb-14	Els-1	Els-1	Els-3	Els-4	Els-4
Date of collection	03-29-84	07-13-66	05-08-84	10-07-57	06-07-66	02-28-84	05-29-66	02-28-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tci (A_2)	Tci (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	44-49	64-69	77-82	50	50	115-120	91-96	134
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	.05	--	--	.73	--	.02	--
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	3	4	0	--	6	0	4	0
Carbonate (CO_3)	0	0	0	--	0	0	0	0
Sulfate (SO_4)	--	--	--	--	--	--	--	--
Chloride (Cl)	10	15	5.0	18	3.2	10	3.0	10
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	30	--	--	10	--	5	--
Specific conductance (micromhos at 25°C)	52	112	39	--	27	55	17	38
Turbidity (NTU)[1]	0	--	0	--	--	0	--	--
Color (Pt-Co)[2]	0	--	0	--	--	0	--	--
pH	4.7	5.6	3.6	6.9	5.7	4.1	5.5	4.5
Temperature								
°C	19	21	--	--	22	--	22	21
°F	66	70	--	--	71	--	71	69

Appendix B. (cont'd)

Well number	Els-5	Els-6	Fol-1	Fol-1	Fol-1	Fol-2	Fol-3	Fol-3
Date of collection	02-28-84	02-28-84	03-14-66	05-14-81[5]	03-01-84	03-01-84	05-07-63[5]	03-14-66
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	122-127	102-107	75-95, 120-140	75-95, 120-140	75-95, 120-140	180-200	98-138	98-138
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	.06	.07	.03	--	.02	.09
Manganese (Mn)	--	--	--	.01	--	--	.00	--
Calcium (Ca)	--	--	--	16	1.9	--	3.9	--
Magnesium (Mg)	--	--	--	2.8	2.9	--	1.1	--
Sodium (Na)	--	--	--	7.0	5.0	--	--	--
Potassium (K)	--	--	--	--	.5	--	--	--
Bicarbonate (HCO_3)	16	0	5	56[3]	0	0	14[3]	4
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	4.0	.0	--	.0	--
Chloride (Cl)	10	5.0	7.6	11	8.2	15	10	8.6
Fluoride (F)	--	--	--	.0	--	--	.0	--
Carbon dioxide (CO_2)	--	--	--	7.5	--	-	7.6	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	14	--	83	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	15	6[3]	16[3]	--	14[3]	12
Specific conductance (micromhos at 25°C)	48	20	45	140	77	36	--	42
Turbidity (NTU)[1]	0	0	--	--	5	0	--	--
Color (Pt-Co)[2]	0	0	--	5	0	0	--	--
pH	5.3	4.5	5.8	6.7	4.2	4.1	5.9	5.5
Temperature								
°C	--	--	21	--	20	20	--	22
°F	--	--	69	--	68	68	--	72

Appendix B. (cont'd)

Well number	Fol-3	Fol-4	Fol-5	Fol-5	Fol-5	Fol-5	Fol-5	Fol-5
Date of collection	03-01-84	03-01-84	11-27-70[5]	11-27-70[7]	12-07-70[5]	12-07-70[5]	12-07-70[5]	12-07-70[5]
Water-bearing unit	Tmu (A_2)	Tci (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	98-138	20-25	98-138	98-138	98-138	98-138	98-138	98-138
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	.20	.10	.06	.06	.05	.05
Manganese (Mn)	--	--	.00	.00	.00	.00	.00	.00
Calcium (Ca)	--	--	--	.0	--	--	--	--
Magnesium (Mg)	--	--	--	.4	--	--	--	--
Sodium (Na)	--	--	--	4.6	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	0	0	1[3]	--	5[3]	10[3]	7[3]	10[3]
Carbonate (CO_3)	0	0	0	--	0	0	0	0
Sulfate (SO_4)	--	--	--	2	--	--	--	--
Chloride (Cl)	10	10	--	5.4	18	11	23	11
Fluoride (F)	--	--	--	.0	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	58	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	2[3]	--	--	--	--
Specific conductance (micromhos at 25°C)	50	26	--	--	--	--	--	--
Turbidity (NTU)[1]	--	0	--	--	--	--	--	--
Color (Pt-Co)[2]	--	0	--	--	--	--	--	--
pH	4.2	4.3	5.4	5.4	5.6	5.7	5.7	5.7
Temperature								
°C	21	--	--	--	--	--	--	--
°F	70	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Fol-5	Fol-5	Fol-6	Fol-6	Fol-6	Fol-6	Fol-6	Fol-7
Date of collection	03-01-84	03-13-85	02-23-62[4]	05-07-63[5]	03-14-66	09-15-75[5]	03-01-84	06-24-66
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	98-138	98-138	108-133, 137-147	108-133, 137-147	108-133, 137-147	108-133, 137-147	108-133, 137-147	61-71
Silica (SiO_2)	--	6.0	11.8	--	--	--	--	--
Iron (Fe)	--	.02	.04	.03	.10	<.10	.08	.07
Manganese (Mn)	--	.03	.00	.00	--	.05	--	--
Calcium (Ca)	--	--	1.6	4.2	--	20	7.9	--
Magnesium (Mg)	--	--	.5	1.5	--	1.7	3.5	--
Sodium (Na)	--	4.6	2.5	--	--	7.0	7.7	--
Potassium (K)	--	.5	--	--	--	--	6.2	--
Bicarbonate (HCO_3)	0	--	10[3]	9[3]	0	67[3]	0	2
Carbonate (CO_3)	0	--	0	0	0	0	0	0
Sulfate (SO_4)	--	.0	.0	.0	--	<2.0	9.8	--
Chloride (Cl)	10	4.3	8.6	13	15	10	18	6.4
Fluoride (F)	--	.0	.0	.0	--	.6	--	--
Carbon dioxide (CO_2)	--	--	--	21.4	2	--	--	--
Strontium (Sr)	--	.03	--	--	--	--	--	--
Dissolved solids	--	--	40	54	--	--	54	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	6[3]	16[3]	28	57[3]	34[3]	8
Specific conductance (micromhos at 25°C)	66	51	--	--	103	140	172	49
Turbidity (NTU)[1]	0	--	--	--	--	--	0	--
Color (Pt-Co)[2]	0	--	--	--	--	--	0	--
pH	4.1	--	5.7	5.4	4.5	--	4.1	6.1
Temperature								
°C	20	22	--	--	21	--	20	21
°F	69	72	--	--	70	--	69	70

Appendix B. (cont'd)

Well number	Fol-7	Fol-8	Fol-8	Fol-8	Fol-9	Fol-11	Fol-12	Fol-13
Date of collection	03-01-84	02-04-41[9]	08-21-45	03-14-66	03-01-84	05-09-84	05-09-84	06-05-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2,A_3)	Tmu (A_2)	Tmu (-)
Depth of interval sampled (ft)	61-71	94-134	94-134	94-134	85-105	139-174, 435-498	164	1,662-1,672
Silica (SiO_2)	--	4.2	--	7.2	--	--	--	--
Iron (Fe)	--	.35	--	.05	--	.08	--	6.2
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	.3	--	.5	--	1.0	--	630
Magnesium (Mg)	--	.6	--	.9	--	.6	--	450
Sodium (Na)	--	--	--	6.5	--	2.3	--	12,400
Potassium (K)	--	--	--	.4	--	.1	--	130
Bicarbonate (HCO_3)	0	0	4	3	0	0	0	220
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	.2	--	1.0	--	0	--	0
Chloride (Cl)	18	7.6	6.0	7.3	10	4.2	18	22,000
Fluoride (F)	--	--	.0	.0	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	.05	--	130
Dissolved solids	--	33	--	30	--	33	--	36,900
Hardness (as $CaCO_3$) Calcium, magnesium	--	3[3]	3	5[3]	--	5[3]	--	3,430[3]
Specific conductance (micromhos at 25°C)	91	--	--	42	41	29	95	47,270
Turbidity (NTU)[1]	--	--	--	--	10	0	55	--
Color (Pt-Co)[2]	--	--	--	--	35	0	200	--
pH	4.3	5.0	--	5.2	4.5	3.9	4.3	6.2
Temperature								
°C	21	--	--	21	20	19	--	24
°F	70	--	--	70	69	66	--	75

Appendix B. (cont'd)

Well number	Fol-14	Fol-14	Fol-14	Fol-14	For-1	For-1	For-1	For-2
Date of collection	05-12-49[10]	05-23-49[10]	05-23-49[5]	03-14-66	06-28-66	09-22-69[11]	02-01-84	09-13-82[5]
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (-)	Tmu (-)	Tmu (-)	Qalt (A_1)
Depth of interval sampled (ft)	429	633	633	93-133	1,513	1,513	1,513	20±
Silica (SiO_2)	--	9.0	--	--	--	--	--	--
Iron (Fe)	.2	.1	.1	.07	.84	--	.30	1.1
Manganese (Mn)	--	--	--	--	--	--	--	.04
Calcium (Ca)	6.0	4.0	--	--	--	--	230	--
Magnesium (Mg)	6.0	4.0	--	--	--	--	110	--
Sodium (Na)	42	38	--	--	--	--	4,900	--
Potassium (K)	--	--	--	--	--	--	28	--
Bicarbonate (HCO_3)	90	110	130	4[3]	380	--	350	120
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	8.0	12	--	--	--	--	0	--
Chloride (Cl)	6.0	11	--	7.8	4,400	12,100	7,800	57
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	42	18	6	29	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	8.4	--
Dissolved solids	303	171	--	--	--	15,014	13,070	--
Hardness (as $CaCO_3$) Calcium, magnesium	40[3]	18[3]	--	8	910	--	1,030[3]	--
Specific conductance (micromhos at 25°C)	--	--	--	43	20,700	--	20,000	--
Turbidity (NTU)[1]	--	--	--	--	--	--	10	--
Color (Pt-Co)[2]	--	--	--	--	--	--	30	--
pH	4.7	6.5	7.0	5.4	7.6	7.2	6.9	6.7
Temperature								
°C	--	--	--	21	28	--	27	--
°F	--	--	--	70	82	--	81	--

Appendix B. (cont'd)

Well number	For-2	For-2	For-3	For-3	For-4	For-5	For-5	Gat-1
Date of collection	09-14-82[5]	02-01-84	08-21-57	02-01-84	02-01-84	02-01-84	05-14-84	10-05-57
Water-bearing unit	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Tmu (A_2)
Depth of interval sampled (ft)	20±	20±	16-21	20±	20±	20±	20±	92-97
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	1.3	--	--	.05	--	--	.15	--
Manganese (Mn)	.00	--	--	--	--	--	.01	--
Calcium (Ca)	--	--	--	58	--	--	84	--
Magnesium (Mg)	--	--	--	13	--	--	6.8	--
Sodium (Na)	--	--	--	72	--	--	25	--
Potassium (K)	--	--	--	5.6	--	--	2.3	--
Bicarbonate (HCO_3)	--	76	--	200	260	280	270	--
Carbonate (CO_3)	--	0	--	0	0	0	0	--
Sulfate (SO_4)	--	--	--	24	--	--	20	--
Chloride (Cl)	--	32	18	110	42	45	20	11
Fluoride (F)	--	--	--	--	--	--	.2	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	.40	--	--	.47	--
Dissolved solids	--	--	--	473	--	--	298	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	240	200[3]	--	--	240[3]	16
Specific conductance (micromhos at 25°C)	--	195	--	740	560	500	480	--
Turbidity (NTU)[1]	--	32	--	2	20	5	--	--
Color (Pt-Co)[2]	--	125	--	10	60	15	--	--
pH	--	6.5	6.8	7.3	6.8	6.9	7.0	6.7
Temperature								
°C	--	--	--	20	--	--	23	--
°F	--	--	--	68	--	--	73	--

Appendix B. (cont'd)

Well number	Gat-1	Gul-1	Gul-1	Gul-2	Gul-3	Gul-3	Gul-3	Gul-4
Date of collection	05-18-66	03-13-84	03-13-85	03-14-84	03-14-66	09-30-71[5]	03-26-84	11-29-67[5]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	92-97	199-219	199-219	86-106	72-93	72-93	72-93	103-128
Silica (SiO_2)	--	--	21	--	--	--	--	--
Iron (Fe)	.10	.76	.90	--	2.2	.33	1.4	.45
Manganese (Mn)	--	--	.02	--	--	.00	--	.02
Calcium (Ca)	--	4.3	.6	--	--	19	1.7	--
Magnesium (Mg)	--	7.7	.1	--	--	1.2	1.0	--
Sodium (Na)	--	3.0	3.7	--	--	--	6.4	--
Potassium (K)	--	2.3	2.0	--	--	--	3.0	--
Bicarbonate (HCO_3)	6	0	--	0	3	61[3]	3	6[3]
Carbonate (CO_3)	0	0	--	0	0	0	0	0
Sulfate (SO_4)	--	2.5	3.9	--	--	.0	.0	--
Chloride (Cl)	3.4	3.8	3.6	5.0	14	14	12	8.0
Fluoride (F)	--	--	.0	--	--	.1	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	19	--	--
Strontium (Sr)	--	.07	.02	--	--	--	.06	--
Dissolved solids	--	24	--	--	--	70	22	--
Hardness (as $CaCO_3$) Calcium, magnesium	5	42[3]	2[3]	--	10	53[3]	8[3]	--
Specific conductance (micromhos at 25°C)	20	43	42	49	50	--	63	--
Turbidity (NTU)[1]	--	5	--	0	--	--	0	--
Color (Pt-Co)[2]	--	10	--	0	--	--	0	--
pH	7.0	4.4	--	4.1	5.4	6.2	4.6	5.5
Temperature								
°C	22	21	22	20	21	--	21	--
°F	71	71	72	69	70	--	70	--

Appendix B. (cont'd)

Well number	Gul-4	Gul-4	Gul-4	Gul-4	Gul-4	Gul-4	Gul-4	Gul-4
Date of collection	11-30-67[5]	12-08-67[5]	12-08-67[5]	12-11-67[5]	12-21-67[6]	02-04-69[5]	02-04-69[5]	02-04-69[5]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	103-128	103-128	103-128	103-128	103-128	103-128	103-128	103-128
Silica (SiO_2)	--	--	--	--	8.0	--	--	--
Iron (Fe)	.07	.02	.04	.02	.03	.35	.42	.44
Manganese (Mn)	.03	--	.00	.04	.00	.00	.00	.00
Calcium (Ca)	--	--	--	.8	.8	--	--	--
Magnesium (Mg)	--	--	--	--	1.2	--	--	--
Sodium (Na)	--	--	--	--	12	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	3[3]	--	5[3]	5[3]	7[3]	7[3]	5[3]	5[3]
Carbonate (CO_3)	0	--	0	0	0	0	0	0
Sulfate (SO_4)	--	--	.0	4.0	9.0	--	--	--
Chloride (Cl)	7.0	--	4.0	14	14	--	--	--
Fluoride (F)	--	--	.8	.0	.0	--	--	--
Carbon dioxide (CO_2)	--	--	--	110	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	56	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	4[3]	7[3]	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--
Turbidity (NTU)[1]	--	--	--	--	--	--	--	--
Color (Pt-Co)[2]	--	--	--	--	--	--	--	--
pH	5.3	--	5.3	--	5.0	5.9	5.6	5.6
Temperature								
°C	--	--	--	--	--	--	--	--
°F	--	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-4	Gul-4	Gul-4	Gul-4	Gul-5	Gul-5	Gul-5	Gul-5
Date of collection	05-07-70[5]	10-16-70[5]	10-08-71[5]	03-26-84	10-23-75[12]	10-24-75[12]	10-29-75[12]	04-20-76[12]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	103-128	103-128	103-128	103-128	320-400	182-216	182-216	185-215
Silica (SiO_2)	--	--	--	--	15	19	18	18
Iron (Fe)	.39	.30	.33	.27	.03	.78	.87	1.1
Manganese (Mn)	.00	.06	.00	--	.00	.00	.00	.00
Calcium (Ca)	--	--	19	1.1	.1	1.5	3.2	3.4
Magnesium (Mg)	--	--	1.2	1.0	.2	.5	.1	.3
Sodium (Na)	--	--	--	5.9	4.2	4.2	4.0	3.8
Potassium (K)	--	--	--	.3	.5	1.5	1.0	1.0
Bicarbonate (HCO_3)	6[3]	5[3]	61[3]	2	12[3]	11[3]	12[3]	12[3]
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	.0	.0	2.5	10	6.7	6.8
Chloride (Cl)	--	--	14	10	7.6	8.1	8.0	7.0
Fluoride (F)	--	--	.1	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	19	--	4	24	26	45
Strontium (Sr)	--	--	--	.05	--	--	--	--
Dissolved solids	--	--	70	17	38	57	16	66
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	50[3]	6[3]	1[3]	6[3]	9[3]	10[3]
Specific conductance (micromhos at 25°C)	--	--	--	46	--	--	--	--
Turbidity (NTU)[1]	--	--	--	0	--	--	--	--
Color (Pt-Co)[2]	--	--	--	0	--	--	--	--
pH	5.6	5.4	6.2	4.6	6.6	5.8	5.9	5.6
Temperature								
°C	--	--	--	21	--	--	--	--
°F	--	--	--	70	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-5	Gul-6	Gul-6	Gul-6	Gul-7	Gul-7	Gul-7	Gul-8
Date of collection	03-26-84	03-15-79	06-19-79[12]	06-07-84	04-11-84	04-26-84[12]	04-26-84	03-27-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)
Depth of interval sampled (ft)	185-215	175-205	175-205	175-205	160-200	300-340	300-340	58-63
Silica (SiO_2)	--	--	13	--	--	11	--	--
Iron (Fe)	.87	1.5	.22	.19	.22	.18	.17	--
Manganese (Mn)	--	.01	.02	--	--	.00	--	--
Calcium (Ca)	2.2	1.2	1.5	1.6	1.7	.7	1.0	--
Magnesium (Mg)	.8	.4	2.2	.5	.6	.8	.6	--
Sodium (Na)	4.5	1.9	4.1	4.2	4.7	2.7	2.8	--
Potassium (K)	1.9	.5	.6	.6	.5	.9	.7	--
Bicarbonate (HCO_3)	8	10	6[3]	0	0	17	2	13
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	2.8	3.4	3.2	1.8	5.6	8.0	.8	--
Chloride (Cl)	7.0	7.1	2.0	6.8	8.0	6.0	5.0	15
Fluoride (F)	--	.0	.0	--	--	.02	--	--
Carbon dioxide (CO_2)	--	--	31	--	--	10	--	--
Strontium (Sr)	.07	--	--	.03	.05	--	.03	--
Dissolved solids	42	--	44	43	19	34	40	--
Hardness (as $CaCO_3$) Calcium, magnesium	9[3]	5[3]	13[3]	6[3]	6[3]	7	5[3]	--
Specific conductance (micromhos at 25°C)	54	44	--	51	44	--	38	64
Turbidity (NTU)[1]	0	--	--	0	5	--	--	0
Color (Pt-Co)[2]	0	--	--	0	20	--	--	0
pH	5.1	5.1	5.2	3.5	3.7	5.5	6.0	5.1
Temperature								
°C	21	22	--	22	--	--	--	21
°F	71	72	--	72	--	--	--	70

Appendix B. (cont'd)

Well number	Gul-9	Gul-10	Gul-13	Gul-14	Gul-15	Gul-16	Gul-17	Gul-18
Date of collection	03-27-84	03-27-84	03-27-84	03-27-84	01-18-67	03-29-84	03-28-84	03-29-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	50-80	60-80	41-46	50-55	100	76-81	44	74-84
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	.27	--	--	.47
Manganese (Mn)	--	--	--	--	.04	--	--	--
Calcium (Ca)	--	--	--	--	2.4	--	--	1.0
Magnesium (Mg)	--	--	--	--	--	--	--	.8
Sodium (Na)	--	--	--	--	--	--	--	5.5
Potassium (K)	--	--	--	--	--	--	--	.2
Bicarbonate (HCO_3)	10	12	14	6	7	0	0	7
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	--	.0	--	--	.0
Chloride (Cl)	15	18	25	18	12	12	20	8.9
Fluoride (F)	--	--	--	--	.0	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	.06
Dissolved solids	--	--	--	--	68	--	--	35
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	--	--	--	--	6[3]
Specific conductance (micromhos at 25°C)	65	66	78	75	--	47	135	48
Turbidity (NTU)[1]	0	0	0	0	--	0	5	5
Color (Pt-Co)[2]	10	0	0	0	--	0	10	10
pH	5.1	5.0	5.2	5.0	5.3	3.5	3.3	5.6
Temperature								
°C	21	--	21	21	--	18	--	20
°F	71	--	71	71	--	65	--	69

Appendix B. (cont'd)

Well number	Gul-19	Gul-19	Gul-20	Gul-22	Gul-22	Gul-22	Gul-22	Gul-22
Date of collection	03-15-79	03-30-84	03-15-79	06-24-81[13]	07-02-81[13]	07-10-81	04-09-84	11-07-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Qalt (A_1)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	196-201	196-201	35	100-120	100-120	100-120	100-120	100-120
Silica (SiO_2)	--	--	5.5	--	6.0	9.1	--	9.8
Iron (Fe)	5.0	--	69	--	.14	.02	.13	.17
Manganese (Mn)	.00	--	.10	--	.00	.01	--	.01
Calcium (Ca)	2.6	--	120	--	3.6	.4	1.5	1.2
Magnesium (Mg)	.6	--	290	--	.7	.7	1.7	2.0
Sodium (Na)	13	--	95	--	8.7	5.4	10	12
Potassium (K)	1.3	--	14	--	--	.4	.4	.5
Bicarbonate (HCO_3)	8	0	190	--	15	2	0	0
Carbonate (CO_3)	0	0	0	--	0	0	0	0
Sulfate (SO_4)	4.3	--	630	--	<1.0	.0	.0	7.0
Chloride (Cl)	5.8	10	29	--	6.0	5.2	19	20
Fluoride (F)	.1	--	.1	.1	.1	--	--	.0
Carbon dioxide (CO_2)	--	--	--	--	252	--	--	--
Strontium (Sr)	--	--	--	--	--	.05	.05	.01
Dissolved solids	46	--	1,100	--	38	--	66	54
Hardness (as $CaCO_3$) Calcium, magnesium	9[3]	--	1,500[3]	--	12[3]	4[3]	10[3]	11[3]
Specific conductance (micromhos at 25°C)	71	51	1,690	--	--	41	82	90
Turbidity (NTU)[1]	--	0	--	.5	.1	--	0	--
Color (Pt-Co)[2]	--	0	--	--	0	--	0	--
pH	6.8	4.5	6.4	--	5.0	4.8	3.8	4.5
Temperature								
°C	--	21	17	--	--	26	--	21
°F	--	70	63	--	--	79	--	71

Appendix B. (cont'd)

Well number	Gul-23	Gul-23	Gul-23	Gul-23	Gul-23	Gul-23	Gul-24	Gul-24
Date of collection	11-06-83[5]	11-09-83[13]	11-14-83[13]	11-28-83	04-09-84	05-14-84	04-10-79[12]	04-11-79[12]
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)
Depth of interval sampled (ft)	331-407	331-407	331-407	331-407	331-407	331-407	338-370	338-370
Silica (SiO_2)	--	9.88	8.85	19	--	11	--	--
Iron (Fe)	2.6	.28	.69	2.1	3.2	6.5	3.6	2.9
Manganese (Mn)	.06	.00	.00	--	--	.12	--	--
Calcium (Ca)	14	10	18	13	17	17	--	--
Magnesium (Mg)	2.0	1.4	3.3	1.6	1.6	1.7	--	--
Sodium (Na)	10	9.3	9.0	13	12	12	--	--
Potassium (K)	--	2.9	2.7	2.4	2.1	2.2	--	--
Bicarbonate (HCO_3)	50[3]	44	44	85	64	88	--	--
Carbonate (CO_3)	0	0	0	0	0	0	--	--
Sulfate (SO_4)	7.0	18	2.7	3.8	2.8	.0	--	--
Chloride (Cl)	6.0	12	12	5.4	5.0	5.5	6.0	5.0
Fluoride (F)	.2	.1	.0	.1	--	<.1	--	--
Carbon dioxide (CO_2)	--	18.5	1.49	--	--	--	--	--
Strontium (Sr)	--	--	--	--	.13	.18	--	--
Dissolved solids	--	70	70	100	120	93	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	43[3]	31[3]	57[3]	39[3]	49[3]	50[3]	--	--
Specific conductance (micromhos at 25°C)	105	--	--	160	150	170	--	--
Turbidity (NTU)[1]	--	29	21	--	10	--	--	--
Color (Pt-Co)[2]	70	50	5	--	20	--	--	--
pH	6.4	6.6	7.7	6.4	5.6	6.4	--	--
Temperature								
°C	--	--	--	20	21	22	--	--
°F	--	--	--	68	71	72	--	--

Appendix B. (cont'd)

Well number	Gul-24	Gul-24	Gul-24	Gul-24	Gul-24	Gul-24	Gul-24	Gul-24
Date of collection	04-11-79[13]	04-11-79[13]	06-11-79[13]	06-13-79[13]	06-18-79[13]	06-20-79[13]	06-29-79[13]	07-05-79[13]
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)
Depth of interval sampled (ft)	338-370	338-370	338-370	338-370	338-370	338-370	338-370	338-370
Silica (SiO_2)	22	--	20	23	24	24	--	--
Iron (Fe)	.75	--	1.7	1.1	2.7	2.3	2.7	2.4
Manganese (Mn)	<.05	--	<.05	<.05	<.05	<.05	<.05	<.1
Calcium (Ca)	9.6	--	9.6	11	11	9.6	--	--
Magnesium (Mg)	2.7	--	1.7	1.5	1.5	2.2	--	--
Sodium (Na)	6.9	--	7.5	6.9	6.0	6.9	--	--
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	46	--	51	48	51	48	--	--
Carbonate (CO_3)	0	--	0	0	0	0	--	--
Sulfate (SO_4)	8.0	--	8.0	5.5	7.0	5.5	--	--
Chloride (Cl)	7.0	--	3.0	2.0	6.0	3.0	--	--
Fluoride (F)	.71	.06	.06	.06	.04	.05	--	--
Carbon dioxide (CO_2)	61	--	54	--	--	128	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	75	--	80	85	103	80	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	35[3]	--	31[3]	33[3]	33[3]	33[3]	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--
Turbidity (NTU)[1]	.8	--	16	8	22	15	40	33
Color (Pt-Co)[2]	0	--	2	0	3	5	--	--
pH	6.1	--	6.2	6.2	5.9	5.8	--	--
Temperature								
°C	--	--	--	--	--	--	--	--
°F	--	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-24	Gul-24	Gul-25	Gul-25	Gul-25	Gul-25	Gul-25	Gul-25
Date of collection	04-19-84	11-07-84	02-07-74[5]	02-22-74[5]	02-27-74[5]	02-27-74[5]	02-27-74[5]	02-27-74[5]
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	338-370	338-370	120-140	120-140	120-140	120-140	120-140	120-140
Silica (SiO_2)	--	.2	--	--	--	--	--	--
Iron (Fe)	--	.07	.20	<.10	.10	<.10	<.10	<.10
Manganese (Mn)	--	.12	<.10	<.03	<.03	<.03	<.03	<.03
Calcium (Ca)	--	5.7	1.2	.8	--	--	--	--
Magnesium (Mg)	--	0.6	.7	.5	--	--	--	--
Sodium (Na)	--	7.5	4.0	5.0	--	--	--	--
Potassium (K)	--	2.7	--	--	--	--	--	--
Bicarbonate (HCO_3)	60	27	4[3]	6[3]	7[3]	9[3]	9[3]	9[3]
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	10	24	6.0	--	--	--	--
Chloride (Cl)	7.5	3.5	14	9.5	7.0	8.0	7.0	7.0
Fluoride (F)	--	.0	.3	.0	--	--	--	--
Carbon dioxide (CO_2)	--	--	34	--	--	--	--	--
Strontium (Sr)	--	.03	--	--	--	--	--	--
Dissolved solids	--	44	<1	152	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	17[3]	6[3]	5[3]	--	--	--	--
Specific conductance (micromhos at 25°C)	126	100	--	--	--	--	--	--
Turbidity (NTU)[1]	230	--	--	--	--	--	--	--
Color (Pt-Co)[2]	430	--	--	--	--	--	--	--
pH	5.6	8.0	5.1	5.1	5.5	5.4	5.4	5.4
Temperature								
°C	21	23	--	--	--	--	--	--
°F	71	73	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-25	Gul-25	Gul-25	Gul-25	Gul-25	Gul-25	Gul-25	Gul-25
Date of collection	02-27-74[5]	02-28-74[5]	02-28-74[5]	02-28-74[5]	02-28-74[5]	02-28-74[5]	02-28-74[5]	09-05-74[13]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	120-140	120-140	120-140	120-140	120-140	120-140	120-140	120-140
Silica (SiO_2)	--	--	--	--	--	--	--	10
Iron (Fe)	<.10	<.10	<.10	<.10	<.10	<.10	<.10	.10
Manganese (Mn)	<.03	<.03	<.03	<.03	<.03	<.03	<.03	0
Calcium (Ca)	--	--	--	--	--	--	--	1.6
Magnesium (Mg)	--	--	--	--	--	--	--	1.0
Sodium (Na)	--	--	--	--	--	--	--	4.3
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	6[3]	7[3]	7[3]	6[3]	6[3]	7[3]	7[3]	15
Carbonate (CO_3)	0				0	0	0	0
Sulfate (SO_4)	--	--	--	--	--	--	--	.0
Chloride (Cl)	7.0	7.0	7.0	7.0	7.0	7.5	7.0	3.0
Fluoride (F)	--	--	--	--	--	--	--	.06
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	--	--	--	33
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	--	--	--	--	8[3]
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--
Turbidity (NTU)[1]	--	--	--	--	--	--	--	0
Color (Pt-Co)[2]	--	--	--	--	--	--	--	0
pH	5.2	6.3	6.5	5.4	5.6	5.5	5.4	5.8
Temperature								
°C	--	--	--	--	--	--	--	--
°F	--	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-25	Gul-25	Gul-25	Gul-25	Gul-25	Gul-32	Gul-33	Gul-33
Date of collection	09-17-75[5]	02-05-77	02-06-77	02-07-77	04-09-84	1975[12]	09-18-70[6]	09-21-70[6]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	120-140	120-140	120-140	120-140	120-140	142-162	100-120	100-120
Silica (SiO_2)	--	--	--	--	--	--	12	9
Iron (Fe)	.10	--	--	--	.22	.47	.24	.22
Manganese (Mn)	<.05	--	--	--	--	--	.00	.00
Calcium (Ca)	.4	--	--	--	1.4	--	2.4	.8
Magnesium (Mg)	.5	--	--	--	1.6	--	6.3	6.3
Sodium (Na)	4.0	--	--	--	5.0	--	2.4	2.9
Potassium (K)	--	--	--	--	.1	--	--	--
Bicarbonate (HCO_3)	4[3]	--	--	--	0	--	7[3]	17[3]
Carbonate (CO_3)	0	--	--	--	0	--	0	0
Sulfate (SO_4)	<2.0	--	--	--	.0	--	.0	.0
Chloride (Cl)	9.8	7.0	7.0	7.2	3.1	10	19	18
Fluoride (F)	.05	--	--	--	--	--	.0	.0
Carbon dioxide (CO_2)	--	--	--	--	--	--	40	160
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	3	--	56	40
Hardness (as $CaCO_3$) Calcium, magnesium	3[3]	--	--	--	10[3]	2	32[3]	28[3]
Specific conductance (micromhos at 25°C)	28	32	33	31	38	--	--	--
Turbidity (NTU)[1]	--	--	--	--	0	5	--	--
Color (Pt-Co)[2]	--	--	--	--	0	--	--	--
pH	5.3	--	--	--	3.9	5.3	5.5	5.2
Temperature								
°C	--	--	--	--	20	--	--	--
°F	--	--	--	--	69	--	--	--

Appendix B. (cont'd)

Well number	Gul-34	Gul-35	Gul-36	Gul-36	Gul-36	Gul-36	Gul-36	Gul-36
Date of collection	04-11-84	04-11-84	01-11-78	01-22-78	02-02-78	02-10-78	04-11-84	06-07-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)
Depth of interval sampled (ft)	145-165	70-90	415	415	415	415	415	415
Silica (SiO_2)	--	--	26	20	26	22	--	--
Iron (Fe)	.09	5.1	10.0	7.0	12.0	8.0	.03	.08
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	780	88	17	26	15	12	19	17
Magnesium (Mg)	3.3	310	5.2	4.8	4.3	5.1	5.6	5.7
Sodium (Na)	4,200	2,000	19	17	17	15	17	18
Potassium (K)	170	60	4.5	4.0	4.0	3.9	4.1	4.5
Bicarbonate (HCO_3)	--	60	43	52	60	49	44	50
Carbonate (CO_3)	--	0	0	0	0	0	0	0
Sulfate (SO_4)	.5	620	6.0	4.4	5.6	2.4	.0	.0
Chloride (Cl)	8,000	3,700	56	45	44	45	49	47
Fluoride (F)	--	--	.1	.1	.1	.1	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	5.3	1.9	--	--	--	--	.17	.20
Dissolved solids	14,730	7,090	128	186	221	190	166	153
Hardness (as $CaCO_3$) Calcium, magnesium	1,960 [3]	1,500 [3]	64 [3]	85 [3]	55 [3]	51 [3]	71 [3]	66 [3]
Specific conductance (micromhos at 25°C)	9,300	5,800	270	235	234	237	272	280
Turbidity (NTU) [1]	260	0	--	--	--	--	--	--
Color (Pt-Co) [2]	760	130	--	--	--	--	--	--
pH	10.2	6.2	6.1	6.2	6.2	6.2	6.5	6.7
Temperature								
°C	18	--	--	--	--	--	22	--
°F	64	--	--	--	--	--	73	--

Appendix B. (cont'd)

Well number	Gul-37	Gul-37	Gul-37	Gul-38	Gul-38	Gul-38	Gul-39	Gul-39
Date of collection	01-10-78	02-10-78	04-11-84	01-11-78	02-10-78	04-11-84	09-26-57	04-19-66[5]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_1)	Tmu (A_1)
Depth of interval sampled (ft)	120-140	120-140	120-140	628-648	628-648	628-648	29-33	29-33
Silica (SiO_2)	14	16	--	1.1	4.5	--	--	--
Iron (Fe)	.18	.18	.07	.06	.04	.04	--	.02
Manganese (Mn)	--	--	--	--	--	--	--	.0
Calcium (Ca)	100	110	70	5.8	94	18	--	1.0
Magnesium (Mg)	150	110	84	4.7	83	7.0	--	1.0
Sodium (Na)	1,200	940	810	170	1,000	150	--	--
Potassium (K)	50	44	4.3	9	42	100	--	--
Bicarbonate (HCO_3)	182	171	204	20	130	70	--	5[3]
Carbonate (CO_3)	0	0	0	0	0	0	--	0
Sulfate (SO_4)	120	160	140	3.2	120	1.8	--	4.0
Chloride (Cl)	2,000	2,400	1,500	200	1,600	270	18	14
Fluoride (F)	.1	.1	--	.1	.1	--	--	.1
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	12
Strontium (Sr)	--	--	.42	--	--	--	--	--
Dissolved solids	3,690	3,570	2,947	602	3,490	196	--	28
Hardness (as $CaCO_3$) Calcium, magnesium	870[3]	730[3]	520[3]	34[3]	580[3]	74[3]	--	7[3]
Specific conductance (micromhos at 25°C)	6,730	6,250	3,000	956	4,680	770	--	--
Turbidity (NTU)[1]	--	--	--	--	--	10	--	--
Color (Pt-Co)[2]	--	--	--	--	--	120	--	--
pH	7.0	7.1	7.0	6.8	7.7	9.3	7.8	5.2
Temperature								
°C	--	--	20	--	--	--	21	--
°F	--	--	68	--	--	--	71	--

Appendix B. (cont'd)

Well number	Gul-39	Gul-40	Gul-40	Gul-40	Gul-41	Gul-41	Gul-41	Gul-42
Date of collection	04-11-84	09-06-83[12]	04-12-84	03-12-85	07-20-83[12]	04-12-84	03-12-85	04-12-84
Water-bearing unit	Qalt (A_1)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	29-33	280-315	280-315	280-315	100-130	100-130	100-130	35-40
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	2.3	--	--	.20	--	.69	--
Manganese (Mn)	--	.08	--	--	.02	--	.05	--
Calcium (Ca)	--	1.9	--	--	.5	--	1.4	--
Magnesium (Mg)	--	2.0	--	--	.7	--	1.4	--
Sodium (Na)	--	5.5	--	--	7.5	--	15	--
Potassium (K)	--	2.8	--	--	.2	--	3	--
Bicarbonate (HCO_3)	38	27[3]	32	--	12[3]	0	-	0
Carbonate (CO_3)	0	0	0	--	0	0	--	0
Sulfate (SO_4)	--	--	--	0	--	--	.0	--
Chloride (Cl)	18	6.2	10	4.8	10	10	8.0	10
Fluoride (F)	--	.00	--	--	.04	--	.02	--
Carbon dioxide (CO_2)	--	51	--	--	50	--	--	--
Strontium (Sr)	--	--	--	--	--	--	.01	--
Dissolved solids	--	68.8	--	--	42	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	13[3]	--	--	4[3]	--	9[3]	--
Specific conductance (micromhos at 25°C)	112	--	73	83	--	47	51	95
Turbidity (NTU)[1]	130	--	0	--	--	0	--	0
Color (Pt-Co)[2]	300	--	0	--	--	0	--	0
pH	6.2	5.9	5.7	7.0	5.4	4.3	--	3.9
Temperature								
°C	20	--	18	22	--	18	22	20
°F	68	--	64	72	--	64	72	68

Appendix B. (cont'd)

Well number	Gul-43	Gul-43	Gul-44	Gul-44	Gul-45	Gul-45	Gul-45	Gul-45
Date of collection	10-07-75[15]	06-07-84	07-28-77	04-12-84	07-20-83[12]	09-29-83[12]	10-05-83[12]	10-07-83[12]
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	324-366, 386-428	324-366, 386-428	500	500	180-215	180-215	180-215	180-215
Silica (SiO_2)	--	--	--	--	--	2.7	16	--
Iron (Fe)	.65	.25	1.9	1.8	.20	.23	.21	.20
Manganese (Mn)	--	--	--	--	.00	.02	.02	.00
Calcium (Ca)	1.9	2.6	--	1.8	.7	1.3	1.9	--
Magnesium (Mg)	.9	.6	--	.7	.6	1.0	1.0	--
Sodium (Na)	4.4	4.2	--	4.3	4.9	6.1	5.1	4.4
Potassium (K)	--	.7	--	1.6	1.7	2.4	2.0	--
Bicarbonate (HCO_3)	14	0	--	2	13[3]	12[3]	11[3]	11[3]
Carbonate (CO_3)	0	0	--	0	0	0	0	0
Sulfate (SO_4)	15	1.6	--	3.6	--	6.0	7.0	3.0
Chloride (Cl)	8.0	5.4	7.2	5.8	9.0	7.5	8.4	8.0
Fluoride (F)	.12	--	--	--	.1	.0	.0	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	9	--
Strontium (Sr)	--	.04	--	.03	--	--	--	--
Dissolved solids	--	46	--	28	42	44	41	43
Hardness (as $CaCO_3$) Calcium, magnesium	9[3]	9[3]	--	8[3]	4[3]	7[3]	9[3]	--
Specific conductance (micromhos at 25°C)	--	48	--	52	--	--	--	--
Turbidity (NTU)[1]	--	12	--	0	--	4.6	.9	--
Color (Pt-Co)[2]	--	55	--	0	--	1	2	--
pH	6.3	4.1	--	4.6	5.4	5.6	5.6	5.3
Temperature								
°C	--	23	--	22	--	--	--	--
°F	--	74	--	72	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-45	Gul-45	Gul-46	Gul-46	Gul-46	Gul-46	Gul-46	Gul-46
Date of collection	10-10-83[12]	10-12-83[12]	07-15-83[12]	09-29-83[12]	10-05-83[12]	10-07-83[12]	10-10-83[12]	10-12-83[12]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	180-215	180-215	100-150	100-150	100-150	100-150	100-150	100-150
Silica (SiO_2)	--	--	--	10	10	--	--	--
Iron (Fe)	.18	.22	.10	.12	.12	.07	.05	.02
Manganese (Mn)	.02	.00	.01	.02	.06	.02	.00	.00
Calcium (Ca)	--	--	.7	.2	.4	--	--	--
Magnesium (Mg)	--	--	.7	1.0	1.1	--	--	--
Sodium (Na)	4.3	4.5	5.7	5.7	5.6	5.2	5.0	6.0
Potassium (K)	--	--	1.0	.3	.3	--	--	--
Bicarbonate (HCO_3)	7[3]	7[3]	16[3]	9[3]	11[3]	10[3]	7[3]	7[3]
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	7.0	13	--	0	0	0	0	0
Chloride (Cl)	7.5	8.2	9.5	10	9.6	10	10	9.6
Fluoride (F)	--	--	.05	.00	.00	--	--	--
Carbon dioxide (CO_2)	--	--	26	11	9	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	44	42	26.4	27	25.9	28.9	35.6	26.8
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	5[3]	5[3]	6[3]	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--
Turbidity (NTU)[1]	--	--	--	.0	.4	--	--	--
Color (Pt-Co)[2]	--	--	--	2	2	--	--	--
pH	5.3	5.3	5.7	5.4	5.5	5.4	5.3	5.3
Temperature								
°C	--	--	--	--	--	--	--	--
°F	--	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-47	Gul-48	Gul-48	Gul-48	Gul-48	Gul-48	Gul-49	Gul-49
Date of collection	04-12-84	06-07-77	06-18-77	06-29-77	06-30-77	04-03-84	02-01-71[14]	04-06-71[14]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	228-233	90-110	90-110	90-110	90-110	90-110	110-128	110-128
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	.1	1.5
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	3.3	--	--	--	--	--
Magnesium (Mg)	--	--	.9	--	--	--	--	--
Sodium (Na)	--	--	7.6	--	--	--	--	--
Potassium (K)	--	--	.9	--	--	--	--	--
Bicarbonate (HCO_3)	100	20	24	--	--	12	--	--
Carbonate (CO_3)	0	0	0	--	--	0	--	--
Sulfate (SO_4)	--	--	1.6	--	--	--	--	--
Chloride (Cl)	8.0	10	13	14	10	10	50	50
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	48	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	12[3]	--	--	--	0	34
Specific conductance (micromhos at 25°C)	190	83	79	132	57	74	--	--
Turbidity (NTU)[1]	0	--	--	--	--	10	--	--
Color (Pt-Co)[2]	0	--	--	--	--	45	--	--
pH	6.7	6.1	5.9	--	--	5.4	6.0	5.0
Temperature								
°C	20	--	--	--	--	21	--	--
°F	68	--	--	--	--	70	--	--

Appendix B. (cont'd)

Well number	Gul-49	Gul-49	Gul-49	Gul-49	Gul-49	Gul-49	Gul-49	Gul-49
Date of collection	04-06-71[5]	08-09-73	08-30-73	08-30-73	08-30-73	08-30-73	06-17-77	06-29-77
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	110-128	110-128	110-128	110-128	110-128	110-128	110-128	110-128
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	1.4	.21	1.3	--	--	--	--	--
Manganese (Mn)	.00	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	13	14
Magnesium (Mg)	--	--	--	--	--	--	31	36
Sodium (Na)	--	--	--	--	--	--	230	270
Potassium (K)	--	--	--	--	--	--	9.0	8.9
Bicarbonate (HCO_3)	7[3]	--	--	--	--	--	2	0
Carbonate (CO_3)	0	--	--	--	--	--	0	0
Sulfate (SO_4)	--	--	--	--	--	--	70	72
Chloride (Cl)	--	180	150	180	210	230	490	500
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	--	--	973	1,100
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	--	--	--	160[3]	180[3]
Specific conductance (micromhos at 25°C)	--	720	680	693	832	910	1,647	1,830
Turbidity (NTU)[1]	--	--	--	--	--	--	--	--
Color (Pt-Co)[2]	--	--	--	--	--	--	--	--
pH	5.3	--	--	--	--	--	4.7	4.5
Temperature								
°C	--	--	--	--	--	--	--	--
°F	--	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-49	Gul-49	Gul-49	Gul-49	Gul-49	Gul-49	Gul-50	Gul-50
Date of collection	06-29-77	06-30-77	06-30-77	09-01-83 [12]	04-12-84	11-29-84	12-08-67 [5]	12-08-67 [5]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	110-128	110-128	110-128	110-128	110-128	110-128	120-148	120-148
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	2.8	2.8	--	.02	.04
Manganese (Mn)	--	--	--	.05	--	--	--	.0
Calcium (Ca)	--	11	15	9.0	12	--	--	--
Magnesium (Mg)	--	38	38	2.7	28	--	--	--
Sodium (Na)	--	290	300	270	210	--	--	--
Potassium (K)	--	9.7	9.9	9.1	7.3	--	--	--
Bicarbonate (HCO_3)	--	.4	2	6	4	0	--	5
Carbonate (CO_3)	--	0	0	0	0	0	--	0
Sulfate (SO_4)	--	75	71	--	56	--	--	.0
Chloride (Cl)	540	520	550	500	410	100	--	4.0
Fluoride (F)	--	--	--	.25	--	--	--	.8
Carbon dioxide (CO_2)	--	--	--	8	--	--	--	--
Strontium (Sr)	--	--	--	--	.19	--	--	--
Dissolved solids	--	1,149	1,194	1,196	721	170	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	180[3]	190[3]	34[3]	140[3]	--	--	--
Specific conductance (micromhos at 25°C)	1,850	1,920	1,980	--	1,070	420	--	--
Turbidity (NTU)[1]	--	--	--	--	0	--	--	--
Color (Pt-Co)[2]	--	--	--	--	0	--	--	--
pH	--	4.6	4.6	5.1	5.2	3.7	--	5.3
Temperature								
°C	--	--	--	--	--	--	--	--
°F	--	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-50	Gul-50	Gul-50	Gul-50	Gul-50	Gul-50	Gul-50	Gul-50
Date of collection	02-08-71[5]	10-11-72[5]	08-30-73	08-30-73	08-30-73	08-30-73	06-17-77	09-01-83[12]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	120-148	120-148	120-148	120-148	120-148	120-148	120-148	120-148
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	.10	.08	.16	--	--	--	--	.01
Manganese (Mn)	.07	--	--	--	--	--	--	.00
Calcium (Ca)	--	--	--	--	--	--	.9	1.7
Magnesium (Mg)	--	--	--	--	--	--	.8	2.5
Sodium (Na)	--	--	--	--	--	--	5.7	27
Potassium (K)	--	--	--	--	--	--	.3	.8
Bicarbonate (HCO_3)	--	--	--	--	--	--	4	21[3]
Carbonate (CO_3)	--	--	--	--	--	--	0	0
Sulfate (SO_4)	--	--	--	--	--	--	--	--
Chloride (Cl)	12	15	7.6	7.4	7.4	7.4	9.4	45
Fluoride (F)	--	--	--	--	--	--	--	.06
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	6
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	--	--	38	133
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	--	--	--	6[3]	14[3]
Specific conductance (micromhos at 25°C)	--	--	33	35	33	35	38	--
Turbidity (NTU)[1]	--	--	--	--	--	--	--	--
Color (Pt-Co)[2]	--	--	--	--	--	--	--	--
pH	5.2	5.8	--	--	--	--	5.7	6.0
Temperature								
°C	--	--	--	--	--	--	--	--
°F	--	--	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Gul-50	Gul-50	Gul-51	Gul-51	Gul-51	Gul-52	Gul-53	Gul-53
Date of collection	04-12-84	11-29-84	12-06-77	05-23-78	03-16-79	10-27-76	04-12-84[15]	08-10-84[15]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Qalt (A_1)	Tmu (A_3)	Tmu (A_3)
Depth of interval sampled (ft)	120-148	120-148	508	508	508	32	235-345	270-320
Silica (SiO_2)	--	--	--	--	21	--	--	--
Iron (Fe)	.21	--	.25	.06	.23	--	.33	.16
Manganese (Mn)	--	--	--	.21	.02	--	.01	.02
Calcium (Ca)	2.8	--	--	40	43	--	--	1.2
Magnesium (Mg)	3.7	--	--	5.3	6.4	--	--	1.0
Sodium (Na)	22	9.2	--	30	22	--	5.3	2.8
Potassium (K)	.7	--	--	.6	4.7	--	--	--
Bicarbonate (HCO_3)	2	1	--	160	180	--	--	3
Carbonate (CO_3)	0	0	--	0	0	--	0	0
Sulfate (SO_4)	5.8	--	--	.8	2.2	--	3.8	3.8
Chloride (Cl)	45	18	--	4.8	4.4	12	8.2	4.3
Fluoride (F)	--	--	--	--	.1	--	.1	<.1
Carbon dioxide (CO_2)	--	--	--	--	--	--	0.8	22
Strontium (Sr)	.06	--	--	--	--	--	--	--
Dissolved solids	78	36	--	180	--	--	25	17
Hardness (as $CaCO_3$) Calcium, magnesium	22[3]	--	--	120[3]	130[3]	--	--	7
Specific conductance (micromhos at 25°C)	180	77	--	265	--	66	28	26
Turbidity (NTU)[1]	0	--	--	--	--	--	--	14
Color (Pt-Co)[2]	0	--	--	--	--	--	10	5
pH	5.2	4.7	--	7.9	7.5	5.6	6.2	5.1
Temperature								
°C	--	--	--	--	18	--	--	--
°F	--	--	--	--	65	--	--	--

Appendix B. (cont'd)

Well number	Gul-54	Gul-55	Gul-56	Gul-57	Gul-58	Gul-58	Gul-59	Gul-59
Date of collection	05-09-84	05-09-84	05-09-84	06-06-84	07-12-66	05-10-84	02-27-78	02-28-78
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	310-350	267-317	220-307	420-500	110-120	135-140	114-144	114-144
Silica (SiO_2)	--	--	--	--	--	--	14	13
Iron (Fe)	--	.15	.77	3.9	.03	--	.36	.27
Manganese (Mn)	--	--	--	--	--	--	0	--
Calcium (Ca)	--	1.5	1.4	2.3	--	--	45	28
Magnesium (Mg)	--	.6	.7	1.4	--	--	120	81
Sodium (Na)	--	3.3	3.9	7.3	--	--	1,000	680
Potassium (K)	--	.6	1.0	2.3	--	--	30	20
Bicarbonate (HCO_3)	0	0	0	16	4	0	0	0
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	2.0	3.0	4.8	--	--	250	150
Chloride (Cl)	7.5	5.0	5.4	3.4	11	10	1,900	1,300
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	.05	.00	.06	--	--	--	--
Dissolved solids	--	18	31	66	--	--	3,460	2,400
Hardness (as $CaCO_3$) Calcium, magnesium	--	6[3]	6[3]	12[3]	--	--	610[3]	400[3]
Specific conductance (micromhos at 25°C)	36	35	42	83	48	47	5,750	4,100
Turbidity (NTU)[1]	5	0	0	150	--	10	--	--
Color (Pt-Co)[2]	10	0	0	480	--	30	--	--
pH	3.7	3.6	3.8	5.1	5.4	4.1	4.5	4.4
Temperature								
°C	19	22	23	22	21	23	--	--
°F	66	73	73	72	70	73	--	--

Appendix B. (cont'd)

Well number	Gul-59	Gul-59	Gul-59	Gul-59	Gul-59	Gul-59	Gul-59	Gul-59
Date of collection	03-16-79	05-10-84	03-12-85	03-12-85	03-12-85	03-12-85	03-12-85	03-12-85
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	114-144	114-144	114-144	114-144	114-144	114-144	114-144	114-144
Silica (SiO_2)	15	--	1.4	--	--	--	--	1.2
Iron (Fe)	.35	.04	.27	--	--	--	--	.10
Manganese (Mn)	.05	--	--	--	--	--	--	.15
Calcium (Ca)	130	150	120	--	--	--	--	130
Magnesium (Mg)	330	490	420	--	--	--	--	450
Sodium (Na)	3,100	3,800	3,400	--	--	--	--	3,100
Potassium (K)	84	150	100	--	--	--	--	1,000
Bicarbonate (HCO_3)	0	0	--	--	--	--	--	--
Carbonate (CO_3)	0	0	--	--	--	--	--	--
Sulfate (SO_4)	630	100	810	820	830	820	850	840
Chloride (Cl)	5,100	7,200	4,500	4,500	4,700	5,000	4,900	5,100
Fluoride (F)	1.0	--	.1	--	--	--	--	.0
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	2.6	--	--	--	--	--	2.5
Dissolved solids	--	13,770	--	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	1,680[3]	2,390[3]	2,000[3]	--	--	--	--	2,180[3]
Specific conductance (micromhos at 25°C)	13,800	23,000	17,500	19,300	19,200	18,900	18,800	18,200
Turbidity (NTU)[1]	--	0	--	--	--	--	--	--
Color (Pt-Co)[2]	--	0	--	--	--	--	--	--
pH	4.2	4.1	--	6.0	6.0	6.1	6.1	--
Temperature								
°C	23	23	24	23	23	23	23	23
°F	73	73	75	73	73	73	73	73

Appendix B. (cont'd)

Well number	Gul-60	Gul-61	Gul-61	Gul-62	Gul-63	Gul-64	Gul-64	Gul-65
Date of collection	05-10-84	05-10-84	11-28-84	05-10-84	05-10-84	06-19-68	05-11-84	03-14-66[16]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	196-201	97-102	97-102	57-62	70-80	176-184	176-184	165-173
Silica (SiO_2)	--	--	--	--	--	--	--	25
Iron (Fe)	.10	.64	.01	.60	--	1.2	--	1.1
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	1.8	4.4	4.4	6.0	--	1.5	--	--
Magnesium (Mg)	1.8	16	17	19	--	1.0	--	--
Sodium (Na)	13	110	140	150	--	--	--	--
Potassium (K)	.7	1.4	2.2	2.2	--	--	--	--
Bicarbonate (HCO_3)	0	0	--	0	0	4	0	--
Carbonate (CO_3)	0	0	--	0	0	0	0	--
Sulfate (SO_4)	3.4	.0	8.8	6.5	--	4.6	--	8.1
Chloride (Cl)	24	210	230	290	380	6.0	7.5	3.9
Fluoride (F)	--	--	--	--	--	.0	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	.05	.12	--	.17	--	--	--	--
Dissolved solids	59	494	--	580	--	--	--	50
Hardness (as $CaCO_3$) Calcium, magnesium	12[3]	77[3]	81[3]	93[3]	--	8[3]	--	--
Specific conductance (micromhos at 25°C)	76	600	800	950	900	43	42	--
Turbidity (NTU)[1]	0	0	--	0	--	--	0	--
Color (Pt-Co)[2]	0	0	--	0	--	--	0	--
pH	3.9	3.7	--	4.1	4.1	5.5	3.9	5.7
Temperature								
°C	22	22	18	23	--	--	22	--
°F	72	72	64	73	--	--	73	--

Appendix B. (cont'd)

Well number	Gul-65	Gul-65	Gul-66	Gul-66	Gul-67	Gul-68	Gul-69	Gul-70
Date of collection	06-22-66	05-11-84	06-27-66	06-04-84	06-05-84	06-05-84	06-06-84	06-22-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (-)	Tmu (-)	Qalt (A_1)	Qalt (A_1)
Depth of interval sampled (ft)	165-173	165-173	57-60	57-60	1,689-1,693	1,326-1,336	16.5-19	17-22
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	1.1	--	.07	--	4.4	5.4	2.5	.08
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	1,100	500	3.3	52
Magnesium (Mg)	--	--	--	--	5.9	410	8.0	150
Sodium (Na)	--	--	--	--	14,500	10,300	57	1,200
Potassium (K)	--	--	--	--	190	91	1.6	67
Bicarbonate (HCO_3)	2	0	6	0	200	290	0	206
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	--	.0	.0	6.6	280
Chloride (Cl)	5.6	7.5	7.6	10	28,000	18,000	110	2,000
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	190	43	.06	.84
Dissolved solids	--	--	--	--	45,700	31,200	226	4,110
Hardness (as $CaCO_3$) Calcium, magnesium	8	--	8	--	2,770[3]	2,940[3]	12[3]	750[3]
Specific conductance (micromhos at 25°C)	47	47	42	72	55,390	41,330	380	4,650
Turbidity (NTU)[1]	--	0	--	0	--	--	15	20
Color (Pt-Co)[2]	--	0	--	0	--	--	62	80
pH	5.5	3.6	6.0	3.8	6.5	6.7	4.5	7.5
Temperature								
°C	22	22	19	20	26	31	23	24
°F	72	72	67	68	79	88	73	75

Appendix B. (cont'd)

Well number	Gul-72	Gul-72	Gul-72	Gul-73	Gul-74	Gul-75	Gul-76	Gul-77
Date of collection	12-24-46	12-27-46	07-16-66	06-07-84	06-07-84	06-07-84	06-08-84	06-19-84
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Qalt (A_1)	Qalt (A_1)	Tmu (A_2)
Depth of interval sampled (ft)	349-369	349-369	349-369	150	127-132	16-36	10	77-82
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	12	.04	2.1	.05	.29	--
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	1.1	11	1.6	18	--
Magnesium (Mg)	--	--	--	.8	2.8	1.1	6.7	--
Sodium (Na)	--	--	--	5.3	24	5.7	33	--
Potassium (K)	--	--	--	.1	2.8	1.0	2.3	--
Bicarbonate (HCO_3)	--	--	20	0	14	0	86	0
Carbonate (CO_3)	--	--	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	.0	2.2	6.6	9.4	--
Chloride (Cl)	130	130	63	8.6	60	8.2	58	5.0
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	.02	.08	.09	.12	--
Dissolved solids	--	--	--	40	188	39	246	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	45	6[3]	39[3]	8[3]	73[3]	--
Specific conductance (micromhos at 25°C)	--	--	244	50	230	67	400	39
Turbidity (NTU)[1]	--	--	--	4	100	8	70	0
Color (Pt-Co)[2]	--	--	--	6	260	30	280	0
pH	--	--	6.1	4.5	4.9	4.0	5.7	4.2
Temperature								

Appendix B. (cont'd)

Well number	Gul-78	Gul-79	Gul-80	Gul-81	Gul-81	Gul-82	Gul-84	Gul-84
Date of collection	06-20-84	06-20-84	06-19-84	01-18-67[5]	06-19-84	06-19-84	03-16-79	06-21-84
Water-bearing unit	Qalt (A_1)	Tmu (A_2)	Qalt (A_1)	Tmu (A_2)	--	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)
Depth of interval sampled (ft)	51-61	80-90	69-79	100	--	19-24	27-30	27-30
Silica (SiO_2)	--	--	--	--	--	--	5.2	--
Iron (Fe)	3.1	.25	8.1	.60	--	--	4.6	--
Manganese (Mn)	--	--	--	.10	--	--	.01	--
Calcium (Ca)	1.5	1.3	2.0	4	--	--	.1	--
Magnesium (Mg)	1.4	.9	1.5	--	--	--	.5	--
Sodium (Na)	10	6.6	10	--	--	--	2.8	--
Potassium (K)	.3	.2	.5	--	--	--	.1	--
Bicarbonate (HCO_3)	10	6	32	20	6	2	8	11
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	1.2	.8	.7	8	--	--	.8	--
Chloride (Cl)	18	11	18	13	18	10	10	10
Fluoride (F)	--	--	--	--	--	--	.0	--
Carbon dioxide (CO_2)	--	--	--	79	--	--	--	--
Strontium (Sr)	.12	.14	.05	--	--	--	--	--
Dissolved solids	57	37	55	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	10[3]	7[3]	11[3]	--	--	--	2[3]	--
Specific conductance (micromhos at 25°C)	80	51	106	--	75	94	52	53
Turbidity (NTU)[1]	0	15	0	--	0	0	--	0
Color (Pt-Co)[2]	0	50	0	--	0	0	--	0
pH	5.4	5.3	5.9	5.5	5.1	4.7	5.4	5.5
Temperature								
°C	--	--	25	--	--	--	19	22
°F	--	--	77	--	--	--	67	72

Appendix B. (cont'd)

Well number	Gul-85	Gul-86	Gul-87	Gul-88	Gul-89	Gul-90	Gul-91	Gul-93
Date of collection	02-10-78	07-16-84	07-16-84	08-05-66	07-16-84	07-18-84	07-18-84	07-27-84[17]
Water-bearing unit	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Qalt (A_1)	Qalt (A_1)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	413-423	55-60	92-97	104-108	18-23	15-17.5	76-86	110-120
Silica (SiO_2)	.6	--	--	--	--	--	--	--
Iron (Fe)	.06	--	--	1.3	--	.07	--	1.4
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	12	--	--	--	--	5.6	--	--
Magnesium (Mg)	4.7	--	--	--	--	11	--	--
Sodium (Na)	70	--	--	--	--	240	--	--
Potassium (K)	7	--	--	--	--	25	--	--
Bicarbonate (HCO_3)	56	4	6	6	6	200	0	--
Carbonate (CO_3)	0	0	0	0	0	0	0	--
Sulfate (SO_4)	16	--	--	--	--	4.4	--	.0
Chloride (Cl)	74	12	7.5	25	10	300	22	40
Fluoride (F)	.1	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	.15	--	--
Dissolved solids	428	--	--	--	--	779	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	50[3]	--	--	18	--	59[3]	--	--
Specific conductance (micromhos at 25°C)	650	41	44	105	66	1,250	136	--
Turbidity (NTU)[1]	--	0	25	--	15	65	0	--
Color (Pt-Co)[2]	--	0	140	--	90	380	0	--
pH	6.1	4.7	5.3	5.7	5.2	7.6	4.3	5.8
Temperature								
°C	--	23	29	22	27	22	23	--
°F	--	73	84	72	81	72	73	--

Appendix B. (cont'd)

Well number	Gul-94	Lil-2	Lil-2	Lil-2	Lil-2	Lil-2	Lil-3	Lil-3
Date of collection	07-30-84[17]	07-05-77[12]	07-06-77[12]	05-14-81[5]	06-28-82[5]	03-28-84	03-22-74[12]	04-04-74[12]
Water-bearing unit	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	115-120	260-300	260-300	260-300	260-300	260-300	240-270	240-270
Silica (SiO_2)	--	9.8	9.4	--	--	--	7.7	11
Iron (Fe)	.40	.03	.00	.15	.11	.25	.15	.00
Manganese (Mn)	--	.00	.00	.00	.00	--	.00	.00
Calcium (Ca)	--	1.5	1.5	16	16	1.6	1.0	.8
Magnesium (Mg)	--	.3	.2	.6	.6	.5	.6	.2
Sodium (Na)	--	3.4	3.4	3.0	3.0	2.9	3.0	2.8
Potassium (K)	--	.1	.0	--	--	.3	.5	.0
Bicarbonate (HCO_3)	--	12[3]	15[3]	54[3]	48[3]	0	11[3]	9[3]
Carbonate (CO_3)	--	0	0	0	0	0	0	0
Sulfate (SO_4)	.0	.4	.3	2.0	3.0	.0	4.1	.0
Chloride (Cl)	20	3.0	2.0	10	6.6	4.4	4.0	6.0
Fluoride (F)	--	.1	.1	.0	.9	--	.0	.0
Carbon dioxide (CO_2)	--	23	21	--	6.6	--	3	--
Strontium (Sr)	--	--	--	--	--	.04	--	--
Dissolved solids	--	31	28	--	--	6	45	10
Hardness (as $CaCO_3$) Calcium, magnesium	--	5[3]	4[3]	43[3]	43[3]	6[3]	5[3]	3[3]
Specific conductance (micromhos at 25°C)	--	--	--	100	94	27	--	--
Turbidity (NTU)[1]	--	--	--	--	--	0	--	--
Color (Pt-Co)[2]	--	--	--	5	5	5	--	--
pH	5.6	5.7	5.4	7.1	7.1	4.2	5.8	5.4
Temperature								
°C	--	--	--	--	--	21	--	--
°F	--	--	--	--	--	71	--	--

Appendix B. (cont'd)

Well number	Lil-3	Lil-3	Lil-3	Lil-3	Lil-3	Lil-3	Lil-4	Lil-5
Date of collection	04-04-74[5]	07-21-76[15]	10-04-76[15]	02-15-77[15]	07-27-82[5]	03-28-84	06-17-66	06-15-66
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	240-270	240-270	240-270	240-270	240-270	240-270	55-59	106-110
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	<.10	--	--	--	.04	.40	.16	.41
Manganese (Mn)	<.03	--	--	--	--	--	--	--
Calcium (Ca)	2.0	--	--	--	14	1.1	--	--
Magnesium (Mg)	.1	--	--	--	.7	.6	--	--
Sodium (Na)	3.0	--	--	--	3.0	3.2	--	--
Potassium (K)	--	--	--	--	--	.2	--	--
Bicarbonate (HCO_3)	6[3]	4[3]	5[3]	--	--	0	2	12
Carbonate (CO_3)	0	0	0	--	--	0	0	0
Sulfate (SO_4)	2.0	--	--	--	5.0	.0	--	--
Chloride (Cl)	8.5	7.5	9.0	8.2	.0	4.1	4.8	4.4
Fluoride (F)	.2	--	--	--	.0	.0	--	--
Carbon dioxide (CO_2)	18	--	--	--	0.01	--	--	--
Strontium (Sr)	--	--	--	--	--	.04	--	--
Dissolved solids	27	--	--	--	--	6	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	6[3]	--	--	--	38[3]	5[3]	32	15
Specific conductance (micromhos at 25°C)	--	30	29	--	--	28	61	42
Turbidity (NTU)[1]	--	--	--	--	--	5	--	--
Color (Pt-Co)[2]	--	--	--	--	5	10	--	--
pH	5.4	5.5	5.6	4.3	8.7	4.3	5.6	6.1
Temperature								
°C	--	19	16	--	--	21	22	22
°F	--	66	61	--	--	71	71	71

Appendix B. (cont'd)

Well number	Lil-5	Mag-1	Mag-1	Mag-2	Mag-3	Mag-5	Mag-5	Mag-5
Date of collection	03-29-84	05-06-81[12]	02-02-84	03-02-84	02-03-84	09-13-57	05-13-66	03-14-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	106-110	131-186	131-186	102-107	51-56	145	145	145
Silica (SiO_2)	--	8.4	--	--	--	--	--	--
Iron (Fe)	--	.08	.04	--	.44	--	.15	1.0
Manganese (Mn)	--	.01	--	--	--	--	--	--
Calcium (Ca)	--	.1	1.9	--	6.0	--	--	3.5
Magnesium (Mg)	--	.8	1.1	--	8.0	--	--	3.1
Sodium (Na)	--	3.6	6.9	--	31	--	--	3.7
Potassium (K)	--	.2	.4	--	.8	--	--	.6
Bicarbonate (HCO_3)	0	4[3]	0	0	0	--	4	0
Carbonate (CO_3)	0	0	0	0	0	--	0	0
Sulfate (SO_4)	--	1.0	.4	--	.0	--	--	.0
Chloride (Cl)	7.5	3.7	2.5	10	68	11	8.4	12
Fluoride (F)	--	.0	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	39	68	--	116	--	--	66
Hardness (as $CaCO_3$) Calcium, magnesium	--	4[3]	9[3]	--	48[3]	18	--	22[3]
Specific conductance (micromhos at 25°C)	53	--	31	43	270	--	53	128
Turbidity (NTU)[1]	35	--	10	5	5	--	--	5
Color (Pt-Co)[2]	60	--	25	0	5	--	--	0
pH	4.3	5.2	4.3	4.1	4.2	6.1	6.6	4.4
Temperature								
°C	20	--	20	--	20	--	21	--
°F	69	--	69	--	68	--	70	--

Appendix B. (cont'd)

Well number	Mag-6	Mag-6	Mag-7	Mag-8	Mag-9	Mag-9	Mag-12	Mag-13
Date of collection	10-09-57	05-13-66	03-04-84	06-06-84	06-24-66	03-14-84	04-09-64[18]	10-09-57
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	280-300	280-300	50-55	77-89	66-70	56-66	112-117	137-155
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	1.3	--	--	.27	--	.05	--
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	44	0	0	2	0	6	--
Carbonate (CO_3)	--	0	0	0	0	0	0	--
Sulfate (SO_4)	--	--	--	--	--	--	1.6	--
Chloride (Cl)	25	15	10	7.5	10	15	2.1	18
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	20	15	--	--	8	--	3	11
Specific conductance (micromhos at 25°C)	--	128	35	61	43	72	--	--
Turbidity (NTU)[1]	--	--	0	0	--	0	--	--
Color (Pt-Co)[2]	--	--	0	5	--	0	--	--
pH	6.1	6.5	4.2	4.0	5.7	4.0	4.8	5.9
Temperature								
°C	22	22	21	20	21	20	--	--
°F	72	71	70	68	70	69	--	--

Appendix B. (cont'd)

Well number	Mag-13	Mag-14	Mag-15	Mag-18	Mag-19	Mag-21	Ora-1	Ora-2
Date of collection	06-24-66	03-14-84	03-15-84	03-15-84	07-18-66	03-15-84	04-10-84	07-11-66
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Qalt (A_1)	Tmu (A_3)
Depth of interval sampled (ft)	137-155	120-125	102-107	74-79	104-110	45-50	20	730-750
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	1.1	--	--	--	.08	--	2.0	.17
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	8.0	--
Magnesium (Mg)	--	--	--	--	--	--	15	--
Sodium (Na)	--	--	--	--	--	--	62	--
Potassium (K)	--	--	--	--	--	--	9.0	--
Bicarbonate (HCO_3)	10	0	0	3	4	0	190	618
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	--	--	--	1.4	--
Chloride (Cl)	6.6	10	10	10	6.8	--	83	2,500
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	.11	--
Dissolved solids	--	--	--	--	--	--	251	--
Hardness (as $CaCO_3$) Calcium, magnesium	8	--	--	--	8	--	82[3]	160
Specific conductance (micromhos at 25°C)	35	36	43	37	44	73	530	8,190
Turbidity (NTU)[1]	--	45	3	5	--	15	155	--
Color (Pt-Co)[2]	--	120	0	10	--	35	760	50
pH	6.8	4.4	3.9	4.8	5.5	4.5	6.4	7.8
Temperature								
°C	21	--	20	22	21	--	20	22
°F	70	--	69	71	70	--	69	72

Appendix B. (cont'd)

Well number	Ora-2	Ora-2	Ora-3	Ora-3	Ora-3	Ora-3	Ora-4	Ora-5
Date of collection	09-19-66	10-26-76	04-06-70[19]	04-09-70[5]	04-20-70[13]	04-20-70[5]	04-10-84	04-10-84
Water-bearing unit	Tmu (A_3)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_3)	Tmu (A_3)	Qalt (A_1)	Qalt (A_1)
Depth of interval sampled (ft)	730-750	730-750	100-140	100-140	726-770	726-770	19.5-22	16-20
Silica (SiO_2)	14	--	--	--	--	--	--	--
Iron (Fe)	.12	--	.10	--	.45	--	.09	--
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	23	--	--	--	--	--	35	--
Magnesium (Mg)	23	--	--	--	--	--	2.5	--
Sodium (Na)	1,800	--	--	--	--	--	10	--
Potassium (K)	21	--	--	--	--	--	.6	--
Bicarbonate (HCO_3)	560	--	--	16[3]	--	550[3]	98	14
Carbonate (CO_3)	0	--	--	0	--	0	0	0
Sulfate (SO_4)	10	--	--	--	--	--	11	--
Chloride (Cl)	2,600	2,300	2,800	1,600	1,600	1,400	19	10
Fluoride (F)	.7	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	.17	--
Dissolved solids	--	--	--	--	--	--	126	--
Hardness (as $CaCO_3$) Calcium, magnesium	150[3]	--	--	--	--	--	98[3]	--
Specific conductance (micromhos at 25°C)	8,360	--	--	--	--	--	232	66
Turbidity (NTU)[1]	--	--	--	--	--	--	5	10
Color (Pt-Co)[2]	50	--	--	--	--	--	20	90
pH	6.8	7.6	5.0	5.6	7.9	8.4	6.8	5.1
Temperature								
°C	22	--	--	--	--	--	21	20
°F	72	--	--	--	--	--	70	68

Appendix B. (cont'd)

Well number	Ora-6	Ora-9	Ora-9	Ora-11	Ora-13	Ora-15	Ora-17	Ora-18
Date of collection	09-28-57	04-10-84	07-18-84	07-08-83[12]	05-07-84	06-17-66	05-08-84	05-08-84
Water-bearing unit	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	12	20	20	280-320	185	21-25	43-48	57-62
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	.05	.07	.22	--	.56	--	--
Manganese (Mn)	--	--	--	.60	--	--	--	--
Calcium (Ca)	--	52	54	99	--	--	--	--
Magnesium (Mg)	--	6.6	8.9	16	--	--	--	--
Sodium (Na)	--	12	16	610	--	--	--	--
Potassium (K)	--	.6	1.8	--	--	--	--	--
Bicarbonate (HCO_3)	--	160	180	18[3]	0	6	0	0
Carbonate (CO_3)	--	0	0	0	0	0	0	0
Sulfate (SO_4)	--	19	15	--	--	--	--	--
Chloride (Cl)	60	21	29	1,400	7.5	6.6	20	10
Fluoride (F)	--	--	--	.6	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	57	--	--	--	--
Strontium (Sr)	--	.36	.47	--	--	--	--	--
Dissolved solids	--	192	244	3,625	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	38	160[3]	170[3]	310[3]	--	10	--	--
Specific conductance (micromhos at 25°C)	--	330	350	--	45	42	90	89
Turbidity (NTU)[1]	--	1	0	--	0	--	0	0
Color (Pt-Co)[2]	--	20	0	--	0	--	0	0
pH	7.5	6.6	7.0	5.5	3.4	5.7	4.2	4.5
Temperature								
°C	--	20	27	--	23	21	22	--
°F	--	68	81	--	74	69	72	--

Appendix B. (cont'd)

Well number	Ora-20	Ora-20	Ora-21	Ora-22	Ora-22	Ora-24	Ora-24	Ora-25
Date of collection	07-13-66	05-08-84	05-08-84	06-24-66	05-08-84	09-26-57	10-27-76	07-12-66
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)
Depth of interval sampled (ft)	18-22	18-22	74-94	142-152	142-152	13-16	13-16	34-36
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	.33	.21	--	5.2	4.5	--	--	1.3
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	2.0	--	--	1.4	--	--	--
Magnesium (Mg)	--	2.8	--	--	.9	--	--	--
Sodium (Na)	--	11	--	--	4.0	--	--	--
Potassium (K)	--	.8	--	--	2.0	--	--	--
Bicarbonate (HCO_3)	4	0	0	10	0	--	0	6
Carbonate (CO_3)	0	0	0	0	0	--	0	0
Sulfate (SO_4)	--	1.0	--	--	2.4	--	--	--
Chloride (Cl)	6.0	2.2	10	4.8	4.2	60	27	14
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	.05	--	--	.05	--	--	--
Dissolved solids	--	61	--	--	40	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	5	17[3]	--	8	7[3]	54	--	8
Specific conductance (micromhos at 25°C)	37	104	45	43	53	--	157	63
Turbidity (NTU)[1]	--	0	5	--	0	--	--	--
Color (Pt-Co)[2]	--	0	15	--	10	--	--	--
pH	5.3	3.8	3.6	6.1	4.5	7.1	3.6	5.8
Temperature								
°C	23	--	22	21	21	--	23	22
°F	73	--	72	70	70	--	74	71

Appendix B. (cont'd)

Well number	Ora-25	Ora-26	Ora-27	Ora-28	Ora-29	Ora-29	Ora-30	Ora-31
Date of collection	06-05-84	06-05-84	11-15-48	06-05-84	06-12-66	06-05-84	07-13-66	06-22-84
Water-bearing unit	Qalt (A_1)	Qalt (A_1)	Tmu (A_3)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Tmu (A_2)	Qalt (A_1)
Depth of interval sampled (ft)	34-36	65±	734-742	45-55	37-41	37-41	89-93	15
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	.03	--	.20	.32
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	14
Magnesium (Mg)	--	--	--	--	--	--	--	3.9
Sodium (Na)	--	--	--	--	--	--	--	24
Potassium (K)	--	--	--	--	--	--	--	2.1
Bicarbonate (HCO_3)	0	0	--	0	2	0	4	40
Carbonate (CO_3)	0	0	--	0	0	0	0	0
Sulfate (SO_4)	--	--	--	--	--	--	--	6.3
Chloride (Cl)	10	110	1,600	22	18	18	6.2	44
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	.11
Dissolved solids	--	--	--	--	--	--	--	157
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	105	--	15	--	5	51[3]
Specific conductance (micromhos at 25°C)	43	390	--	106	81	90	42	215
Turbidity (NTU)[1]	0	0	--	5	--	0	--	45
Color (Pt-Co)[2]	0	0	--	10	--	0	--	170
pH	3.9	4.2	--	3.8	5.5	3.8	5.6	6.7
Temperature								
°C	24	22	--	--	21	20	21	23
°F	76	72	--	--	69	68	70	74

Appendix B. (cont'd)

Well number	Ora-32	Ora-34	Ora-34	Ora-34	Ora-35	Per-1	Per-2	Per-3
Date of collection	07-17-84	06-18-84[17]	06-18-84[17]	06-19-84[17]	07-31-84	04-12-84	05-07-84	06-16-66
Water-bearing unit	Qalt (A_1)	Qalt (A_1)	Tmu (A_2)	Tmu (A_3)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	20-30	20-30	115-125	340-360	73-83	44-49	29-33	188-197
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	1.4	.30	1.7	2.0	5.2	--	--	.66
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	18	--	--	--	--	--	--	--
Magnesium (Mg)	4.3	--	--	--	--	--	--	--
Sodium (Na)	12	--	--	--	--	--	--	--
Potassium (K)	2.7	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	68	--	--	--	--	0	0	6
Carbonate (CO_3)	0	--	--	--	--	0	0	0
Sulfate (SO_4)	5.6	.0	.0	.0	.0	--	--	--
Chloride (Cl)	16	40	1,000	1,100	480	10	7.5	4.6
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	.19	--	--	--	--	--	--	--
Dissolved solids	116	--	--	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	63[3]	--	--	--	--	--	--	15
Specific conductance (micromhos at 25°C)	162	--	--	--	--	61	52	36
Turbidity (NTU)[1]	15	--	--	--	--	0	0	--
Color (Pt-Co)[2]	90	--	--	--	--	0	0	--
pH	6.3	5.9	5.9	6.8	5.6	4.1	4.2	5.6
Temperature								
°C	27	--	--	--	--	20	22	22
°F	81	--	--	--	--	69	72	72

Appendix B. (cont'd)

Well number	Pin-2	Pin-3	Pin-3	Pin-4	Pin-7	Pin-10	Pin-10	Pin-12
Date of collection	06-19-84	06-29-66	06-19-84	06-20-84	06-20-84	01-10-80	06-20-84	10-17-84
Water-bearing unit	Qalt (A_1)	Tmu (A_2)	Tmu (A_2)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)
Depth of interval sampled (ft)	40	100-105	100-105	16-20	23	40-45	40-45	9
Silica (SiO_2)	--	--	--	--	--	3.1	--	--
Iron (Fe)	2.0	2.1	2.1	3.8	15	--	.26	.08
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	2.2	--	44	7.1	13	120	49	18
Magnesium (Mg)	1.6	--	9.8	6.6	20	170	16	1.8
Sodium (Na)	10	--	26	38	160	1,500	170	12
Potassium (K)	.5	--	4	1.4	8.0	54	4.8	.5
Bicarbonate (HCO_3)	6	160	170	12	100	160	67	0
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	3.8	--	.0	12	9.8	390	36	6.3
Chloride (Cl)	20	26	69	81	300	2,900	340	17
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	.06	--	.31	.10	.15	--	.38	--
Dissolved solids	98	--	294	233	632	4,240	780	90
Hardness (as $CaCO_3$) Calcium, magnesium	12[3]	140	150[3]	45[3]	110[3]	1,000[3]	190[3]	53[3]
Specific conductance (micromhos at 25°C)	89	319	460	310	1,100	8,300	1,120	182
Turbidity (NTU)[1]	90	--	30	65	500	--	20	--
Color (Pt-Co)[2]	340	--	115	250	--	--	60	--
pH	5.0	7.2	6.9	5.1	6.4	7.5	7.5	3.9
Temperature								
°C	29	21	27	27	28	--	27	--
°F	84	70	81	81	82	--	81	--

Appendix B. (cont'd)

Well number	Pin-13	Poi-1	Poi-1	Poi-2	Poi-3	Poi-4	Poi-9	Poi-9
Date of collection	10-29-84	03-09-82[12]	02-02-84	03-13-84	03-13-84	03-13-84	09-16-57	05-04-66
Water-bearing unit	Qalt (A_1)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	17	110-220	110-220	152-162	115-125	162	100-120	100-120
Silica (SiO_2)	--	10	--	--	--	--	--	--
Iron (Fe)	.05	.04	.06	--	--	--	--	.13
Manganese (Mn)	--	.02	--	--	--	--	--	--
Calcium (Ca)	17	.8	2.3	--	--	--	--	--
Magnesium (Mg)	3.1	1.9	3.4	--	--	--	--	--
Sodium (Na)	7.9	4.0	5.9	--	--	--	--	--
Potassium (K)	.4	.3	2.1	--	--	--	--	--
Bicarbonate (HCO_3)	63	12[3]	0	0	0	3	4	4
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	7.4	<1.0	.5	--	--	--	--	--
Chloride (Cl)	12	7.0	6.2	12	10	10	11	7.4
Fluoride (F)	--	.0	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	18	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	114	48	67	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	56[3]	10[3]	20[3]	--	--	--	24	10
Specific conductance (micromhos at 25°C)	170	--	83	56	35	36	--	30
Turbidity (NTU)[1]	--	--	0	10	10	10	--	--
Color (Pt-Co)[2]	--	--	0	20	10	15	--	--
pH	6.4	5.8	4.1	4.4	4.4	4.8	6.2	5.6
Temperature								
°C	--	--	20	21	22	21	21	21
°F	--	--	69	70	71	69	70	69

Appendix B. (cont'd)

Well number	Poi-11	Poi-12	Poi-12	Rob-3	Rob-4	Rob-5	Rob-6	Rob-6
Date of collection	03-14-84	01-15-41[9]	05-04-66	01-19-84	01-19-84	01-19-84	05-06-44[9]	08-17-45
Water-bearing unit	Tmu (A_2)	Tmu (A_3)	Tmu (A_3)	Tci (A_2)	Tci (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	71-76	291-341	291-341	77-82	42-47	70-75	122-167	122-167
Silica (SiO_2)	--	27	--	--	--	--	8.0	--
Iron (Fe)	--	.09	.12	--	--	--	.05	--
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	9.2	--	--	--	--	.7	--
Magnesium (Mg)	--	2.2	--	--	--	--	.6	--
Sodium (Na)	--	23	--	--	--	--	2.7	--
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	0	77	110	1	0	2	4	4
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	5.6	--	--	--	--	.2	1.0
Chloride (Cl)	7.5	5.6	5.2	10	10	10	9.5	7.0
Fluoride (F)	--	--	--	--	--	--	--	.0
Carbon dioxide (CO_2)	--	8.0	--	--	--	--	20.5	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	115	--	--	--	--	31	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	32[3]	40	--	--	--	4[3]	8
Specific conductance (micromhos at 25°C)	32	--	190	45	76	94	--	--
Turbidity (NTU)[1]	15	--	--	0	0	0	--	--
Color (Pt-Co)[2]	35	--	--	5	0	0	--	--
pH	4.4	6.9	7.6	4.6	4.3	4.8	5.5	--
Temperature								
°C	18	--	22	18	--	--	--	--
°F	64	--	72	64	--	--	--	--

Appendix B. (cont'd)

Well number	Rob-6	Rob-6	Rob-6	Rob-7	Rob-7	Rob-7	Rob-8	Rob-8
Date of collection	01-17-51[5]	03-11-66	01-19-84	10-03-58[4]	03-11-66	01-19-84	06-07-66	01-20-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	122-167	220-260	220-260	153-193	153-193	153-193	130-133	130-133
Silica (SiO_2)	--	--	--	9.0	--	--	--	--
Iron (Fe)	.30	.04	.03	.00	.06	--	.08	.03
Manganese (Mn)	.00	--	--	.00	--	--	--	--
Calcium (Ca)	4.0	--	.9	1.3	--	--	--	.9
Magnesium (Mg)	.0	--	1.2	1.1	--	--	--	.7
Sodium (Na)	--	--	4.0	1.7	--	--	--	2.0
Potassium (K)	--	--	.3	--	--	--	--	.8
Bicarbonate (HCO_3)	18[3]	4	2	2[3]	3	3	8	0
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	3.0	--	1.3	1.7	--	--	--	1.4
Chloride (Cl)	8.0	7.4	5.0	6.0	8.6	7.5	3.4	1.8
Fluoride (F)	.2	--	--	.0	--	--	--	--
Carbon dioxide (CO_2)	27	--	--	20.0	--	--	--	--
Strontium (Sr)	--	--	.10	--	--	--	--	--
Dissolved solids	23	--	20	37	--	--	--	45
Hardness (as $CaCO_3$) Calcium, magnesium	10[3]	12	7[3]	8[3]	15	--	18	6[3]
Specific conductance (micromhos at 25°C)	--	30	47	--	42	46	26	24
Turbidity (NTU)[1]	--	--	10	--	--	0	--	--
Color (Pt-Co)[2]	--	--	20	--	--	20	--	--
pH	5.4	5.7	4.8	5.4	5.5	4.8	6.2	4.5
Temperature								
°C	--	21	20	--	21	20	--	20
°F	--	70	69	--	70	69	--	68

Appendix B. (cont'd)

Well number	Rob-9	Rob-9	Rob-10	Rob-10	Rob-10	Sai-1	Sai-1	Sai-2
Date of collection	07-06-72	01-20-84	09-04-57	06-13-66	02-28-84	04-28-83[5]	03-26-84	06-18-68
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tci (A_2)	Tci (A_2)	Tci (A_2)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)
Depth of interval sampled (ft)	153-184	153-184	55-60	55-60	55-60	22-37	22-37	40
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	.00	--	--	.09	--	.30	.28	1.2
Manganese (Mn)	.00	--	--	--	--	.39	--	--
Calcium (Ca)	.8	--	--	--	--	63	46	2.5
Magnesium (Mg)	.1	--	--	--	--	35	20	3.3
Sodium (Na)	--	--	--	--	--	270	200	--
Potassium (K)	--	--	--	--	--	--	5.7	--
Bicarbonate (HCO_3)	7[3]	0	--	4	0	23[3]	42	0
Carbonate (CO_3)	0	0	--	0	0	0	0	0
Sulfate (SO_4)	--	--	--	--	--	76	68	6.8
Chloride (Cl)	6.5	10	11	4.4	18	490	430	17
Fluoride (F)	--	--	--	--	--	.06	--	.1
Carbon dioxide (CO_2)	4	--	--	--	--	12.7	--	--
Strontium (Sr)	--	--	--	--	--	--	.38	--
Dissolved solids	--	--	--	--	--	1,138	839	--
Hardness (as $CaCO_3$) Calcium, magnesium	3[3]	--	22	15	--	300[3]	200[3]	20[3]
Specific conductance (micromhos at 25°C)	--	54	--	31	112	--	830	94
Turbidity (NTU)[1]	--	5	--	--	0	--	35	--
Color (Pt-Co)[2]	--	5	--	--	0	20	50	--
pH	6.1	4.4	7.9	5.7	4.3	6.5	6.3	4.5
Temperature								
°C	--	20	--	21	--	--	20	--
°F	--	68	--	70	--	--	69	--

Appendix B. (cont'd)

Well number	Sai-2	Sai-3	Sai-4	Sai-4	Sai-5	Sai-8	Sai-9	Sai-10
Date of collection	05-10-84	05-10-84	12-28-77	06-07-84	05-10-84	06-06-84	06-19-84	06-20-84
Water-bearing unit	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)
Depth of interval sampled (ft)	40	14	39-43	39-43	37	4.5-7	10-13	27
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	3.2	.49	.22	.15	.17	.09	.36	6.4
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	4.1	23	--	91	3.1	81	38	19
Magnesium (Mg)	2.C	2.2	--	23	7.0	140	110	6.5
Sodium (Na)	12	24	12	140	26	1,170	870	59
Potassium (K)	1.1	2.0	--	10	2.0	46	38	2.9
Bicarbonate (HCO_3)	0	0	--	200	0	134	70	18
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	13	11	6.8	5.0	24	230	200	.8
Chloride (Cl)	25	40	23	340	48	2,100	1,540	150
Fluoride (F)	--	--	.1	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	10	--	--	--	--	--
Strontium (Sr)	.12	.13	--	.48	.11	1.1	.65	--
Dissolved solids	104	132	--	1,010	158	4,300	3,230	390
Hardness (as $CaCO_3$) Calcium, magnesium	18[3]	67[3]	--	320[3]	37[3]	260[3]	550[3]	74[3]
Specific conductance (micromhos at 25°C)	150	170	--	1,160	260	4,700	4,000	470
Turbidity (NTU)[1]	--	20	.9	10	0	0	20	300
Color (Pt-Co)[2]	--	120	--	50	0	10	40	440
pH	4.5	4.5	6.7	6.5	4.2	6.9	6.2	6.1
Temperature								
°C	23	23	--	22	22	23	27	25
°F	73	74	--	72	72	73	81	77

Appendix B. (cont'd)

Well number	Sai-11	Sai-12	Sai-13	Sai-14	Sem-1	Sem-2	Sem-2	Sil-1
Date of collection	06-29-66	06-20-84	06-20-84	06-29-66	02-28-84	06-08-66	02-28-84	03-08-66
Water-bearing unit	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Qalt (A_1)	Tmu (A_2)	Tci (A_2)	Tci (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	38-41	28	49-52	12-15	142-147	25-29	25-29	144-174
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	1.4	--	.19	.08	--	.14	--	.07
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	54	--	--	--	--	--
Magnesium (Mg)	--	--	14	--	--	--	--	--
Sodium (Na)	--	--	17	--	--	--	--	--
Potassium (K)	--	--	3.5	--	--	--	--	--
Bicarbonate (HCO_3)	162	18	142	136	1	4	1	6
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	0	--	--	--	--	--
Chloride (Cl)	10	160	78	320	7.5	6.4	10	4.0
Fluoride (F)	--	--	--	--	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	.14	.36	--	--	--	--	--
Dissolved solids	--	--	306	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	135	--	190[3]	188	--	20	--	10
Specific conductance (micromhos at 25°C)	274	470	440	1,260	19	55	23	21
Turbidity (NTU)[1]	--	300	35	--	0	--	0	--
Color (Pt-Co)[2]	--	440	60	--	0	--	0	--
pH	7.5	6.1	7.6	7.3	4.7	5.7	4.6	5.6
Temperature								
°C	22	25	28	22	--	21	19	21
°F	71	77	82	71	--	70	66	69

Appendix B. (cont'd)

Well number	Sil-1	Sil-1	Sil-1	Sil-2	Sil-2	Sil-2	Sil-3	Sil-3
Date of collection	10-18-66	07-23-82[5]	01-18-84	03-09-66	06-28-82[5]	01-20-84	11-05-74[8]	01-30-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	144-174	144-174	144-174	156-196	156-196	156-196	140-182	140-182
Silica (SiO_2)	8.5	--	--	--	--	--	--	--
Iron (Fe)	.08	.12	.02	.13	.61	.04	.08	--
Manganese (Mn)	--	<.02	--	--	--	--	--	--
Calcium (Ca)	.5	--	.9	--	2.0	.7	3.0	--
Magnesium (Mg)	.7	--	.7	--	.5	.5	.0	--
Sodium (Na)	3.0	--	3.0	--	2.0	2.9	--	--
Potassium (K)	.2	--	.2	--	--	.2	--	--
Bicarbonate (HCO_3)	6	18[3]	0	45	10[3]	0	7	0
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	.0	.0	--	.0	1.3	3.0	--
Chloride (Cl)	2.2	5.6	3.0	4.4	5.0	2.6	4.0	10
Fluoride (F)	.0	.0	--	--	.0	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	6.6	--	24	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	23	--	11	--	--	41	21	--
Hardness (as $CaCO_3$) Calcium, magnesium	4[3]	--	5[3]	30	7[3]	4[3]	8[3]	--
Specific conductance (micromhos at 25°C)	22	59	31	96	30	26	25	79
Turbidity (NTU)[1]	--	--	0	--	--	5	--	0
Color (Pt-Co)[2]	--	--	5	--	5	0	0	0
pH	5.6	8.0	4.5	7.2	6.1	4.3	5.6	3.4
Temperature								
°C	--	--	20	22	--	20	22	21
°F	--	--	68	72	--	68	72	69

Appendix B. (cont'd)

Well number	Sil-4	Sil-5	Sil-6	Sil-6	Sil-6	Sil-7	Sil-8	Sil-9
Date of collection	06-07-66	08-05-57	06-06-66	09-12-66	02-01-84	01-31-84	01-31-84	06-07-66
Water-bearing unit	Tci (A_2)	Tmu (A_2)	Tmu (A_3)	Tmu (A_3)	Tmu (A_3)	Tci (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	50-60	116-138	756-777	256-777	256-777	52-57	60-65	101-106
Silica (SiO_2)	.08	--	--	13	--	--	--	--
Iron (Fe)	--	--	.09	.08	.20	--	--	.11
Manganese (Mn)	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	9.5	10	--	--	--
Magnesium (Mg)	--	--	--	1.5	1.6	--	--	--
Sodium (Na)	--	--	--	35	42	--	--	--
Potassium (K)	--	--	--	3.0	2.4	--	--	--
Bicarbonate (HCO_3)	8	--	130	125	118	0	0	6
Carbonate (CO_3)	0	--	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	6.2	1.0	--	--	--
Chloride (Cl)	8.2	11	3.8	3.0	15	35	18	4.8
Fluoride (F)	--	--	--	.1	--	--	--	--
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	--
Strontium (Sr)	--	--	--	--	.33	--	--	--
Dissolved solids	--	--	--	133	163	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	10	32	35	30[3]	32[3]	--	--	12
Specific conductance (micromhos at 25°C)	56	--	222	218	216	123	75	23
Turbidity (NTU)[1]	--	--	--	--	--	5	8	--
Color (Pt-Co)[2]	--	--	--	--	--	15	5	--
pH	5.8	6.2	8.2	7.1	7.2	4.1	3.9	5.7
Temperature								
°C	21	21	22	--	20	20	19	21
°F	70	70	71	--	69	68	66	70

Appendix B. (cont'd)

Well number	Sil-9	Sil-10	Sil-11	Sil-11	Sil-11	Sil-11	Sil-11	Sil-11
Date of collection	01-31-84	01-31-84	07-17-73[5]	07-20-73[5]	08-17-73[5]	10-03-73[5]	06-14-74[5]	09-16-75[5]
Water-bearing unit	Tmu (A_2)	Tci (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	101-106	67-72	158-218	158-218	158-218	158-218	158-218	158-218
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	.38	.10	<.10	.15	.20	<.10
Manganese (Mn)	--	--	<.03	<.03	<.03	<.03	<.03	<.05
Calcium (Ca)	--	--	--	--	--	--	--	.4
Magnesium (Mg)	--	--	--	--	--	--	--	.4
Sodium (Na)	--	--	--	--	--	--	--	2.0
Potassium (K)	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	0	0	1[3]	6[3]	5[3]	9[3]	6[3]	4[3]
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	--	--	--	--	--	2.0
Chloride (Cl)	10	12	--	--	--	--	--	5.6
Fluoride (F)	--	--	--	--	--	--	--	.0
Carbon dioxide (CO_2)	--	--	--	--	--	--	23	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	--	--	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	--	--	--	--	3[3]
Specific conductance (micromhos at 25°C)	27	108	--	--	--	--	--	27
Turbidity (NTU)[1]	0	0	--	--	--	--	--	--
Color (Pt-Co)[2]	0	0	--	--	--	--	--	--
pH	4.3	3.8	4.9	5.4	4.8	5.3	5.2	5.1
Temperature								
°C	20	20	--	--	--	--	--	--
°F	68	68	--	--	--	--	--	--

Appendix B. (cont'd)

Well number	Sil-11	Sil-12	Sil-13	Sil-14	Sil-15	Sta-1	Sta-2	Sta-2
Date of collection	02-02-84	02-02-84	02-02-84	02-02-84	06-18-84	01-17-84	03-08-66	07-16-82[5]
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tci (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	158-218	201-261	99-104	42-47	140-180	190-240	265	265
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	.12	.04	--	--	.05	.63	4.7	.52
Manganese (Mn)	--	--	--	--	--	--	--	.02
Calcium (Ca)	13	9.0	--	--	4.5	2.6	--	4.0
Magnesium (Mg)	.9	1.3	--	--	.6	1.2	--	1.0
Sodium (Na)	3.8	3.7	--	--	1.8	3.0	--	12
Potassium (K)	.6	.5	--	--	.5	1.4	--	--
Bicarbonate (HCO_3)	34	22	0	0	14	8	21	28[3]
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	.0	1.6	--	--	.5	5.0	--	11
Chloride (Cl)	4.2	3.6	7.5	12	2.4	2.5	4.8	6.0
Fluoride (F)	--	--	--	--	--	--	--	.0
Carbon dioxide (CO_2)	--	--	--	--	--	--	--	6.6
Strontium (Sr)	--	--	--	--	.06	--	--	--
Dissolved solids	76	71	--	--	36	39	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	36[3]	28[3]	--	--	14[3]	12[3]	20	14[3]
Specific conductance (micromhos at 25°C)	110	79	31	146	42	41	59	70
Turbidity (NTU)[1]	0	5	0	5	0	5	--	--
Color (Pt-Co)[2]	10	25	5	20	0	20	--	5
pH	7.2	5.3	4.4	4.0	5.5	5.1	6.4	7.2
Temperature								
°C	15	20	21	--	22	22	21	--
°F	60	68	69	--	72	72	70	--

Appendix B. (cont'd)

Well number	Sta-5	Sta-6	Sta-7	Sta-9	Sta-9	Sta-11	Sta-11	Sta-11
Date of collection	05-12-66	01-17-84	01-17-84	05-09-66	01-17-84	08-12-77[5]	09-13-77[20]	01-18-84
Water-bearing unit	Tmu (A_2)	Tci (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	77-82	57-62	36-46	168-188	168-188	140-155	140-155	140-155
Silica (SiO_2)	--	--	--	--	--	--	--	--
Iron (Fe)	.40	--	.90	.07	.39	<.30	.12	--
Manganese (Mn)	--	--	--	--	--	<.05	--	--
Calcium (Ca)	--	--	1.2	--	1.1	.6	1.8	--
Magnesium (Mg)	--	--	.9	--	1.2	.5	<.1	--
Sodium (Na)	--	--	5.4	--	5.3	3.0	6.6	--
Potassium (K)	--	--	.1	--	.4	--	--	--
Bicarbonate (HCO_3)	4	0	8	4	9	61[3]	7	0
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	.6	--	.6	1.0	7.5	--
Chloride (Cl)	6.8	5.0	5.2	2.8	4.2	6.5	4.0	5.0
Fluoride (F)	--	--	--	--	--	.0	.0	--
Carbon dioxide (CO_2)	--	--	--	--	--	16	56	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	26	--	29	--	39	--
Hardness (as $CaCO_3$) Calcium, magnesium	18	--	7[3]	8	8[3]	4[3]	5[3]	--
Specific conductance (micromhos at 25°C)	56	65	50	18	46	26	--	25
Turbidity (NTU)[1]	--	2	10	--	--	--	0	0
Color (Pt-Co)[2]	--	10	10	--	--	--	0	0
pH	6.1	4.4	5.1	6.2	5.2	5.6	5.0	4.5
Temperature								
°C	21	--	20	21	22	--	--	20
°F	70	--	69	70	72	--	--	68

Appendix B. (cont'd)

Well number	Sta-12	Sta-12	Sta-12	Sta-12	Sta-12	Sta-12	Sta-12	Sta-13
Date of collection	07-13-82[12]	07-14-82[12]	07-14-82[12]	07-14-82[12]	07-14-82[12]	07-21-82[7]	09-03-82[12]	01-18-84
Water-bearing unit	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)	Tmu (A_2)
Depth of interval sampled (ft)	131-171	131-171	131-171	131-171	131-171	131-171	131-171	130-160
Silica (SiO_2)	--	--	--	--	13	--	8.3	--
Iron (Fe)	.04	.09	.05	.20	.20	.03	.12	.11
Manganese (Mn)	--	--	--	--	.00	<.01	.02	8.3
Calcium (Ca)	--	--	--	--	.7	--	.4	5.1
Magnesium (Mg)	--	--	--	--	.7	--	.7	8.3
Sodium (Na)	2.8	2.6	2.4	2.8	2.8	2.2	1.2	2.9
Potassium (K)	--	--	--	--	3.0	--	.2	.7
Bicarbonate (HCO_3)	--	--	--	--	10[3]	4[3]	12[3]	0
Carbonate (CO_3)	--	--	--	--	0	0	0	0
Sulfate (SO_4)	--	--	--	--	1.0	<1.0	1.0	1.2
Chloride (Cl)	5.0	5.0	5.0	5.0	5.0	3.5	3.0	13
Fluoride (F)	--	--	--	--	.0	.0	.0	--
Carbon dioxide (CO_2)	--	--	--	--	10	--	9	--
Strontium (Sr)	--	--	--	--	--	--	--	--
Dissolved solids	--	--	--	--	25	20	22	85
Hardness (as $CaCO_3$) Calcium, magnesium	--	--	--	--	5[3]	--	4[3]	47[3]
Specific conductance (micromhos at 25°C)	--	--	--	--	--	26	5	140
Turbidity (NTU)[1]	--	--	--	--	--	--	.7	5
Color (Pt-Co)[2]	--	--	--	--	--	2	--	20
pH	5.3	5.6	5.4	5.5	5.5	5.3	5.7	4.5
Temperature								
°C	--	--	--	--	--	--	--	20
°F	--	--	--	--	--	--	--	68

Appendix B. (cont'd)

Well number	Ste-1	Ste-4
Date of collection	01-18-84	01-18-84
Water-bearing unit	Tci (A_2)	Tci (A_2)
Depth of interval sampled (ft)	49-54	39-44
Silica (SiO_2)	--	--
Iron (Fe)	--	--
Manganese (Mn)	--	--
Calcium (Ca)	--	--
Magnesium (Mg)	--	--
Sodium (Na)	--	--
Potassium (K)	--	--
Bicarbonate (HCO_3)	0	14
Carbonate (CO_3)	0	0
Sulfate (SO_4)	--	--
Chloride (Cl)	12	5.0
Fluoride (F)	--	--
Carbon dioxide (CO_2)	--	--
Strontium (Sr)	--	--
Dissolved solids	--	--
Hardness (as $CaCO_3$) Calcium, magnesium	--	--
Specific conductance (micromhos at 25°C)	79	51
Turbidity (NTU)[1]	0	2
Color (Pt-Co)[2]	2	5
pH	4.3	5.8
Temperature		
°C	20	--
°F	68	--

Appendix B. (cont'd)

[1]NTU - Nephelometric Turbidity Units
[2]Pt-Co - Platinum-Cobalt scale units
[3]Calculated from analysis information
[4]Law and Company analysis
[5]Alabama Department of Public Health analysis
[6]Gulf Coast Laboratories, Inc. analysis
[7]Vester J. Thompson, Jr. analysis
[8]Pensacola Testing Laboratories analysis
[9]Pittsburg Testing Laboratory analysis
[10]A. W. Williams Inspection Company analysis
[11]Research Products, Inc. analysis
[12]Reid H. Leonard, Biochemist, analysis
[13]Orlando Laboratories analysis
[14]Carloss Well Supply Company analysis
[15]Pioneer Laboratory, Inc. analysis
[16]Nalco Chemical Company analysis
[17]Southern Earth Science analysis
[18]Universal Water Softener Company analysis
[19]Layne Central Company analysis
[20]Water Treatment and Controls analysis

Notes: The absence of a footnote number by the sampling date indicates that the analysis was conducted by the Geological Survey of Alabama or the U.S. Geological Survey (Tuscaloosa). Historic (pre-1984) analysis results may include parameters not shown. These analysis data are in the files of the Water Resources Division. Analysis values are standardized for entry into the computer STORET system.

APPENDIX C

Results of chemical analyses of surface waters in southern Baldwin County, Alabama.

Appendix C. Results of chemical analyses of surface waters in southern Baldwin County, Alabama

Note: Concentrations of chemical constituents expressed in milligrams per liter.

	Pond at Marine Research Center (SW¼SW¼ sec. 3, T. 9 S., R. 4 E.)	Rainfall sample collected at West Beach (W. edge sec. 29, T. 9 S., R. 3 E.)	Gulf of Mexico at Governor's Mansion (SW¼SW¼ sec. 29, T. 9 S., R. 2 E.)	Gulf of Mexico at Romar Beach (NE¼NW¼ sec. 23, T. 9 S., R. 4 E.)
Date of collection	03-12-85	10-29-84	05-10-84	05-10-84
Silica (SiO_2)	--	--	--	--
Iron (Fe)	--	.00	.08	.07
Manganese (Mn)	--	--	--	--
Calcium (Ca)	--	.3	90	340
Magnesium (Mg)	--	.2	1,100	1,100
Sodium (Na)	--	2.1	9,000	9,500
Potassium (K)	--	.1	350	360
Bicarbonate (HCO_3)	--	0	134	102
Carbonate (CO_3)	--	0	0	0
Sulfate (SO_4)	1,300	.0	2,400	2,400
Chloride (Cl)	7,500	2.4	16,000	16,000
Fluoride (F)	--	--	--	--
Dissolved solids	--	2	30,590	30,610
Calcium/magnesium hardness (as $CaCO_3$)	--	2[1]	4,750[1]	5,380[1]
Specific conductance (micromhos @ 25°C)	25,200	16	42,000	44,000
Turbidity (NTU)[2]	--	--	0	0
Color (Pt-Co)[3]	--	--	0	0
pH	6.5	3.9	7.3	7.1
Temperature				
°C	27	--	26	24
°F	81	--	79	74

Appendix C. (cont'd)

	Bayou St. John at Perdido Pass (W. side sec. 3, T. 9 S., R. 5 E.)	Intracoastal Waterway at Gulf Shores (SE¼NE¼ sec. 8, T. 9 S., R. 4 E.)	Bon Secour Bay at Hwy. 182--State boat ramp (NW¼SE¼ sec. 20, T. 9 S., R. 2 E.)	Shelby Lake at Gulf State Park
Date of collection	05-10-84	07-18-84	05-10-84	05-10-84
Silica (SiO_2)	--	--	--	--
Iron (Fe)	.06	.07	--	.49
Manganese (Mn)	--	--	--	--
Calcium (Ca)	410	150	51	14
Magnesium (Mg)	1,200	440	120	13
Sodium (Na)	10,000	3,600	1,000	98
Potassium (K)	360	140	.7	4.0
Bicarbonate (HCO_3)	136	74	44	34
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	2,700	8.2	270	18
Chloride (Cl)	17,600	6,900	2,000	170
Fluoride (F)	--	--	--	--
Dissolved solids	33,680	12,800	3,720	500
Calcium/ magnesium hardness (as $CaCO_3$)	5,960[1]	2,190[1]	622[1]	89[1]
Specific conductance (micromhos @ 25°C)	49,000	21,000	6,600	630
Turbidity (NTU)[2]	0	18	25	160
Color (Pt-Co)[3]	5	70	110	700
pH	7.7	7.2	7.6	6.6
Temperature °C	27	28	27	24
°F	81	82	81	75

[1]Calculated value
[2]NTU - Nephelometric Turbidity Units
[3]Pt-Co - Platinum-Cobalt scale units