CDM Camp Dresser & McKee

Monitor Well AID-MZL
AID-MZU

Acme Improvement District

IW1-W-1605-

Wastewater Treatment Plant Effluent Injection Well Disposal Dual Zone Monitor Well Final Design Report

Revised April 1994

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Wastewater Treatment Plant
Effluent Injection Well Disposal
Dual Zone Monitor Well
Final Design Report

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Section 1
Introduction

1.1 Purpose

In September 1993, Camp Dresser & McKee Inc. was authorized by the Acme Improvement District (AID) to provide professional hydrogeologic/engineering services for the design, permitting, bidding, and general engineering related to the construction of a dual zone monitor well at the AID Wastewater Treatment Plant (WWTP) in unincorporated Palm Beach County, Florida. The dual zone monitor well is being constructed to replace the annular monitor tubes installed in deep injection well IW-1, which was constructed by Geraghty & Miller in 1986. The design and area of review is presented in this report to support the Florida Department of Environmental Protection (FDEP) Application to Construct a Class I Injection Well Monitor Well. This application is included in Appendix A. The FDEP application to abandon the annular monitor tubes for IW-1 is also included in Appendix A.

1.2 Area of Review

1.2.1 Location and Surroundings

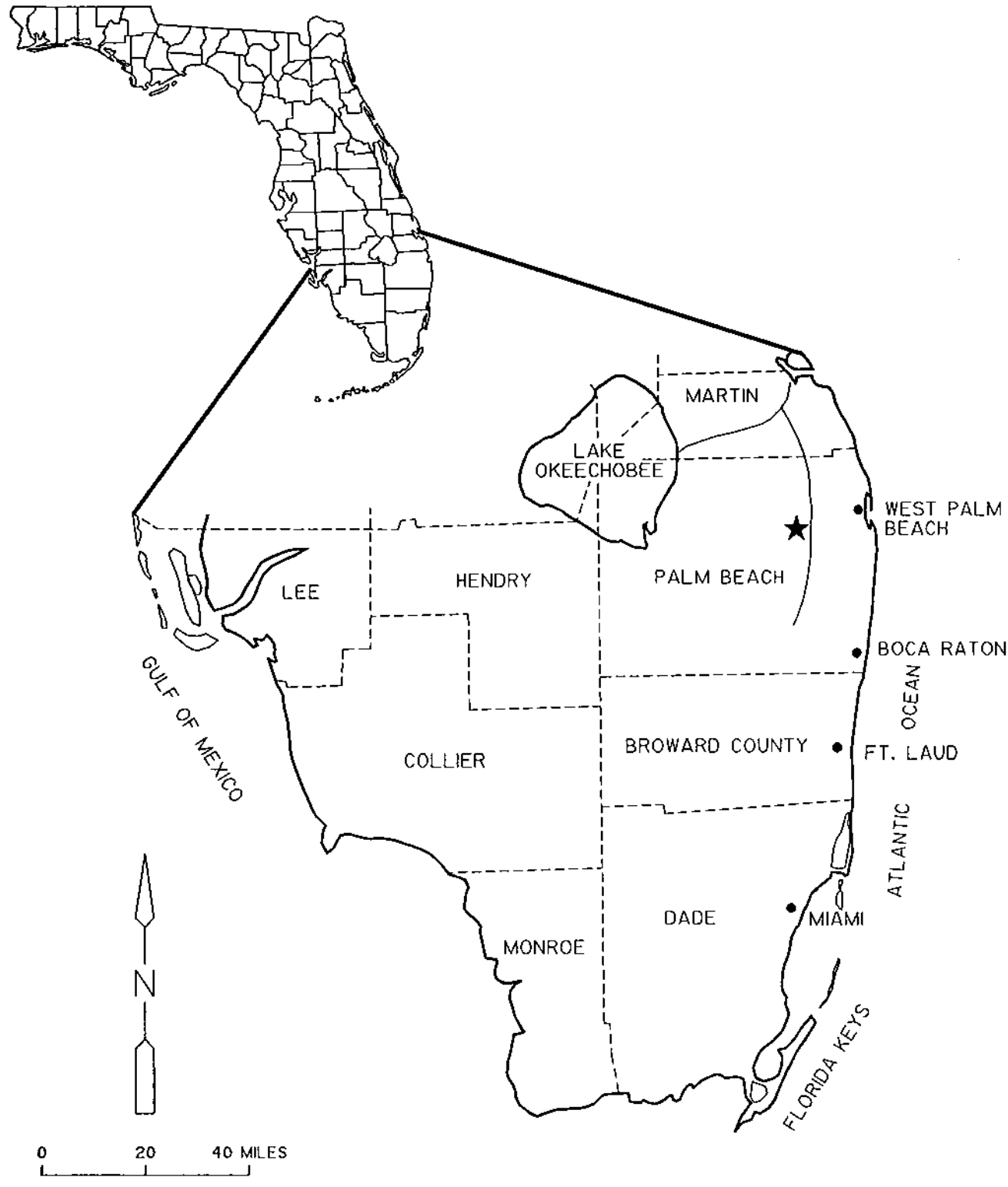
The general location of the Acme Improvement District WWTP in Palm Beach County is shown on Figure 1-1. Figure 1-2 indicates a one-mile radius area of review for the proposed monitor well. A records search of the South Florida Water Management District (SFWMD) files indicated that there are no public water supply wells within the area of review. The closest public water supply wells in the vicinity of the Acme Improvement District WWTP are located one and one-half miles to the northeast and southeast. These public supply wells are operated by AID under water use permit W-50-00464. The water supply for the Acme Improvement District WWTP is provided by the Acme Improvement District Water Plant. The file search indicated the presence of 11 irrigation wells within the one-mile area of review. The construction details for these irrigation wells are presented in Appendix B. None of the wells penetrate the Floridan Aquifer system.

The existing injection well at the Acme Improvement District WWTP, IW-1, is the only well which penetrates the injection zone in the lower Floridan aquifer within the area of review. The existing annular monitor tubes for IW-1 (SMW-1 and DMW-1) penetrate the proposed monitor zones in the upper Floridan aquifer. Figure 1-3 illustrates the location of IW-1 and the relative proximity of other wells in eastern Palm Beach County that penetrate the upper Floridan aquifer.

In addition, there are no known natural hazards such as faults or sinkholes present within the area of review.

1.2.2 Existing Injection Well

The Acme Improvement District currently operates one 16-inch outside diameter (O.D.) injection well (IW-1). The well was completed in August 1986 and operates under FDEP permit No. UO-50-142048. The operating permit for IW-1 was renewed in May 1991 and will expire in November 1995. IW-1 was drilled to a total depth of 3,502 feet below land surface (bls),



LEGEND:

★ ACME WASTEWATER TREATMENT PLANT

2820-001\G0000004 ALN 2/8/94

ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

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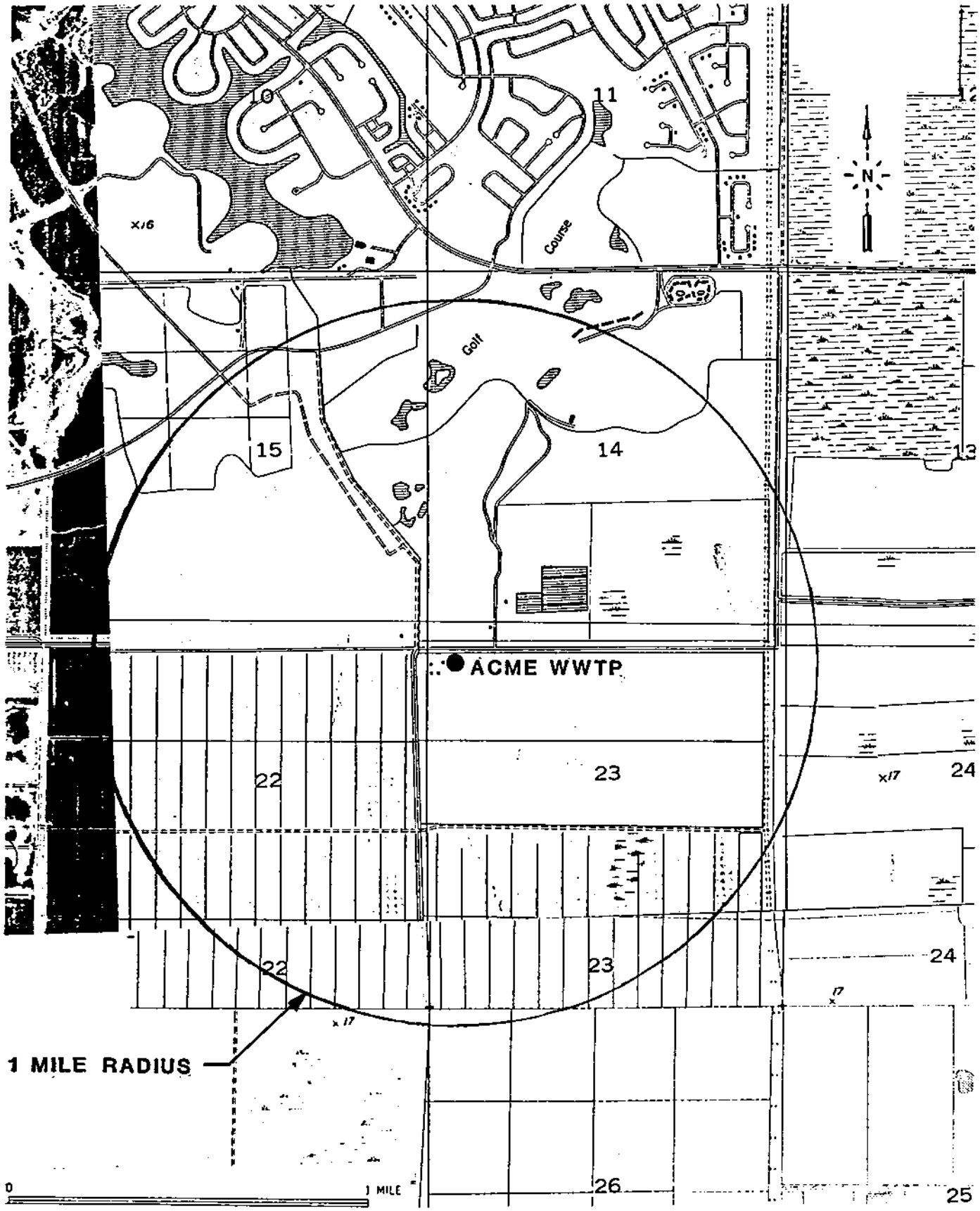
WASTEWATER TREATMENT PLANT
GENERAL LOCATION

FIGURE 1-1



2820-001\G0000008 ALN 10/15/93

ACME IMPROVEMENT DISTRICT
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SITE LOCATION AND AREA OF REVIEW MAP

FIGURE 1-2

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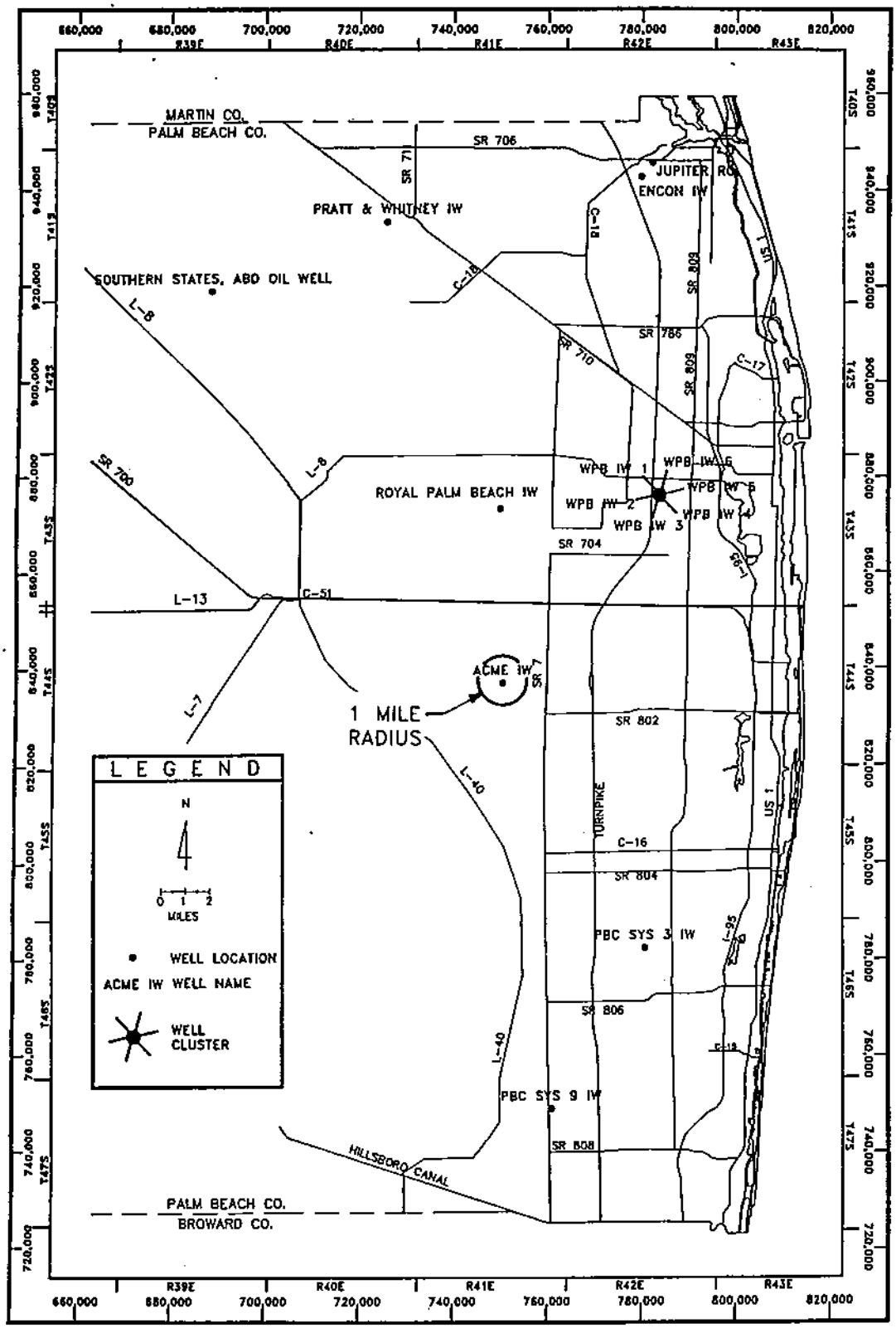

(SOURCE SFWMD PUBLICATION 89-4, 1989)

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LOCATION OF WELLS PENETRATING THE FLORIDAN AQUIFER SYSTEM IN EASTERN PALM BEACH COUNTY, FLA.

FIGURE 1-3

backfilled to 3,389 feet bls, and was cased to 2,756 feet bls. Two monitor tubes were emplaced in the annulus of IW-1 to monitor water quality above and below the underground source of drinking water (USDW). The well construction diagram for IW-1 is contained in Appendix B. In June 1993, the deep monitor tube (DMW-1) would no longer yield a sample. This monitor tube had displayed diminishing flow since 1987 and two rehabilitation attempts in 1991 and 1992 were unsuccessful. The shallow monitor tube (SMW-1) is still functional.

2 Section Two

Section 2
Hydrogeology

2.1 Regional Hydrogeology

The two major aquifer systems underlying Palm Beach County (Florida Geological Survey, 1986 and Meyer, 1989) from land surface to a depth of approximately 4,000 feet below land surface (bls) are the surficial aquifer system and the deeper artesian Floridan aquifer system. These two systems are separated by a confining sequence called the intermediate confining unit. Below a depth of approximately 4,000 feet bls, low permeability strata limit the depth of active groundwater circulation in southeast Florida (Figure 2-1). The hydrogeologic and geologic nomenclature used in this report corresponds to that of the United States Geological Survey (USGS). Additional figures which illustrate the regional hydrogeology are included in Appendix C.

2.1.1 Surficial Aquifer System

The surficial aquifer is an unconfined aquifer which underlies most of Palm Beach County and the southernmost portion of the county which is underlain by the wedge-shaped Biscayne aquifer. In general, water from the eastern part of the aquifer (where the aquifer system is thickest) is generally of better quality than in the western and northern parts of the aquifer.

The upper 200 feet of aquifer sediments consist of unconsolidated to consolidated sands, sandstones, clays, marls, and limestones which comprise Anastasia and Tamiami Formations. These two units comprise the surficial aquifer, which currently serves as the sole source of potable water in Palm Beach County. The base of the aquifer is reached at a depth of approximately 200 feet bls, where the surficial deposits begin to grade vertically downward into the distinctive clay-rich beds of the Tamiami and Hawthorn Formations.

2.1.2 Intermediate Confining Unit

The lower part of the Tamiami Formation, the Hawthorn Group, and the Tampa Limestone consist primarily of clay and marl, with minor amounts of limestone and chert. Because of their clay-rich nature, these formations are relatively low in permeability and form a confining unit which separates the surficial aquifer from the deeper artesian Floridan aquifer system. Collectively, these formations are referred to as the intermediate confining unit (Florida Geological Survey, 1986). The confining unit is approximately 800 feet thick in Palm Beach County and extends to a depth of approximately 1,000 feet bls.

Stratigraphically, below the Hawthorn Formation lies a thick sequence of carbonate rocks, which include the Suwannee Limestone, the Ocala Group, and the Avon Park, Oldsmar, and Cedar Keys Formations. Generally, these carbonate rocks are very permeable and comprise the Floridan aquifer system.

GEOLOGIC UNIT	AGE OR PERIOD	APPROXIMATE THICKNESS (FT)	GENERAL LITHOLOGY	HYDRAULIC CHARACTERISTICS
PAMLICO FM. (Qp)	Late Pleistocene	0 – 50	Quartz sand with shelly or silty intervals.	SURFICIAL AQUIFER SYSTEM
ANASTASIA FM. (Qa)	Pleistocene	0 – 200+	Ranges from sand and shell to well-cemented biogenic limestone.	BISCAYNE AQUIFER Extremely Permeable Solutioned Limestone
FORT THOMPSON FM. (Qa)	Pleistocene	0 – 40+	Ranges from shelly marl to biogenic limestone.	Unconfined aquifer Permeability ranges over 3 orders of magnitude. May be semiconfined locally.
CALOOSA-HATCHEE FM. (Qc)	Plio-Pleistocene	0 – 50?	Shell and marl with sand and limestone intervals.	
TAMIAMI FM. (Pl)	Pliocene	0 – 100+	Reefal limestone and talus deposits. Some sandy limestone.	
HAWTHORN GROUP (Mh)	Miocene	500 – 700	Sandy silt grading into dense, green clay with beds of limestone, sandy shell or dolomite. phosphate common. Limestone and marl common in basal unit.	INTERMEDIATE CONFINING UNIT Extremely low permeability sediments
SUWANNEE FM. (Os)	Oligocene	0 – 100?	Silty to clean, pale orange limestone. Not reliably described in study area.	Main Producing Interval in Study Area
OCALA GROUP (Eo)	Eocene	0 – 500	Highly fossiliferous pale orange limestone. Commonly fractured and solutioned.	UPPER FLORIDAN AQUIFER
AVON PARK FM. (Ea)	Eocene	500 – 700	Fossiliferous, chalky to granular limestone with dolomitic beds.	
LAKE CITY FM. (El)	Eocene	> 1500 ?	Chalky, fossiliferous limestone and dense brown dolmite.	Major Intra-Aquifer Confining Unit
OLDSMAR FM. (Eol)	Eocene	700 – 900	Biogenic, limestone grading downward into solutioned, crystalline dolomite.	
CEDAR KEYS FM. (Pc)	Paleocene	> 500	Cavernous grey to brown dolomite with intervals of creamy white limestone. Anhydrite common in lower section.	LOWER FLORIDAN AQUIFER Disposal Zone ("Boulder Zone")
LAWSON FM. (Kl)	Late Cretaceous	?	Interbedded dolomite anhydrite and limestone.	SUBFLORIDAN CONFINING UNIT

FLORIDAN AQUIFER SYSTEM

(MODIFIED AFTER SFWMD PUBLICATION 89-4, 1989)

2820-001\G0000009 ALN 10/20/93

ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

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GENERAL HYDROGEOLOGIC COLUMN
EASTERN PALM BEACH COUNTY

FIGURE 2-1

2.1.3 Floridan Aquifer System

The following description of the regional hydrogeology of southeastern Florida is excerpted from U.S. Geological Survey Professional Paper 1403-G (Meyer, 1989). Minor changes in content have been made in order to limit the discussion to southeastern Florida. The changes are primarily deletions of discussions regarding hydrogeology of other parts of the state of Florida.

Evaporite deposits in the Cedar Keys Formation of Paleocene age probably constitute the lower confining unit, or base of the active flow system. Overlying the evaporites, in ascending order, are limestone and dolostones of the Cedar Keys, Oldsmar, and Avon Park formations and the Ocala and Suwannee Limestones that make up the Floridan aquifer system, part of which was once called the Floridan aquifer (Parker and others, 1955) and all of which was once called the Tertiary limestone aquifer system (Johnston and others, 1980). In southwest Florida, the lower part of the Tampa Limestone is also included in the Floridan aquifer system.

The Floridan aquifer system is a vertically continuous sequence of permeable carbonate rocks of Tertiary age that are hydraulically connected in varying degrees, and whose permeability is generally several orders of magnitude greater than that of the rocks that bound the system above and below. In Florida, the Floridan aquifer system includes rocks ranging from Paleocene to early Miocene age, and locally in southeast Georgia, it includes rocks of late Cretaceous age.

Overlying the Floridan are alternating beds of sand, clay, marl, and limestone in the Tampa Limestone and Hawthorn Formation (both of Miocene age) that contain intermediate artesian aquifers, and make up the upper confining unit for the Floridan aquifer system. As discussed, this upper confining unit is known as the intermediate confining unit (Florida Geologic Survey, 1986). In southeastern Florida, clay in the Tamiami Formation of Pliocene age is included in the intermediate confining unit. Overlying these deposits are limestones and sands of the Tamiami Formation and of undifferentiated Pleistocene deposits that make up the surficial aquifer and contain unconfined groundwater.

Groundwater in the Floridan aquifer system in southern Florida is generally too saline for most uses. The lower Floridan aquifer contains groundwater that is similar in composition to seawater and is chiefly used as a receiving zone for injectedliquid wastes. The upper Floridan aquifer contains brackish water and is chiefly used as a source of limited industrial and agricultural supply and for feedwater to desalting plants. Pilot studies indicate that the upper part of the Floridan aquifer system in southern Florida also can be used for seasonal storage of surplus freshwater commonly referred to as aquifer storage recovery (ASR) (Merritt and others, 1983). However, the surficial aquifer generally is the major source of potable water in southern Florida.

In southeastern Florida, the Floridan aquifer system includes (from shallowest to deepest) all or part of the Suwannee Limestone of Oligocene age, the Ocala Limestone of late Eocene age, the Avon Park Formation of middle Eocene age, the Oldsmar Formation of early Eocene age, and the upper part of the Cedar Keys Formation of Paleocene age.

The top of the Floridan aquifer system, as used in this report, is located at approximately 970 feet in depth which corresponds to the top of the Suwannee Limestone. The base of the Floridan

aquifer system (the lowest confining unit) generally coincides with the top of evaporite beds in the Cedar Keys Formation (Miller, 1986), and it ranges from about 3,500 to 4,100 feet in depth.

The rocks that make up the Floridan aquifer system vary greatly in permeability so that the system resembles a "layer cake" composed of many alternating zones of low and high permeability. Crossflow (vertical flow) between permeable zones probably occurs through sinkholes and fractures. However, the amount of crossflow is probably small compared with the amount of horizontal flow. The zones of highest permeability generally are at or near unconformities and are generally parallel to bedding planes.

The temperature of groundwater in the Floridan aquifer system in areas near the southeastern coast generally decreases with increasing depth. However, anomalies frequently occur, probably owing to local upwelling through fractures and sinkholes. Groundwater temperatures are generally coolest along the southeast coast, where the temperature of seawater in the adjacent Straits of Florida is the lowest. Groundwater salinity is generally highest in coastal parts of southern Florida and in the lower part of the aquifer system owing to inland circulation of seawater.

The southern Florida, the Floridan aquifer system can generally be divided largely on the basis of the geology, hydrochemistry, and hydraulics into three hydrogeologic units, as follows:

1. The upper Floridan aquifer, which contains brackish groundwater. The specific conductance of the groundwater ranges from about 2,500 to 25,000 micromhos per centimeter (umhos/cm) at 78°F (25°C) and averages about 5,000 umhos/cm.

2. The middle confining unit, which contains salty groundwater. The specific conductance of the groundwater ranges from about 35,000 to 37,000 umhos/cm and averages about 36,000 umhos/cm.

3. The lower Floridan aquifer, which contains groundwater that is similar in composition to seawater. The specific conductance of the groundwater ranges from about 43,000 to 50,000 umhos/cm and averages 49,000 umhos/cm.

Each of these hydrogeologic units is discussed below.

2.1.3.1 Upper Floridan Aquifer

The upper Floridan aquifer in southern Florida chiefly consists of permeable zones in the Tampa, Suwannee, and Ocala Limestones and in the upper part of the Avon Park Formation. On the basis of aquifer tests and a regional flow model, the transmissivity is estimated to range from 75,000 to 450,000 gallons per day per foot (gpd/ft) (Bush and Johnston, 1988). The contained groundwater is brackish. The salinity of the groundwater generally increases with increasing depth and with distance down gradient and southward from central Florida. Groundwater temperatures also generally increase down gradient and southward from the recharge area in central florida. However, temperatures along the southeastern coast are lowest (about 70.0°F) owing to heat transfer to the Atlantic Ocean (Straits of Florida) (Sproul, 1977, p. 75) and/or to heat transfer to cooler saltwater in the lower Floridan aquifer (Kohout, 1965).

Water movement is chiefly lateral through highly permeable zones of dissolution at or near the top of each formation. Groundwater movement in May 1980 was generally southward from the area of highest head near Polk City in central Florida to the Gulf of Mexico and to the Atlantic Ocean.

The area of highest freshwater head is herein referred to as the "Polk City high." Prior to development (late 1800s or early 1900s), the head in south Florida probably was 5 to 10 feet higher than at present. As water use increased and wells were drilled in the area north of Lake Okeechobee, water levels were lowered and a saddle formed in the potentiometric surface toward the center of the peninsula. Hydraulic gradients in southern Florida were reduced, resulting in a decrease of natural discharge by submarine springs along the southeastern coast and the movement of seawater inland to a new position of equilibrium.

The concave shape of the contours of the 1980 potentiometric surface map along the southeastern coast indicates convergency of flow toward the submerged karst on the Miami Terrace between Fort Lauderdale and Miami. Groundwater discharge in this area is also suggested by computer flow modeling as described by Bush and Johnston (1988). The rugged topography of the submarine terrace was formed by the collapse of solution features (sinkholes) in the underlying limestone. A seismic reflection profile across the Miami Terrace shows the pinnacles and troughs associated with the submerged karst and the northward-prograding sediments of Miocene through Pleistocene age unconformably overlying the Suwannee Limestone. Currents and perhaps upwelling fresh water from submarine springs are probably responsible for the lack of sediment on the terrace and terrace slope. Malloy and Hurley (1970) reported that rock samples from dredge hauls on the Miami Terrace by the University of Miami's Institute of Marine Science (now the Rosenstiel School of Marine and Atmospheric Sciences) indicated that the ocean floor is composed of fossiliferous phosphatic limestone that contains numerous foraminifers, chiefly Miogypsina sp., Globigerina sp., miliolids, and rotalids. Rock samples from equivalent depths in artesian wells at Miami and Fort Lauderdale contain the same fossil assemblages and are identified as the Suwannee Limestone of Oligocene age.

Sinkholes on the Miami Terrace are both filled and unfilled. Those that are unfilled probably are active submarine springs. Sinkholes are generally present throughout Florida and are prominent in central Florida as chains of sinkhole lakes. The sinkholes are chiefly in Tertiary Limestones along joints or fractures that trend generally northwestward to southeastward. Sinkholes in southern Florida are virtually obscured because they are filled by deposits that are Miocene or younger in age. Their presence, however, is often indicated by drilling and by local salinity or temperature anomalies.

2.1.3.2 Middle Confining Unit

The middle confining unit of the Floridan aquifer system consists chiefly of the lower part of the Avon Park Formation but locally includes the upper part of the Oldsmar Formation. The unit has relatively low permeability, and it generally separates the upper Floridan aquifer, containing brackish groundwater, from the lower Floridan aquifer, containing groundwater that compares closely to seawater.

2.1.3.3 Lower Floridan Aquifer

The lower Floridan aquifer consists chiefly of the Oldsmar Formation and, to a lesser degree, the upper part of the Cedar Keys Formation. Groundwater in the lower Floridan aquifer compares chemically to modern seawater. In the lower Floridan aquifer are three permeable dolostones of the Oldsmar Formation that are separated by less permeable limestones. The transmissivity of the lower dolostone (locally called the Boulder Zone; Miller, 1986, p. B65-B66) ranges from about $23.9 10^6$ gpd/ft (Meyer, 1984) to 18.4×10^7 gpd/ft (Singh and others, 1983), whereas that for the overlying dolostones is probably an order of magnitude less. In southeastern Florida, hydraulic connection between the lower and intermediate dolostones is inferred from pumping tests and from the presence of sinkholes and fractures; however, hydraulic connection between the intermediate and upper dolostones apparently is poor, and locally the upper dolostone may be more closely related to the middle confining unit than to the lower Floridan aquifer.

A pronounced temperature anomaly is present in the lower Floridan aquifer, with the lowest measured temperature (50.5°F) in a deep disposal well (G-2334) at Fort Lauderdale. Temperatures increase generally from the Straits of Florida inland toward the center of the Floridan Plateau and, as previously mentioned, Kohout (1965) hypothesized circulation of cold seawater inland from the Straits of Florida through the lower part of the Floridan aquifer system driven by geothermal heat flow.

Attempts to calculate hydraulic gradients in the lower Floridan aquifer to verify the direction of groundwater movement have, thus far, been unsuccessful owing to a lack of reliable head data and to transitory effects of tides (ocean, earth, and atmospheric). However, recent measurements of head and carbon-14 activity substantiate the Kohout hypothesis.

2.2 Site Hydrogeology

2.2.1 Geologic Setting

The following description of the site hydrogeology at the Acme WWTP location is excerpted from the report entitled "Construction and Testing of an Injection Well, Acme Improvement District, Palm Beach County, Florida", by Geraghty & Miller, 1987. Minor editorial changes have been made to reflect the most recent revisions in stratigraphic nomenclature.

A well defined, areally extensive sequence of carbonate sediments is present at the Acme site and throughout the region. The confining sequence and injection zone are present at similar depths in four wells in northern Palm Beach County. These wells are the City of West Palm Beach Injection Well No. 5, the Pratt & Whitney injection well, the ENCON well in Jupiter, and the Acme well. The locations of these wells are shown on Figure 1-3. The geologic units found during the construction of the Acme well satisfied the requirements of Chapter 17-28 FAC. The injection zone is capable of receiving the design volume of effluent (5.76 million gallons per day at peak flow) and disposal of the effluent into this zone will not result in contamination of any underground source of drinking water. A brief description of the various geologic units follows.

From land surface to a depth of 192 feet, the sediments consist of limestone and clay with varying amounts of unconsolidated shell and sand. The limestone is generally a light to medium gray, bluish gray, or yellowish brown biomicrite. This material varies from fine- to medium-

grained and from poorly to well cemented. These sediments are Pleistocene to Miocene in age and correspond to descriptions of the Anastasia and Tamiami formations in Palm Beach County.

From 192 feet to 850 feet, the sediment is predominantly composed of an olive gray clay with small and varying amounts of sand and shell. There are some thin layers of limestone and chert interbedded with the clay. These sediments represent the Hawthorn Group. Below the Hawthorn and extending to 1,002 feet is interbedded limestone, sandstone, siltstone, marl, and clay, representing the Tampa Formation. The sediments in the interval from 192 to 1,002 feet are Miocene to Upper-Eocene in age. The interval from 1,002 to 1,724 feet consists of interbedded dolomite and limestone with dolomite first occurring at 1,040 feet. The limestone is a fine- to medium-grained, very pale orange, and poorly cemented micrite with sparse biomicrite. The dolomite is mainly yellowish brown, cryptocrystalline to microcrystalline, and generally hard. With depth, the dolomite becomes yellowish brown to black and more predominant. There are numerous vugs and much drusy crystallization. This section is of Upper- to Middle-Eocene age and is similar to descriptions of the Avon Park Formation and Lake City Limestone. Without detailed microfossil identification, it is difficult to delineate the boundary between the base of the Avon Park Formation and the top of the conformable Lake City Limestone.

From 1,724 to 2,352 feet, another interval of interbedded limestone and dolomite occurs. This interval corresponds to descriptions of the Lake City Limestone of early Middle-Eocene age. There is much interbedding of limestone and dolomite in the upper and lower portions of this interval, with limestone predominant between 2,090 and 2,230 feet. The limestone is generally light-colored; it is moderately well cemented near the top but becomes softer with depth. The dolomite is generally dark yellowish brown and hard with some fractures and drusy crystallization. Two cores were taken in the limestone beds near the bottom of this interval. The cores exhibited porosities of 24.2 and 29.4 percent.

Limestone and dolomite corresponding to descriptions of the Oldsmar Limestone of Lower-Eocene age occur below 2,352 feet. The limestone is light in color, fine-grained, and generally soft, with core-sample porosities of 27.8 to 36.3 percent. The dolomite is generally yellowish brown and olive gray to black, very hard, with much drusy crystallization and many sharply fractured fragments. Core samples taken in dolomite at 2,629 and 2,703 feet have porosities of 6.2 and 10.3 percent, respectively. Below 2,959 feet, the formation is exclusively dolomite to the total depth of 3,502 feet.

The injection zone extends from approximately 2,800 feet to 3,400 feet in the lower part of the Oldsmar Limestone. Results from the television survey indicate that the dolomite in this zone exhibits extensive dissolution cavities and fracturing. Open-spaced crystal growth is common in the vugs within the dolomite retrieved from the well cuttings. The majority of the injected fluid will be accepted into the cavities between 2,800 and 3,200 feet.

The base of the Oldsmar Limestone was not encountered during drilling of the Acme well. The base is believed to be marked by a gypsiferous limestone lying at the top of the Paleocene-age Cedar Keys Limestone Formation. This strata was not encountered before reaching the total depth of 3,502 feet.

2.2.2 Hydrogeologic Setting

The upper 192 feet of sediments beneath the site are Pleistocene-, Pliocene-, and Upper-Miocene-age sand, silt, limestone, and shell. These sediments contain the surficial aquifer system, which is used as a source of drinking water through the County.

Underlying the surficial aquifer system are approximately 650 feet of Miocene-age clay and marl which form a confining bed between the surficial aquifer and the Oligocene- to Eocene-age limestones and dolomites of the Floridan aquifer. This confining bed is called the Hawthorn Group. Water quality in the Floridan aquifer is poor in comparison to the surficial aquifer. Water from the Floridan aquifer in this area contains concentrations of dissolved solids which exceed drinking water standards. The aquifer generally is not used as a source of drinking water in the County because of the additional treatment required to meet potable standards and because of the availability of better-quality water at shallower depths in the overlying surficial aquifer. The Floridan aquifer exists under artesian conditions with a potentiometric level above land surface. The dense Miocene clays of the overlying Hawthorn Group provide good confinement for this aquifer.

A thick confining sequence consisting of dense limestone with interbedded layers of dolomite is present between 2,080 feet and 2,920 feet below pad level in the Acme well. This confining sequence overlies a section of highly permeable dolomite of the lower Oldsmar Formation referred to as the "Boulder Zone". This zone contains highly mineralized water and is used throughout south Florida for the disposal of treated domestic waste effluent.

2.2.3 Confining Sequence

Geraghty & Miller obtained information on the nature of the confining sequence during various phases of their drilling and testing program. During pilot-hole drilling, drill cuttings were collected and examined by the on-site geologist, and seven cores were taken in the interval between 2,232 and 2,714 feet. A portion of each core was selected and sent to a laboratory to be analyzed for a number of parameters, including porosity and vertical hydraulic conductivity.

After the completion of pilot hole drilling to a depth of 3,502 feet, straddle-packer tests were conducted in the borehole. Five tests were run in the interval between 1,780 feet and 2,558 feet. Values of hydraulic conductivity were obtained from these tests. The data from the packer tests were analyzed using a method derived by the U.S. Bureau of Land Reclamation.

2.2.4 Injection Zone

The anticipated presence of a suitable injection zone in the Wellington area was based on data from other wells in south Florida. A number of other injection wells and exploratory wells have been drilled in Palm Beach County and surrounding counties and it was believed that the thick, cavernous dolomites of the lower Oldsmar Formation existed throughout the area and, in particular, at Wellington. This was confirmed during the drilling of the pilot hole of the Acme well.

The first indications of the presence of an injection zone (Boulder Zone) were found at approximately 2,800 feet below pad level, or about 450 feet below the top of the Oldsmar.

During drilling of the pilot hole, plugging problems and erratic weights on bit and penetration rates were experienced at this depth. These problems were attributed to an excessively hard, fractured formation. The drill cuttings were composed mainly of hard, cryptocrystalline to finely crystalline dolomite with evidence of dissolution features and fine, mineral-filled fractures. Large cavities could be seen on the final caliper log and on the television survey at several places between 2,800 and 3,200 feet.

The injection zone and the occurrence of dolomite are shown clearly on the borehole-compensated sonic log presented in Appendix D (of Geraghty & Miller's well completion report). On the borehole-compensated sonic log, the faster transit velocities and cycle skipping between 2,900 feet and 3,400 feet confirm the presence of fractured dolomite containing large cavities. The presence of large cavities and fractures also can be seen on the television survey.

2.2.5 Mechanical Integrity Testing

The existing operating permit for the injection well (UO-50-142048) was renewed in May 1991, based on the results of the mechanical integrity testing (MIT) and review of monitoring data. The MIT will be performed prior to renewal of the current operating permit, which expires in November 1995.

3 Section Three

Section 3
Dual Zone Monitor Well Design

3.1 Well Design

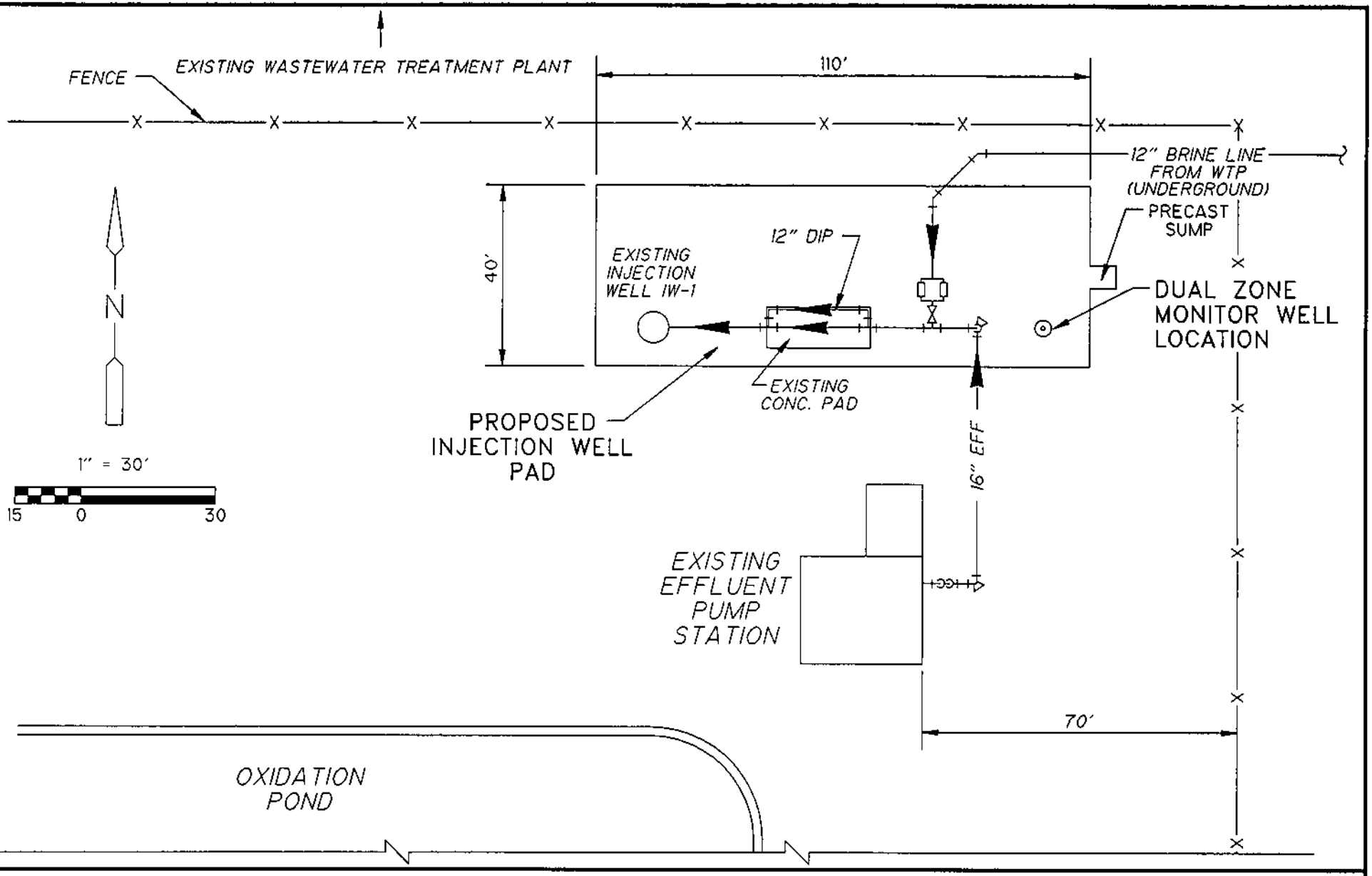
The design of the dual zone monitor well is based on the existing annular monitor tubes SMW-1 and DMW-1. The purpose of the dual zone monitor well is to continue monitoring the same zones presently served by SMW-1 and DMW-1. The upper monitor zone will obtain water from a transmissive zone located within and near the base of the underground source of drinking water (USDW) so termed because the total dissolved solids (TDS) content is less than 10,000 mg/l. The lower monitor zone will obtain water from the first transmissive zone above the intermediate confining beds and the injection zone. The upper zone will monitor between 1,420 and 1,470 feet and the lower zone will monitor between 1,950 and 2,000 feet. Records obtained from the drilling and testing at IW-1 indicate that the base of the USDW is located at approximately 1,650 to 1,700 feet below pad level (bpl). The location of the dual zone monitor well is illustrated in Figure 3-1.

3.2 Dual Zone Monitor Well Construction Sequence

The monitor well construction shall proceed in the following manner:

Construction from 0 to 1,420 feet bpl:

- Construct curbed concrete reinforced drilling pad. The drilling pad will encompass the dual-zone monitor well and the existing injection well (IW-1).
- Construct four shallow monitor wells to approximately 20 feet bpl on the perimeter of the drilling pad.
- Collect background water quality samples from the shallow monitor wells, analyze for pH, specific conductance, and chloride and submit results to FDEP prior to initiation of drilling activities. Sample the shallow monitor wells weekly for chloride and specific conductance values and submit results to FDEP during construction.
- Install optional pit casing of sufficient diameter to accommodate a 28-inch bit and cement to surface.
- Drill the nominal 28-inch diameter borehole to approximately 120 feet bpl for the 20-inch O.D. surface casing. Install and cement the 20-inch O.D. surface casing from 120 feet bls to surface.
- Collect formation samples every 10 feet, or at each formation change during well construction.
- Perform inclination surveys every 60 feet. Continue throughout well construction.



2820-001\G0000003 ALN 2/8/94

ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

DUAL ZONE MONITOR WELL LOCATION
SITE PLAN

FIGURE 3-1

CDM
environmental engineers, scientists, planners, & management consultants

- Drill nominal 12-inch diameter pilot hole to approximately 1,420 feet bpl. Perform geophysical logging. Perform packer test if deemed necessary.
- Determine the exact setting depth of the 12-3/4-inch O.D. intermediate casing.
- Obtain FDEP approval of casing setting depth.
- Ream nominal 19-inch diameter borehole to approximately 1,420 feet bpl.
- Install 12-3/4-inch O.D. intermediate casing to approximately 1,420 feet bpl and cement to surface.
- Perform temperature log, cement bond log, and pressure test of 12-3/4-inch O.D. casing.

Construction from 1,420 feet to 1,950 feet bpl:

- Drill a nominal 12-inch diameter bore hole to approximately 1,950 feet bpl.
- Collect formation samples at 10-foot intervals.
- Perform inclination surveys every 60 feet.
- Perform geophysical logging. Perform packer test if deemed necessary.
- Determine the exact setting depth of the 6-5/8-inch O.D. final casing.
- Obtain FDEP approval of casing depth.
- Install the nominal 6-5/8-inch O.D. final casing to approximately 1,950 feet bpl.
- Cement the 6-5/8-inch O.D. final casing from 1,950 feet bpl to 1,470 feet bpl.
- Perform temperature log, cement bond log, and pressure test 6-5/8-inch O.D. casing.

Construction from 1,950 feet bpl to 2,000 feet bpl (open hole drilling):

- Drill a nominal 5-inch diameter borehole from 1,950 feet to 2,000 feet bpl.
- Take formation samples every 10 feet.
- Perform geophysical logs.
- Perform gyroscopic survey at 60-foot minimum intervals from land surface to completion depth (approximately 2,000 feet bls).
- Begin development of upper and lower zones until water quality is representative of background.

- Collect background water quality samples from both zones and analyze for Primary and Second Drinking Water Standards and Priority Pollutants.

3.3 Materials

All materials specified for the Injection Well No. 1 dual zone monitor well shall be in compliance with Chapter 17-28 FAC.

3.3.1 Casings

Three strings of casing are proposed for use in the construction of the monitor well with outside diameters (O.D.) of 20, 12 3/4, and 6 5/8 inches. All casings shall conform to API-5L Grade B standards for steel and shall have perfect roundness and uniform wall thickness. Casing ends shall be mill beveled for butt welding. These casings are designed for the life expectancy of the deep injection disposal well system.

The 20-inch O.D. surface casing shall be spiral- or single-seam submerged arc welded black steel with a 0.375-inch wall thickness. The 12 3/4-inch O.D. intermediate casing shall be spiral- or single-seam submerged are welded black steel with a 0.375 inch wall thickness. The 6 5/8-inch O.D. final casing shall be seamless black steel with a 0.500-inch wall thickness. The proposed casing seats for the 20-inch, 12-3/4-inch, and 6-5/8-inch casings are 120 feet bpl, 1,420 feet bpl, and 1,950 feet bpl. Final casing depths are contingent upon site-specific lithology and the results of geophysical logging and testing, and are subject to TAC approval.

The casings will be centralized with casing centralizers, consisting of a set of three bow-type steel lathes welded to the casing in a horizontal plane 120° apart. The centralizers will be aligned vertically to permit passage of tremie pipe. The centralizers shall be of similar steel as the casing and placed at the following intervals:

1. One (1) centralizer 20 feet above the bottom of the casing.
2. Three (3) centralizers at 40 feet intervals above the bottom centralizer.
3. Centralizers will be placed every 200 feet thereafter to 20 feet below ground surface.
4. One (1) centralizer 20 feet below ground surface.

3.3.2 Epoxy

Epoxy phenolic resin shall be applied on the entire inside of the 12 3/4-inch and 6 5/8-inch O.D. casings and shall also be applied on the outside of the 6 5/8-inch O.D. casing from the 0 - 1,520 feet bpl interval. The epoxy phenolic resin shall be Matcole Epoxy-Phenolic System 1-850, as manufactured by International Paint, or equal. The epoxy coating shall be a minimum of 6 mils thick.

3.3.3 Cement

All cement used during casing cementing operations shall be American Society for Testing and Materials (ASTM) Type II sulfate resistant. Bentonite Gel shall be the only cement additive used during cementing of the casings. A maximum of 8 percent bentonite shall be allowed except during the cementing of the 100-foot interval above each casing seat where only neat cement

shall be used. Initial stages of cement shall be pressure grouted using the Haliburton method and subsequent stages shall be installed by tremie.

3.4 Drilling Pad and Shallow Monitor Wells

3.4.1 Drilling Pad

A reinforced concrete drilling pad shall be constructed for use during the drilling of the dual zone monitor well. The concrete pad will encompass the existing injection well (IW-1) and the dual zone monitor well. The concrete pad shall be constructed primarily for the following reasons: (1) to provide a stable, firm structural support for equipment and materials; (2) to serve as a reservoir for holding drilling fluids, cuttings, and contaminants until the materials could be transported to a proper disposal site; (3) to provide a protective barrier between the fresh water of the surficial aquifer and the saline waters, oils, lubricants, and drilling muds present during drilling operations; and (4) to provide containment of any spills on the pad during additional work on the well over the lifetime of well operation. The drilling pad will be enclosed with water tight reinforced concrete block walls which shall form full fluid containment on the pad during drilling operations and for the lifetime of the well. The proposed dimensions of the drilling pad are 40 feet by 110 feet, which is considered to be adequate to accommodate drill rigs for the injection well, monitor well, and drilling fluid circulation system including settling tanks, pumps, motors, and drilling fluid tanks. The pad shall remain in place after well completion. The pad shall be sloped toward a sump to provide adequate passive stormwater drainage off the pad. Stormwater will be pumped from the sump and the pad to the wet well with a sump pump. No fluid will be allowed to pond in the vicinity of the injection casing, following completion of construction activities.

3.4.2 Shallow Monitor Wells

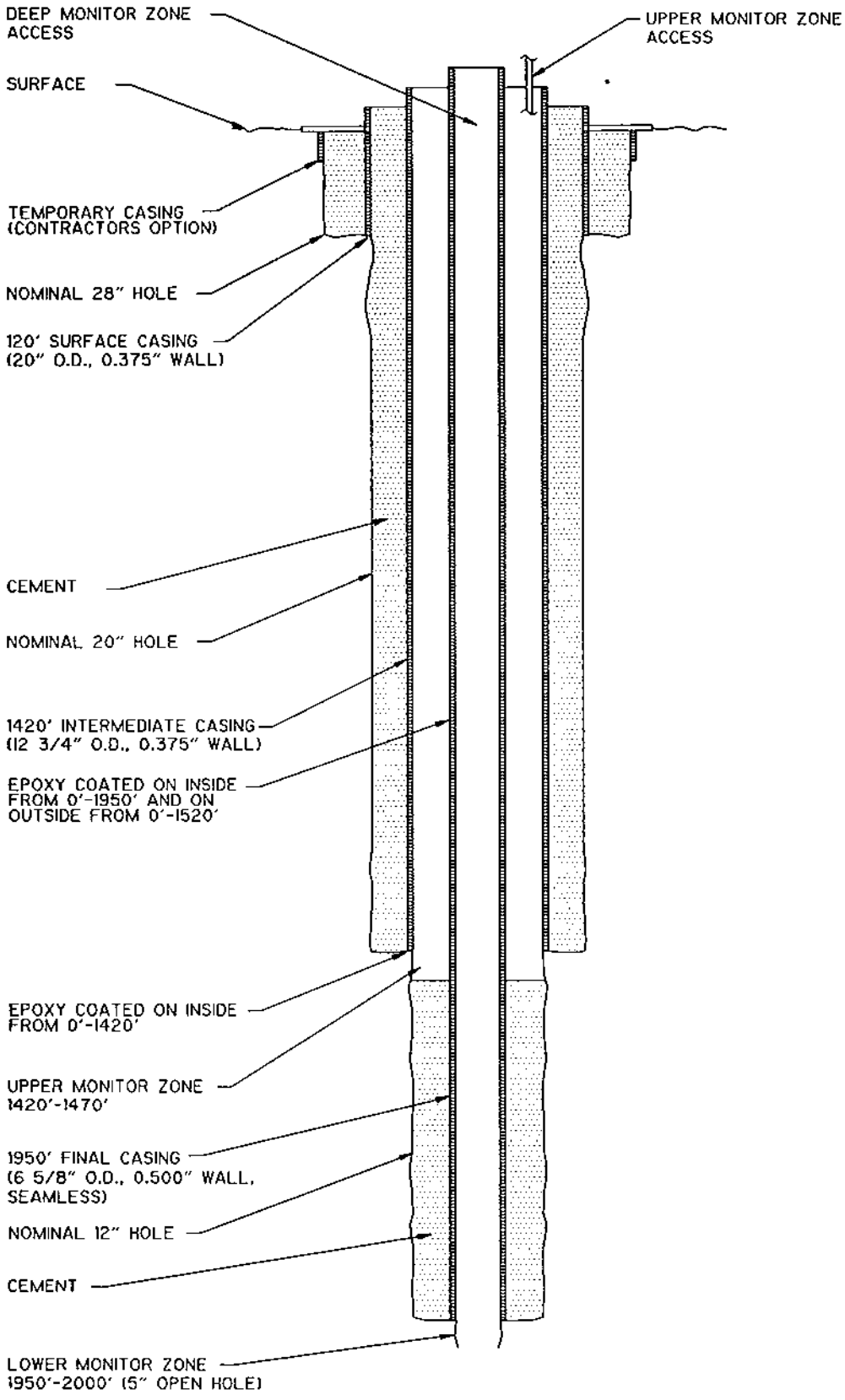
Four shallow polyvinylchloride (PVC) monitor wells shall be installed at the four corners of the concrete drilling pad for the purpose of obtaining samples from the surficial aquifer for selected water quality analysis. A background water quality sample shall be collected and analyzed from the four monitor wells. The analytical results shall be submitted to FDEP prior to the initiation of drilling. The wells shall be sampled for chloride, conductivity and total dissolved solids (TDS) on a weekly basis. The 2-inch diameter monitor wells shall have a total depth of 20 feet and shall be finished with 10 feet of 10-slot PVC screen with appropriate gravel pack. Completion depths of the monitor well are contingent upon depth to groundwater at the Acme WWTP site.

3.5 Dual Zone Monitor Well Construction and Testing

A design drawing of the monitor well is presented on Figure 3-2. The drilling method shall be conventional hydraulic mud rotary (closed circulation). Bentonite drilling mud shall be the primary drilling fluid. A blow out prevention system shall be utilized during drilling operations below the top of the Floridan aquifer.

3.5.1 Borehole Inclination and Gyroscopic Surveys

Inclination and gyroscopic surveys shall be performed during construction of the dual zone monitor well. These surveys will assist in preventing problems in running and setting the casing.



2820-001\G0000006 ALN 2/7/94

ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

DUAL ZONE MONITOR WELL DESIGN

CDM
environmental engineers, scientists, planners, & management consultants

FIGURE 3-2

Inclination is defined as the degree of declination or the deviation from true vertical. Inclination surveys shall be conducted at the dual zone monitor well at a minimum interval of 60 feet. The maximum allowable inclination is one degree (1°) and the maximum allowable inclination between any two successive surveys shall be 30 minutes (30') or one-half of a degree (0.5°).

A gyroscopic survey shall be run upon completion of the dual zone monitor well at a minimum interval of 60 feet. The survey shall be conducted and recorded from pad level to full depth of the well at that time. The gyroscopic survey provides drift angle and direction, true vertical depth, rectangular coordinates, and dog leg severity information for any predetermined depth interval.

3.5.2 Geophysical Logging

Geophysical logs will be performed at various stages of well construction. The geophysical logging program will consist of the following:

- 28-inch Borehole, 0 to 120 feet bpl.
  - Caliper
  - Natural Gamma
  - Single Point Electric and spontaneous potential

- Pilot Hole, 120 to 1,420 feet bpl.
  - Caliper
  - Natural Gamma
  - Standard Electric (long and short normal, spontaneous potential)
  - Dual Induction Laterolog/Spherically Focussed Log (DIL/SFL)
  - Borehole Compensated Sonic/Variable Density Log (BHL/VDL)
  - Fluid Resistivity
  - Temperature

- Reamed Hole, 120 to 1,420 feet bpl.
  - Caliper
  - Natural Gamma

- Cased Hole, 0 - 1,420 feet bls
  - Caliper
  - Natural Gamma
  - Temperature (not more than 24 hours after cementing 12-3/4-inch casing)
  - Cement Bond Log (not less than 24 hours after cementing the 12-3/4-inch casing)

- Borehole, 1,420 to 1,950 feet bpl.
  - Caliper
  - Natural Gamma
  - Standard Electric
  - DIL/SFL
  - BHL/VDL
  - Fluid Resistivity
  - Temperature

- Cased Hole, 0 to 1,950 feet bpl.
  - Caliper
  - Natural Gamma
  - Temperature (not more than 24 hours after cementing 6-5/8-inch O.D. casing)
  - Cement Bond Log (not less than 24 hours after cementing 6-5/8-inch O.D. casing)

- Open Hole, 1,950 to 2,000 feet bpl.
  - Caliper
  - Natural Gamma
  - Standard Electric
  - DIL/SFL
  - BHL/VDL
  - Fluid Resistivity
  - Temperature
  - Gyroscopic Survey (0-2,000 feet bls)

The information obtained from the geophysical logging and lithologic logs will provide the basis for the final well casing setting depths, which is only possible after well construction has begun.

3.5.3 Pressure Testing

Pressure tests of approximately 150 psi shall be conducted on the 12-3/4-inch and 6-5/8-inch casings during well construction. The duration of the pressure tests will be one hour. These tests are to verify the integrity of the well casings and welds.

3.5.4 Background Water Quality

Following completion of the dual zone monitor well, appropriate amounts of water shall be purged from both the upper and the lower monitor zones in order to develop the monitor zones and to restore them to background conditions. When background conditions are restored, water quality samples will be collected and analyzed for Primary and Secondary Drinking Water Standards and Priority Pollutants from both monitor zones to determine background water quality. The parameters that comprise the Primary and Secondary Drinking Water Standards and the Priority Pollutants are included in Appendix D for reference. This parameter list is also referred to as the "free from" list or minimum criteria.

3.5.5 Operational Testing

The operational testing will consist of weekly sampling and analysis of the following parameters for a period of approximately 120 days. Operational testing will be initiated after the construction of the dual zone monitor well is completed and the background water quality samples have been collected and analyzed.

- Maximum and minimum pressure/water levels
- TKN as N (mg/l)
- Ammonia as N (mg/l)

- Fecal Coliform (# colonies/100 ml)
- Total Dissolved Solids (mg/l)
- Total Phosphorus (mg/l)
- Specific Conductance (umho/cm @ 25° C)
- Sulfate (mg/l)
- Chloride (mg/l)
- pH (Standard Units)
- Temperature (°F) - must be recorded immediately as sampling

When the background water quality sampling and the operational testing are completed, monthly sampling and analysis of the monitor zones will resume. The water quality data for the injection well system will be reported monthly to the FDEP on form 17.1205(7) in accordance with Chapter 17-28 FAC. The analyses of the samples from the monitor zones must be reported to the UIC section of the local and the Tallahassee FDEP's office on a monthly basis. Continuous recording of the pressure in the upper and lower monitor zones (in feet of water referenced to NGVD) will also be conducted. The monthly report will include the daily and monthly average, total, minimum, and maximum pressure values for both monitor zones.

3.6 Sample Piping for the Dual Zone Monitor Well

In order to obtain samples from the shallow and deep monitor zones, sample piping consisting of 2-inch diameter PVC will be installed for each monitor zone. Access to the shallow monitor zone is through the annular space between the 6-5/8-inch and 12-3/4-inch casings. Access to the deep monitor zone is through the 6-inch casing (Figure 3-2). The sample piping will ultimately discharge to the wet well which is located within the effluent pump station approximately 50 feet southwest of the proposed dual zone monitor well location. A ball valve will be installed in each sample line to control flow. A sample port will be installed in each sample line prior to discharge into the wet well. This sample port will be located within the effluent pump station in order to prevent a release of brackish water to the surficial aquifer.

3.7 Plugging and Abandonment of Existing Annular Monitor Tubes

The abandonment of the shallow and deep monitor tubes (SMW-1 and DMW-1) would be performed after construction and testing of the new dual zone monitor well is complete. Each tube will be abandoned by pumping neat cement via tremie from the bottom of the tube to surface after the appropriate permit is issued. The volume of neat cement required for the abandonment of the two monitor tubes is estimated to be 75 cubic feet. Plugging and abandonment procedures will be performed in accordance with Chapter 17-28.270 FAC. FDEP will be notified prior to the initiation of the abandonment procedures. The abandonment of these monitor tubes is included in the construction contract for the dual zone monitor well.

The plugging and abandonment plan for the dual zone monitor well, as required by Chapter 17-28.270 FAC, is submitted in Appendix E of this document.

References

Bush, P.W., and Johnston, R.H., in press. Ground-water hydraulics, regional flow and ground-water development of the Floridan aquifer system in Florida and in parts of Georgia, South Carolina, and Alabama: U.S. Geological Survey Professional Paper 1403-C.

Drever, J.I., 1982. The Geochemistry of Natural Waters. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Florida Geological Survey, 1986. Hydrogeological Units of Florida, Florida Geological Survey Special Publication, 28, 9 p.

Geraghty & Miller Inc. 1987. Construction and Testing of an Injection Well Acme Improvement District Palm Beach County, Florida (unpublished).

Johnston, R.H., Krause, R.E., Meyer, F.W., Ryder, P.D., Tibbals, C.H., and Hunn, J.D., 1980. Estimated potentiometric surface for the Tertiary limestone aquifer system, Southeastern United States, prior to development: U.S. Geological Survey Open-File Report 80-406, 1 sheet.

Kohout, F.A., 1965. A hypothesis concerning cyclic flow of salt water related to geothermal heating in the Floridan aquifer: New York Academy of Sciences Transactions, ser. 2, v. 28, no. 2. p. 249-271. - 1967, Ground-water flow and the geothermal regime of the Floridan Plateau: Gulf Coast Association of Geological Societies Transactions, v. 17, p. 339-354.

Malloy, R.J., and Hurley, R.J., 1970. Geomorphology and geologic structure - Straits of Florida: Geological Society of America Bulletin, v. 81, p. 1947-1972.

Merritt, M.L., Meyer, F.W., Sonntag, W.H., and Fitzpatrick. D.J., 1983. Subsurface storage of freshwater in south Florida: A prospectus: U.S. Geological Survey Water-Resources Investigations Report 83-4214, p. 69.

Meyer, F.W., 1971. Saline artesian water as a supplement: American Water Works Association Journal, v. 63, no. 2, p. 65-71. - 1974, Evaluation of hydraulic characteristics of a deep artesian aquifer from natural water-level fluctuations. Miami, Florida: Florida Bureau of Geology Report of Investigations 75, p. 32. - 1984, Disposal of liquid wastes in cavernous dolostones beneath southeastern Florida, in Burger, A., and Dubertret, L., eds., Hydrogeology of karstic terrains: Case histories: International Association of Hydrogeologists, International Contributions to Hydrogeology, v. 1, p. 211-216.

Miller, J.A., 1982. Geology and configuration of the base of the Tertiary limestone aquifer system, Southeastern United States: U.S. Geological Survey Open-File Report 81-1176, 1 sheet. - 1982b, Geology and configuration of the top of the Tertiary limestone aquifer system, Southeastern United States: U.S. Geological Survey Open-File Report 81-1178, 1 sheet. - 1986, Hydrogeologic framework of

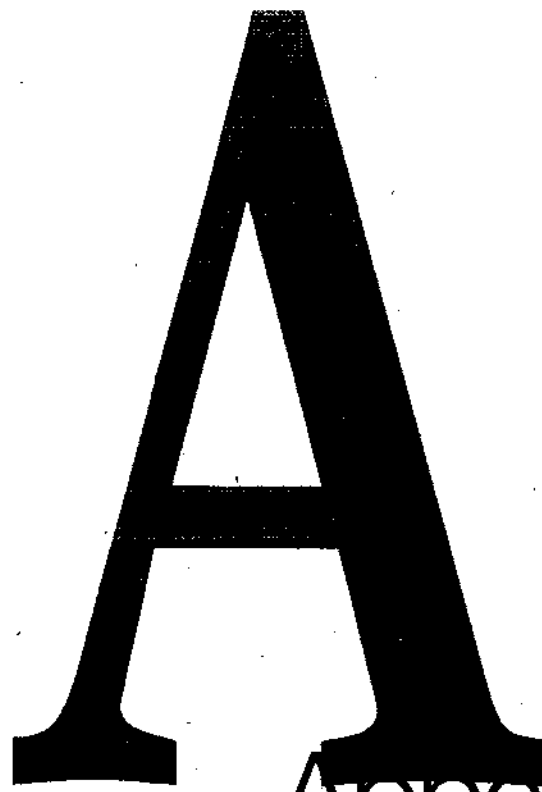
the Florida aquifer system in Florida and in parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Professional Paper 1403-B, p. 91.

Singh, W.P., Eichler, G.E., Sproul. C.R., and Garcia-Bengochea, J.I., 1983. Pump testing Boulder Zone aquifer, South Florida: Journal of Hydraulic Engineering, v. 9, no. 8, p. 4, 1152-1160.

Sproul, C.R., 1977. Spatial distribution of ground-water temperatures in south Florida, in Smith, D.L., and Griffin, G.M., eds., Geothermal nature of the Floridan Plateau: Florida Bureau of Geology Special Publication 21, p. 65-89.

Stringfield, V.T., 1936. Artesian water in the Florida peninsula: U.S. Geological Survey Water-Supply Paper 773-C, p. I 15- I95. - 1966, Artesian water in Tertiary limestone in the Southeastern States: U.S. Geological Survey Professional Paper 517, 226 p.

Westaway and Loomis, 1984. Cameron Hydraulic Data. Ingersoll-Rand, Woodcliff Lake, New Jersey.



Appendix A

APPENDIX A

FDEP CLASS I WELL CONSTRUCTION PERMIT APPLICATION
FDEP CLASS I WELL ABANDONMENT PERMIT APPLICATION

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

APPLICATION TO CONSTRUCT/OPERATE/ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

PART I. Directions

A. All applicable items must be completed in full in order to avoid delay in processing this application. Where attached sheets or other technical documentation are utilized in lieu of the blank space provided, indicate appropriate cross-reference in the space and provide copies to the department in accordance with (C) below. Where certain items do not appear applicable to the project, indicate N/A in the appropriate spaces. When this form is used in conjunction with DER Form 17-1.205(1), duplicative information requests need to be completed only once.

B. All information is to be typed or printed in ink.

C. Four (4) copies of this application and four (4) copies of supporting information such as plans, reports, drawings and other documents shall be submitted to the appropriate District/Subdistrict office. An engineering report is also required to be submitted to support this application pursuant to the applicable sections of Florida Administrative Code Rule 17-28. The attached lists* shall be used to determine completeness of supporting data submitted or previously received. A check for the application fee in accordance with Florida Administrative Code Rule 17-4.05 made payable to the Department shall accompany the application.

D. For projects involving construction, this application is to be accompanied by four (4) sets of engineering drawings, specifications and design data as prepared by a Professional Engineer registered in Florida, where required by Chapter 471, Florida Statutes.

E. Attach 8 1/2" x 11" USGS site location map indicating township, range and section and latitude/longitude for the project.

PART II. General Information

A. Applicant: Name Oliver M. Mitchell Title Public Works Administrator

Address 14000 Greenbriar Boulevard

City Wellington, Florida Zip 33414

Telephone Number (407) 793-4659

B. Project Status: [ ] New [XX] Existing

[X] Modification (specify) Replacement of shallow and deep annular monitor tubes with a dual zone monitor well.

*"Engineering and Hydrogeologic Data Required for Support of Application to Construct, Operate and Abandon Class I, III, or V Injection Wells"

C. Well Type:

( ) Exploratory Well (X) Test/Injection Well (monitor)

D. Type of Permit Application:

( ) Class I Exploratory Well Construction and Testing Permit

(XX) Class I Test/Injection Well Construction and Testing Permit

( ) Class I Well Operating Permit

( ) Class I Well Plugging and Abandonment Permit

( ) Class III Well Construction/Operation/Plugging and Abandonment Permit

( ) Class V well Construction Permit

( ) Class V Well Operating Permit

( ) Class V Well Plugging and Abandonment Permit

E. Facility Identification:

Name: Acme Improvement District

Facility Location: Street: 11860 Pierson Road

City: Unincorporated Palm Beach County County: Palm Beach

SIC Code: N/A

F. Proposed facility located on Indian Lands: Yes____ No X

G. Well Identification:

Well No. MW-1 of 1 (total #) Wells

Purpose (Proposed Use): Monitor Well

Well Location: Latitude: 26° 38' 00" N Longitude 80° 13' 30" W

(attach separate sheet, if necessary, for multiple wells.)

Subpart B. General Projection Description:

(1) Describe the nature, extent and schedule of the injection well project. Refe to existing and/or future pollution control facilities, expected improvement in performance of the facilities and state whether the project will result i full compliance with the requirements of Chapter 403, Florida Statutes, an all rules and regulations of the Department. Attach additional sheet(s) i necessary or cross-reference the engineering report.

The dual zone monitor well will be constructed to replace the shallow and de annular monitor tubes in IW-1. The deep monitor tube is no longer functiona The shallow monitor tube is functional at this time.

PART III Statement by Applicant and Engineer

A. Applicant

I, the owner/authorized representative* of Acme Improvement District, certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I understand that this certification also applies to all subsequent reports submitted pursuant to this permit. Where construction is involved, I agree to retain the design engineer, or other professional engineer registered in Florida, to provide inspection of construction in accordance with Florida Administrative Code Rule 17-28.34(1)(c).

Oliver M. Mitchell — 11/3/93

Signed — Date

Oliver M. Mitchell, Public Works Administrator — (407) 793-4659

Name and Title (Please Type) — Telephone Number

*Attach a Letter of Authorization.

B. Professional Engineer Registered in Florida

This is to certify that the engineering features of this monitor well have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the monitoring of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that the well, when properly maintained and operated, will monitor the effluent in compliance with all applicable statutes of the State of Florida and the rules and regulations of the Department. It is also agreed that the undersigned will furnish the applicant a set of instructions for proper maintenance and operation of the well.

Signed: Bruce R. Snyder

Bruce R. Snyder, P.E.

Name (Please Type)

Camp Dresser & McKee Inc.

Company Name (Please Type)

1500 N.W. 49th Street, Suite 300
Fort Lauderdale, FL 33309

Mailing Address (Please Type)

Bruce R. Snyder 10/18/93

(Please Affix Seal)

FLORIDA REGISTRATION NUMBER 38016 Date: _____ Phone No. (305) 776-1731

ENGINEERING AND HYDROLOGIC DATA REQUIRED FOR SUPPORT OF APPLICATION TO CONSTRUCT, OPERATE, AND ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

The following information shall be provided for each type of permit application.

(A) CLASS I EXPLORATORY WELL CONSTRUCTION AND TESTING PERMIT

(1) Conceptual plan of the injection project. Include number of injection wells proposed injection zone, nature and volume of injection fluid, and propose monitoring program.

(2) Preliminary Area of Review Study. Include the proposed radius of the area o review with justification for that radius. Provide a map showing the loca tion of the proposed injection well or well field area for which a permit i sought and the applicable area of review. Within the area of review, the ma must show the number or name, and location of all producing wells, injectio wells, abandoned wells, dry holes, surfacebodies of water, springs, publi water systems, mines (surface and subsurface), quarries, water wells an other pertinent surface features including residences and roads. The ma should also show faults, if known or suspected. Only information of publi record and pertinent information known to the applicant is required to be in cluded on this map.

(3) Proposed other uses of the exploratory well.

(4) Drilling and testing plan for the exploratory well. The drilling plan mus specify the proposed drilling program, sampling, coring, and testing proce dures.

(5) Abandonment Plan.

(B) CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT
SEE INJECTION WELL PERMIT APPLICATION

(1) A map showing the location of the proposed injection wells or well field are for which a permit is sought and the applicable area of review. Within th area of review, the map must show the number or name, and location of a. producing wells, injection wells, abandoned wells, dry holes, surface bodie of water, springs, public water systems, mines (surface and subsurface quarries, water wells and other pertinent surface features including res dences and roads. The map should also show faults, if known or suspecte Only information of public record and pertinent information known to t applicant is required to be included on this map.

(2) A tabulation of data on all wells within the area of review which penetra into the proposed injection zone, confining zone, or proposed monitori zone. Such data shall include a description of each well's type, constru tion, date drilled, location, depth, record of plugging and/or completio and any additional information the Department may require.

(3) Maps and cross sections indicating the general vertical and lateral limi within the area of review of all underground sources of drinking water, the position relative to the injection formation and the direction of water mov ment, where known, in each underground source of drinking water which may affected by the proposed injection.

(4) Maps and cross sections detailing the hydrology and geologic structures of the local area.

(5) Generalized maps and cross sections illustrating the regional geologic setting.

(6) Proposed operating data.

a. Average and maximum daily rate and volume of the fluid to be injected;
b. Average and maximum injection pressure; and,
c. Source and an anlysis of the chemical, physical, radiological and biological characteristics of injection fluids.

(7) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

(8) Proposed stimulation program.

(9) Proposed injection procedure.

(10) Engineering drawings of the surface and subsurface construction details of the system.

(11) Contingency plans to cope with all shut-ins or well failures, so as to protect the quality of the waters of the State as defined in Florida Administrative Code Rule 17-3, including alternate or emergency discharge provisions.

(12) Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Florida Administrative Code Rule 17-28.25.

(13) For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Florida Administrative Code Rule 17-28.13(5).

(14) Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, proposed blowout protection (if necessary), and a drilling, testing and coring program.

(15) A certification that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Florida Administrative Code Rule 17-28.27(9).

(C) CLASS I INJECTION WELL OPERATING PERMIT

(1) A report shall be submitted with each application for a Class I well operation permit, which shall include, but not be limited to, the following information:

a. Results of the information obtained under the construction permit described in (8)-CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT, including:

1. All available logging and testing program data and construction data on the well or well field;

2. A satisfactory demonstration of mechanical integrity for all new wells pursuant to Florida Administrative Code Rule 17-28.13(6)(b);

3. The actual operating data, including injection pressures versus pumpin rates where feasible, or the anticipated maximum pressure and flow rat at which the permittee will operate, if approved by the Department;

4. The actual injection procedure;

5. The compatibility of injected waste with fluids in the injection zon and minerals in both the injection zone and the confining zone; and,

6. The status of corrective action on defective wells in the area o review.

b. Record drawings, based upon inspections by the engineer or persons unde his direct supervision, with all deviations noted;

c. Certification of completion submitted by the engineer of record;

d. If requested by the Department, operation manual including emergency pro cedures;

e. Proposed monitoring program and data to be submitted;

f. Proof that the existence of the well has been recorded on the surveyor' plan at the county courthouse.

g. Proposed plugging and abandonment plan pursuant to Florida Administrati Code Rule 17-28.27(2).

(D) CLASS I WELL PLUGGING AND ABANDONMENT PERMIT

(1) The reasons for abandonment.

(2) A proposed plan for plugging and abandonment describing the preferred and a. ternate methods, and justification for use.

a. The type and number of plugs to be used;

b. The placement of each plug including the elevation of the top and bottom

c. The type and grade and quantity of cement or any other approved pluggi material to be used;

d. The method for placement of the plugs.

(3) The procedure to be used to meet the requirements of Rule 17-28.27.

(E) CLASS III WELL CONSTRUCTION/OPERATION/PLUGGING AND ABANDONMENT PERMIT

Construction Phase

(1) A map showing the location of the proposed injection wells or well field ar for which a permit is sought and the applicable area of review. Within t area of review, the map must show the number or name, and location of a producing wells, injection wells, abandoned wells, dry holes, surface bodi of water, springs, public water systems, mines (surface and subsurface quarries, water wells and other pertinent surface features including res dences and roads. The map should also show faults, if known or suspecte Only information of public record and pertinent information known to t applicant is required to be included on this map.

(2) A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may required.

(3) Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

(4) Maps and cross sections detailing the hydrology and geologic structures of the local area.

(5) Generalized maps and cross sections illustrating the regional geologic setting.

(6) Proposed operating data:

a. Average and maximum daily rate and volume of the fluid to be injected;

b. Average and maximum injection pressure; and,

c. Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids, including any additives.

(7) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

(8) Proposed stimulation program.

(9) Proposed injection procedure.

(10) Engineering drawings of the surface and subsurface construction details of the system.

(11) Contingency plans to cope with all shut-ins or well failures or catastrophic collapse, so as to protect the quality of the waters of the state as defined in Florida Administrative Code Rule 17-3, including alternate or emergency discharge provisions.

(12) Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Florida Administrative Code Rule 17-28.25.

(13) For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Florida Administrative Code Rule 17-28.13(5).

(14) Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids form surficial aquifers, and a drilling, testing and coring program.

(15) A certificate that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Florida Administrative Code Rule 17-28.27(9).

(16) Expected changes in pressure, native fluid displacement, direction of mov
ment of injection fluid.

(17) A proposed monitoring plan, which includes a plan for detecting migration
fluids into underground sources of drinking water, a plan to detect wat
quality violation in the monitoring wells, and the proposed monitoring da
to be submitted.

Operation Phase

(1) The following information shall be provided to the Department prior to grant
ing approval for the operation of the well or well field:

a. All available logging and testing program data and construction data o
the well or well field;

b. A satisfactory demonstration of mechanical integrity for all new well
pursuant to Florida Administrative Code Rule 17-28.13(6)(b);

c. The actual operating data, including injection pressure versus pumpin
rate where feasible, or the anticipated maximum pressure and flow rate
which the permittee will operate, if approved by the Department;

d. The results of the formation testing program;

e. The actual injection procedure;

f. The status of corrective action on defective wells in the area of review.

Plugging and Abandonment Phase

(1) The justification for abandonment.

(2) A proposed plan for plugging and abandonment describing the preferred and al
ternate methods.

a. The type and number of plugs to be used;

b. The placement of each plug including the elevation of the top and bottom;

c. The type and grade and quantity of cement or any other approved pluggin
material to be used;

d. The method for placement of the pluge.

(3) The procedure to be used to meet the requirements of Florida Administrativ
Code Rule 17-28.27.

(F) CLASS V WELL CONSTRUCTION PERMIT. (This form should be used for Class V well
instead of Form 17-1.209(1) when there is a need for a Technial Adviaory Committe
and an engineering report.)

(1) Type and number of proposed Class V Wells:

Wells Receiving Domestic Waste _____ Salt-water Intrusion Barrier Wells _____

Cooling Water Return Flow Wells, Open-looped System _____ Subsidence Control Wells _____

Sand Backfill Wells _____

Experimental Technology Wells _____

Radioactive Waste Disposal Wells* _____

Other non-hazardous Industrial or Commercial Disposal Wells (explain) _____

Wells used to inject spent brine after halogen recovery _____

Borehole Slurry Mining Wells _____

Other (explain) _____

*Provided the concentrations of the waste do not exceed drinking water standards contained in Chapter 17-22, F.A.C.

(2) Project Description:

a. Description and use of proposed injection system;

b. Nature and volume of injected fluid (The Department may require an analysis (including bacteriological analysis) in accordance with Florida Administrative Code Rule 17-4.27(2)(c));

c. Proposed pretreatment.

(3) Water well contractor's name, title, state license number, address, phone number and signature.

(4) Well Design and Construction Details. (For multi-casing configurations or unusual construction provisions, an elevation drawing of the proposed well should be attached.)

a. Proposed total depth;

b. Proposed depth and type of casing(s);

c. Diameter of well;

d. Cement type, depth, thickness;

e. Injection pumps (if applicable):_____gpm @____psi
Controls:_____
_____
_____

(5) Water Supply Wells - When required by Florida Administrative Code Rule 17-4.27, attach a map section showing the locations of all water supply wells within a one (1) mile radius of the proposed well. The well depths and casing depths should be included. When required by Rule 17-4.27(2)(g), results of bacteriological examinations of water from all water supply wells within one (1) mile and drilled to approximate depth of proposed well should be attached.

(6) Area of Review (may be required at Department's discretion).

Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and

subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

(G) CLASS V WELL OPERATION PERMIT (Final report of the construction that includes the following information may be submitted with the application to operate.)

(1) Permit Number of Class V Construction Permit:_____

(2) Owner's Name:_____

(3) Type of Well:_____

(4) Construction and Testing Summary:

a. Actual Dimensions:

Diameter _____ inches; Well Depth _____ feet; Casing Depth _____ feet.

_____ _____ _____

_____ _____ _____

b. Results of Initial Testing.

(5) Proposed Operating Data:

a. Injection Rate (GPM);

b. Description of injected waste;

c. Injection pressure and pump controls.

(6) Proposed Monitoring Plan (If any):

a. Number of monitoring wells;

b. Depth(s);

c. Parameters;

d. Frequency of sampling;

e. Instrumentation (if applicable) Flow_____

Pressure_____

(H) CLASS V WELL PLUGGING AND ABANDONMENT PERMIT

(1) Permit number of Class V construction or operating permit.

(2) Type of well.

(3) Proposed plugging procedures, plans and specifications.

(4) Reasons for abandonment.

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

APPLICATION TO CONSTRUCT/OPERATE/ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

PART I. Directions

A. All applicable items must be completed in full in order to avoid delay in processing this application. Where attached sheets or other technical documentation are utilized in lieu of the blank space provided, indicate appropriate cross-reference in the space and provide copies to the department in accordance with (C) below. Where certain items do not appear applicable to the project, indicate N/A in the appropriate spaces. When this form is used in conjunction with DER Form 17-1.205(1), duplicative information requests need to be completed only once.

B. All information is to be typed or printed in ink.

C. Four (4) copies of this application and four (4) copies of supporting information such as plans, reports, drawings and other documents shall be submitted to the appropriate District/Subdistrict office. An engineering report is also required to be submitted to support this application pursuant to the applicable sections of Florida Administrative Code Rule 17-28. The attached lists* shall be used to determine completeness of supporting data submitted or previously received. A check for the application fee in accordance with Florida Administrative Code Rule 17-4.05 made payable to the Department shall accompany the application.

D. For projects involving construction, this application is to be accompanied by four (4) sets of engineering drawings, specifications and design data as prepared by a Professional Engineer registered in Florida, where required by Chapter 471, Florida Statutes.

E. Attach 8 1/2" x 11" USGS site location map indicating township, range and section and latitude/longitude for the project.

PART II. General Information

A. Applicant: Name Oliver M. Mitchell Title Public Works Administrator

Address 14000 Greenbriar Boulevard

City Wellington, FL Zip 33414

Telephone Number (407) 793-4659

B. Project Status: [ ] New [XX] Existing

[ ] Modification (specify) Abandon annular monitor tubes SMW-1 and DMW-1

*"Engineering and Hydrogeologic Data Required for Support of Application to Construct, Operate and Abandon Class I, III, or V Injection Wells"

C. Well Type:

( ) Exploratory Well (X) Test/Injection Well (monitor tubes)

D. Type of Permit Application:

( ) Class I Exploratory Well Construction and Testing Permit

( ) Class I Test/Injection Well Construction and Testing Permit

( ) Class I Well Operating Permit

(XX) Class I Well Plugging and Abandonment Permit

( ) Class III Well Construction/Operation/Plugging and Abandonment Permit

( ) Class V well Construction Permit

( ) Class V Well Operating Permit

( ) Class V Well Plugging and Abandonment Permit

E. Facility Identification:

Name: Acme Improvement District

Facility Location: Street: 11860 Pierson Road

City: Unincorporated Palm Beach County County: Palm Beach

SIC Code: N/A

F. Proposed facility located on Indian Lands: Yes____ No X

G. Well Identification:

Well No. SMW-1 DMW-1 of 2 Wells (total #)

Purpose (~~Proposed~~ Present Use): Monitor IW-1 integrity

Well Location: Latitude: 26° 38' 00" N Longitude 80° 13' 30" W

(attach separate sheet, if necessary, for multiple wells.)

Subpart B. General Projection Description:

(1) Describe the nature, extent and schedule of the injection well project. Refer to existing and/or future pollution control facilities, expected improvement in performance of the facilities and state whether the project will result in full compliance with the requirements of Chapter 403, Florida Statutes, and all rules and regulations of the Department. Attach additional sheet(s) if necessary or cross-reference the engineering report.

The annular monitor tubes (SMW-1 and DMW-1) will be abandoned after the construction of a dual zone monitor well (Well MW-1)is complete. DMW-1 is no longer functional. SMW-1 is functional.

PART III Statement by Applicant and Engineer

A. Applicant

I, the owner/authorized representative* of Acme Improvement District, certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I understand that this certification also applies to all subsequent reports submitted pursuant to this permit. Where construction is involved, I agree to retain the design engineer, or other professional engineer registered in Florida, to provide inspection of construction in accordance with Florida Administrative Code Rule 17-28.34(1)(c).

Oliver M. Mitchell — Signed

11/23/93 — Date

Oliver M. Mitchell, Public Works Administrator — Name and Title (Please Type)

(407) 793-4659 — Telephone Number

*Attach a Letter of Authorization.

B. Professional Engineer Registered in Florida

the monitor tubes SMW-1 and DMW-1 will be abandoned properly in accordance with FAC 17-28.270 criteria and procedures.

~~This is to certify that the engineering features of this injection well have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that the well, when properly maintained and operated, will discharge the effluent in compliance with all applicable statutes of the State of Florida and the rules and regulations of the Department. It is also agreed that the undersigned will furnish the applicant a set of instructions for proper maintenance and operation of the well.~~

Signed: Bruce R. Snyder

Bruce R. Snyder — Name (Please Type)

Camp Dresser & McKee Inc. — Company Name (Please Type)

1500 N.W. 49th St., Suite 300
Fort Lauderdale, FL 33309 — Mailing Address (Please Type)

Bruce R. Snyder
10/28/93

(Please Affix Seal)

FLORIDA REGISTRATION NUMBER 38016 Date: _____ Phone No. (305) 776-1731

ENGINEERING AND HYDROLOGIC DATA REQUIRED FOR SUPPORT OF APPLICATION TO CONSTRUCT, OPERATE, AND ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

The following information shall be provided for each type of permit application.

(A) CLASS I EXPLORATORY WELL CONSTRUCTION AND TESTING PERMIT

(1) Conceptual plan of the injection project. Include number of injection wells proposed injection zone, nature and volume of injection fluid, and propose monitoring program.

(2) Preliminary Area of Review Study. Include the proposed radius of the area o review with justification for that radius. Provide a map showing the loca tion of the proposed injection well or well field area for which a permit i sought and the applicable area of review. Within the area of review, the ma must show the number or name, and location of all producing wells, injectio wells, abandoned wells, dry holes, surfacebodies of water, springs, publi water systems, mines (surface and subsurface), quarries, water wells an other pertinent surface features including residences and roads. The ma should also show faults, if known or suspected. Only information of publi record and pertinent information known to the applicant is required to be in cluded on this map.

(3) Proposed other uses of the exploratory well.

(4) Drilling and testing plan for the exploratory well. The drilling plan mu specify the proposed drilling program, sampling, coring, and testing proc dures.

(5) Abandonment Plan.

(B) CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT

(1) A map showing the location of the proposed injection wells or well field ar for which a permit is sought and the applicable area of review. Within t area of review, the map must show the number or name, and location of a producing wells, injection wells, abandoned wells, dry holes, surface bodi of water, springs, public water systems, mines (surface and subsurface quarries, water wells and other pertinent surface features including res dences and roads. The map should also show faults, if known or suspecte Only information of public record and pertinent information known to t applicant is required to be included on this map.

(2) A tabulation of data on all wells within the area of review which penetra into the proposed injection zone, confining zone, or proposed monitori zone. Such data shall include a description of each well's type, constru tion, data drilled, location, depth, record of plugging and/or completio and any additional information the Department may require.

(3) Maps and cross sections indicating the general vertical and lateral limi within the area of review of all underground sources of drinking water, the position relative to the injection formation and the direction of water mov ment, where known, in each underground source of drinking water which may affected by the proposed injection.

(4) Maps and cross sections detailing the hydrology and geologic structures of the local area.

(5) Generalized maps and cross sections illustrating the regional geologic setting.

(6) Proposed operating data.

a. Average and maximum daily rate and volume of the fluid to be injected;
b. Average and maximum injection pressure; and,
c. Source and an anlysis of the chemical, physical, radiological and biological characteristics of injection fluids.

(7) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

(8) Proposed stimulation program.

(9) Proposed injection procedure.

(10) Engineering drawings of the surface and subsurface construction details of the system.

(11) Contingency plans to cope with all shut-ins or well failures, so as to protect the quality of the waters of the State as defined in Florida Administrative Code Rule 17-3, including alternate or emergency discharge provisions.

(12) Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Florida Administrative Code Rule 17-28.25.

(13) For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Florida Administrative Code Rule 17-28.13(5).

(14) Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, proposed blowout protection (if necessary), and a drilling, testing and coring program.

(15) A certification that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Florida Administrative Code Rule 17-28.27(9).

(C) CLASS I INJECTION WELL OPERATING PERMIT

(1) A report shall be submitted with each application for a Class I well operation permit, which shall include, but not be limited to, the following information:

a. Results of the information obtained under the construction permit described in (B)-CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT, including:

1. All available logging and testing program data and construction data on the well or well field;

2. A satisfactory demonstration of mechanical integrity for all new wells pursuant to Florida Administrative Code Rule 17-28.13(6)(b);

3. The actual operating data, including injection pressures versus pumpin rates where feasible, or the anticipated maximum pressure and flow rat at which the permittee will operate, if approved by the Department;

4. The actual injection procedure;

5. The compatibility of injected waste with fluids in the injection zon and minerals in both the injection zone and the confining zone; and,

6. The status of corrective action on defective wells in the area o review.

b. Record drawings, based upon inspections by the engineer or persons unde his direct supervision, with all deviations noted;

c. Certification of completion submitted by the engineer of record;

d. If requested by the Department, operation manual including emergency pro cedures;

e. Proposed monitoring program and data to be submitted;

f. Proof that the existence of the well has been recorded on the surveyor' plan at the county courthouse.

g. Proposed plugging and abandonment plan pursuant to Florida Administrativ Code Rule 17-28.27(2).

(D) CLASS I WELL PLUGGING AND ABANDONMENT PERMIT

(1) The reasons for abandonment.

(2) A proposed plan for plugging and abandonment describing the preferred and al ternate methods, and justification for use.

a. The type and number of plugs to be used;

b. The placement of each plug including the elevation of the top and bottom;

c. The type and grade and quantity of cement or any other approved pluggir material to be used;

d. The method for placement of the plugs.

(3) The procedure to be used to meet the requirements of Rule 17-28.27.

(E) CLASS III WELL CONSTRUCTION/OPERATION/PLUGGING AND ABANDONMENT PERMIT

Construction Phase

(1) A map showing the location of the proposed injection wells or well field ar for which a permit is sought and the applicable area of review. Within t area of review, the map must show the number or name, and location of a producing wells, injection wells, abandoned wells, dry holes, surface bodi of water, springs, public water systems, mines (surface and subsurface quarries, water wells and other pertinent surface features including res dences and roads. The map should also show faults, if known or suspecte Only information of public record and pertinent information known to t applicant is required to be included on this map.

(2) A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may required.

(3) Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

(4) Maps and cross sections detailing the hydrology and geologic structures of the local area.

(5) Generalized maps and cross sections illustrating the regional geologic setting.

(6) Proposed operating data:

a. Average and maximum daily rate and volume of the fluid to be injected;

b. Average and maximum injection pressure; and,

c. Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids, including any additives.

(7) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

(8) Proposed stimulation program.

(9) Proposed injection procedure.

(10) Engineering drawings of the surface and subsurface construction details of the system.

(11) Contingency plans to cope with all shut-ins or well failures or catastrophic collapse, so as to protect the quality of the waters of the state as defined in Florida Administrative Code Rule 17-3, including alternate or emergency discharge provisions.

(12) Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Florida Administrative Code Rule 17-28.25.

(13) For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Florida Administrative Code Rule 17-28.13(5).

(14) Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids form surficial aquifers, and a drilling, testing and coring program.

(15) A certificate that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Florida Administrative Code Rule 17-28.27(9).

(16) Expected changes in pressure, native fluid displacement, direction of mov ment of injection fluid.

(17) A proposed monitoring plan, which includes a plan for detecting migration (fluids into underground sources of drinking water, a plan to detect wat quality violation in the monitoring wells, and the proposed monitoring da to be submitted.

Operation Phase

(1) The following information shall be provided to the Department prior to gran ing approval for the operation of the well or well field:

a. All available logging and testing program data and construction data (the well or well field;

b. A satisfactory demonstration of mechanical integrity for all new well pursuant to Florida Administrative Code Rule 17-28.13(6)(b);

c. The actual operating data, including injection pressure versus pumpin rate where feasible, or the anticipated maximum pressure and flow rate w which the permittee will operate, if approved by the Department;

d. The results of the formation testing program;

e. The actual injection procedure;

f. The status of corrective action on defective wells in the area of review.

Plugging and Abandonment Phase

(1) The justification for abandonment.

(2) A proposed plan for plugging and abandonment describing the preferred and al ternate methods.

a. The type and number of plugs to be used;

b. The placement of each plug including the elevation of the top and bottom;

c. The type and grade and quantity of cement or any other approved pluggin material to be used;

d. The method for placement of the plugs.

(3) The procedure to be used to meet the requirements of Florida Administrativ Code Rule 17-28.27.

(F) CLASS V WELL CONSTRUCTION PERMIT. (This form should be used for Class V well instead of Form 17-1.209(1) when there is a need for a Technial Advisory Committe and an engineering report.)

(1) Type and number of proposed Class V Wells:

Wells Receiving Domestic Waste	_____	Salt-water Intrusion Barrier Wells	_____
Cooling Water Return Flow Wells, Open-looped System	_____	Subsidence Control Wells	_____
		Sand Backfill Wells	_____

Experimental Technology Wells _____

Radioactive Waste Disposal Wells* _____

Other non-hazardous Industrial or Commercial Disposal Wells (explain) _____

Wells used to inject spent brine after halogen recovery _____

Borehole Slurry Mining Wells _____

Other (explain) _____

*Provided the concentrations of the waste do not exceed drinking water standards contained in Chapter 17-22, F.A.C.

(2) Project Description:

a. Description and use of proposed injection system;

b. Nature and volume of injected fluid (The Department may require an analysis (including bacteriological analysis) in accordance with Florida Administrative Code Rule 17-4.27(2)(c));

c. Proposed pretreatment.

(3) Water well contractor's name, title, state license number, address, phone number and signature.

(4) Well Design and Construction Details. (For multi-casing configurations or unusual construction provisions, an elevation drawing of the proposed well should be attached.)

a. Proposed total depth;

b. Proposed depth and type of casing(s);

c. Diameter of well;

d. Cement type, depth, thickness;

e. Injection pumps (if applicable):_____gpm @____psi
Controls:_____
_____
_____

(5) Water Supply Wells - When required by Florida Administrative Code Rule 17-4.27, attach a map section showing the locations of all water supply wells within a one (1) mile radius of the proposed well. The well depths and casing depths should be included. When required by Rule 17-4.27(2)(g), results of bacteriological examinations of water from all water supply wells within one (1) mile and drilled to approximate depth of proposed well should be attached.

(6) Area of Review (may be required at Department's discretion).

Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and

subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

(G) CLASS V WELL OPERATION PERMIT (Final report of the construction that includes the following information may be submitted with the application to operate.)

(1) Permit Number of Class V Construction Permit:_____

(2) Owner's Name:_____

(3) Type of Well:_____

(4) Construction and Testing Summary:

a. Actual Dimensions:

Diameter _____ inches; Well Depth _____ feet; Casing Depth _____ feet.

_____ _____ _____

_____ _____ _____

b. Results of Initial Testing.

(5) Proposed Operating Data:

a. Injection Rate (GPM);

b. Description of injected waste;

c. Injection pressure and pump controls.

(6) Proposed Monitoring Plan (If any):

a. Number of monitoring wells;

b. Depth(s);

c. Parameters;

d. Frequency of sampling;

e. Instrumentation (if applicable) Flow_____

Pressure_____

(H) CLASS V WELL PLUGGING AND ABANDONMENT PERMIT

(1) Permit number of Class V construction or operating permit.

(2) Type of well.

(3) Proposed plugging procedures, plans and specifications.

(4) Reasons for abandonment.

Appendix B

APPENDIX B

CONSTRUCTION DETAILS OF WELLS LOCATED WITHIN THE AREA OF REVIEW

WELL CONSTRUCTION DIAGRAM - IW-1

APPENDIX B

The following information was obtained from the SFWMD files. These wells are located within the one-mile radius area of review of IW-1 at the Acme WWTP.

Address: 12093 Longwood Green Drive, Wellington
Well Use: Irrigation
Construction Details: Depth - 102 feet, Screen - 1 1/4-inch diameter, 84-102 feet

Address: Palm Beach Polo Development, 12190 Glen Bay, Wellington
Well Use: Irrigation
Construction Details: Depth 100 feet, Screen - 4-inch diameter, 80-100 feet

Address: 13815 Newton Place, Wellington
Well Use: Irrigation
Construction Details: Depth - 82 feet, Screen 1 1/4-inch diameter, 63-82 feet

Address: 11707 Maidstone Drive, Wellington
Well Use: Irrigation
Construction Details: Depth - 84 feet, Screen 1 1/2-inch diameter, 63-84 feet

Address: 2086 Portland Avenue, Wellington
Well Use: Irrigation
Construction Details: Depth - 105 feet, Screen 1 1/4-inch diameter, 84-105 feet

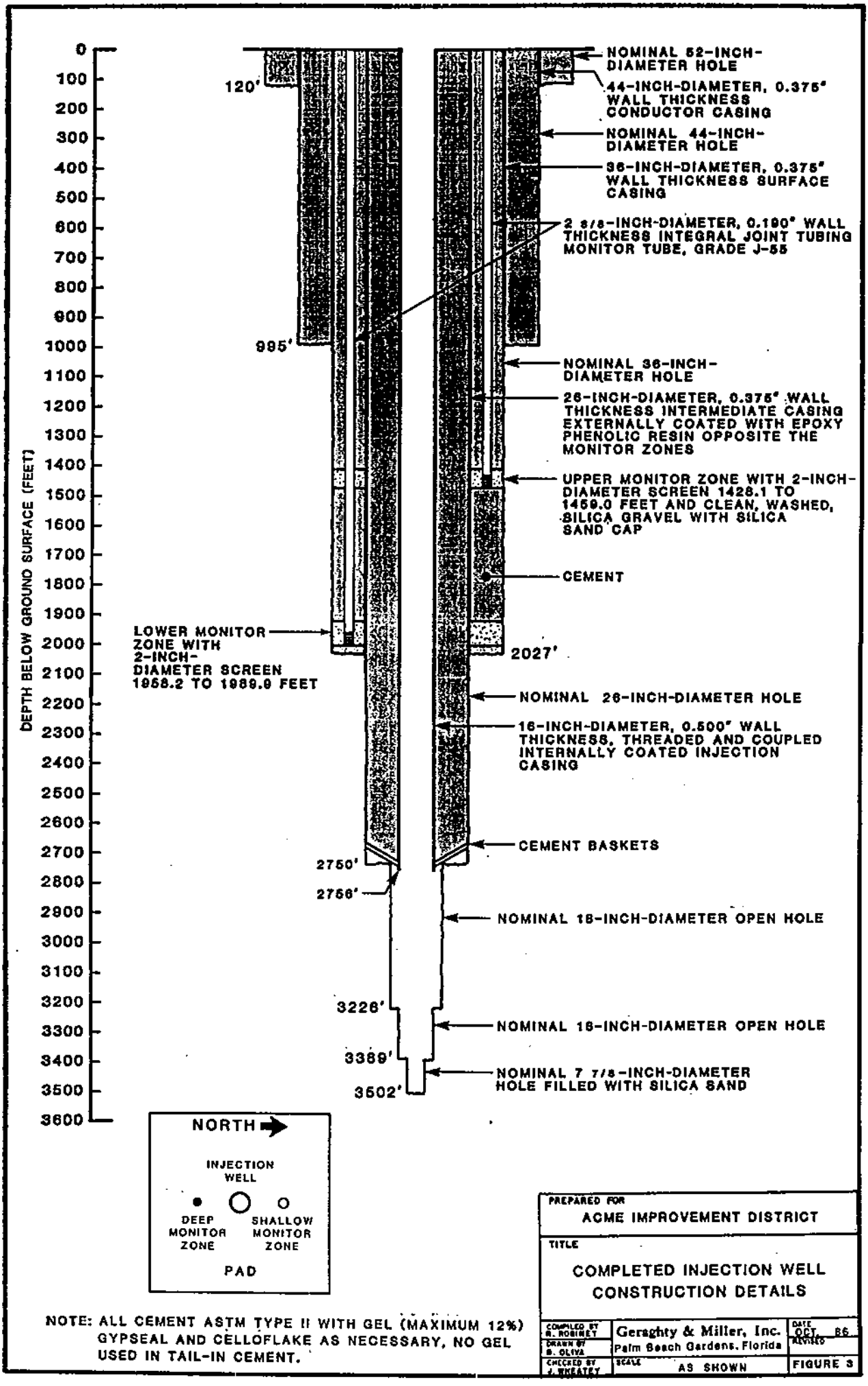
Address: 11333 Longmeadow Drive, Wellington
Well Use: Irrigation
Construction Details: Depth - 94 feet, Screen 1 1/4-inch diameter, 74-94 feet

Address: 13880 Longmeadow Drive, Wellington
Well Use: Irrigation
Construction Details: Depth - 63 feet, Screen 1 1/4-inch diameter, 42-63 feet

Address: 12825 Buckland Street, Wellington
Well Use: Irrigation
Construction Details: Depth - 102 feet, Screen 1 1/4-inch diameter, 84-102 feet

Address: 11861 Hardstone Drive, Wellington
Well Use: Irrigation
Construction Details: Depth - 84 feet, Screen 1 1/2-inch diameter, 63-84 feet

Address: 11365 Longmeadow Drive, Wellington
Well Use: Irrigation
Construction Details: Depth - 86 feet, Screen 1 1/2-inch diameter, 64-86 feet



NOTE: ALL CEMENT ASTM TYPE II WITH GEL (MAXIMUM 12%) GYPSEAL AND CELLOFLAKE AS NECESSARY, NO GEL USED IN TAIL-IN CEMENT.

PREPARED FOR
ACME IMPROVEMENT DISTRICT

TITLE
COMPLETED INJECTION WELL CONSTRUCTION DETAILS

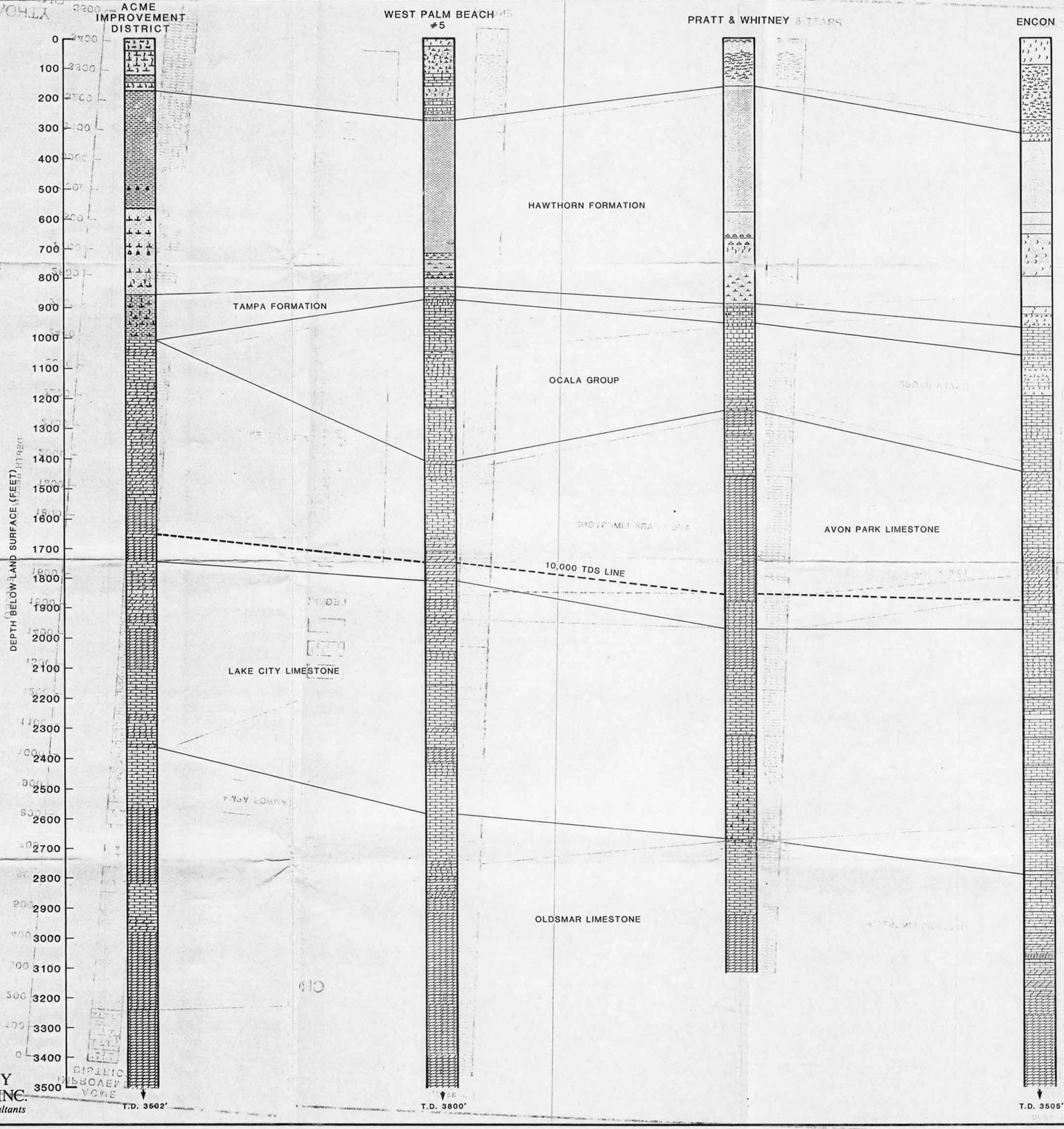
COMPILED BY R. ROBINET	Geraghty & Miller, Inc.	DATE OCT. 86
DRAWN BY B. OLIVA	Palm Beach Gardens, Florida	REVISED
CHECKED BY J. WHEATLEY	SCALE AS SHOWN	FIGURE 3

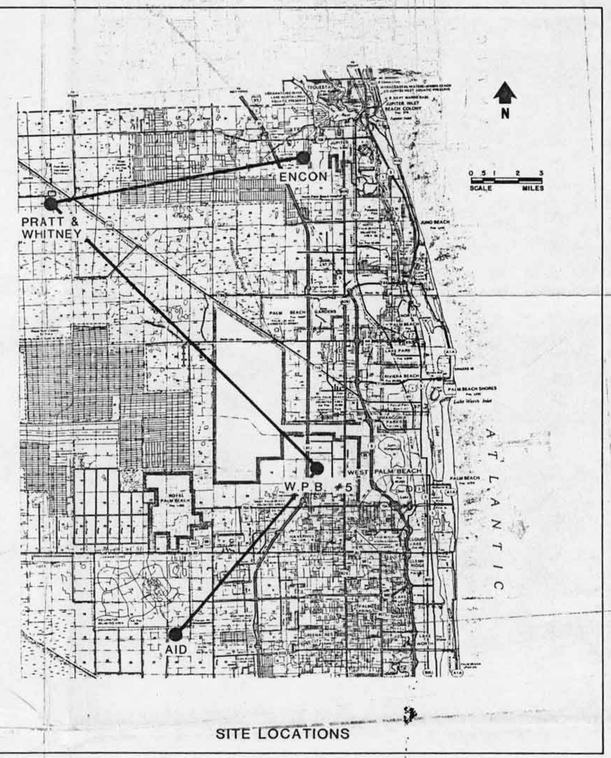
PO 804 DW3

Appendix C

APPENDIX C

REGIONAL HYDROGEOLOGIC CROSS SECTIONS





SITE LOCATIONS

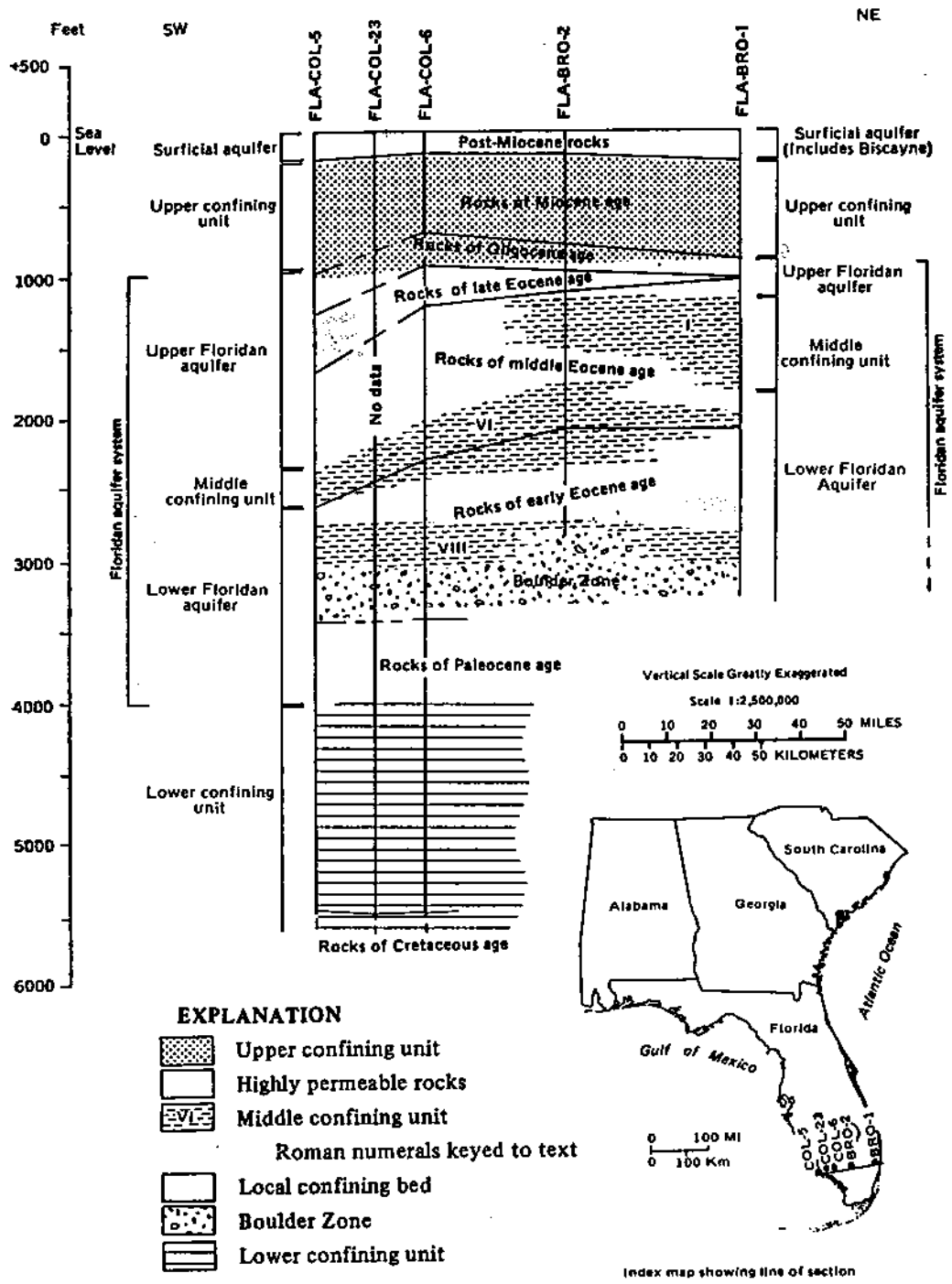
LEGEND:

SAND	CHERT	SANDY LIMESTONE
SHELL	LIMESTONE	SANDSTONE
CLAY	DOLOMITE	DOLOMITIC LIMESTONE

CROSS-SECTION SHOWING CORRELATION BETWEEN FOUR INJECTION WELLS IN PALM BEACH COUNTY

GERAGHTY & MILLER, INC.
Ground-Water Consultants

FIGURE 4



SOURCE: USGS PROFESSIONAL PAPER 1403-B, 1986

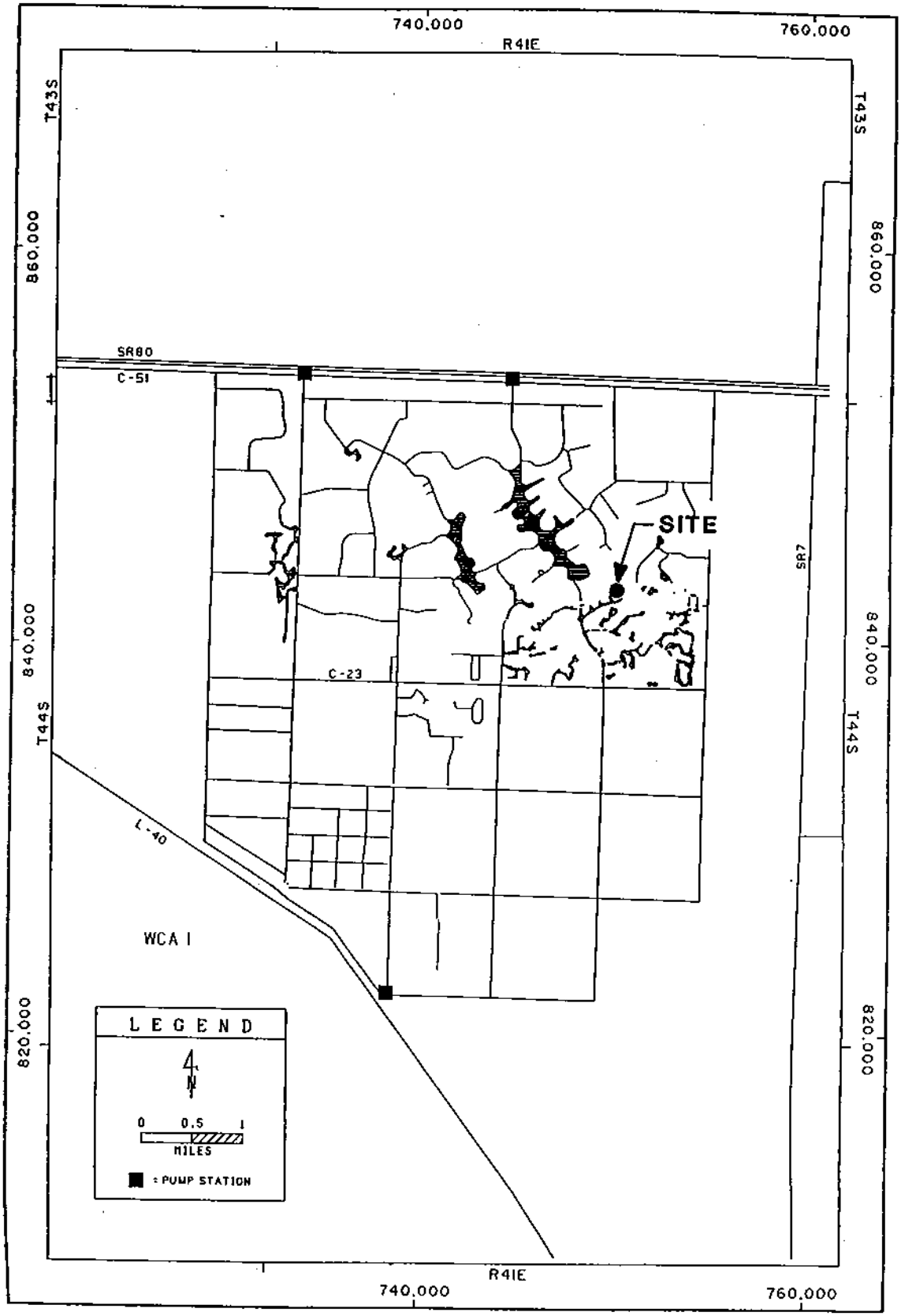
2820-001\G0000012 ALN 1/12/94

ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

GENERALIZED GEOHYDROLOGIC CROSS SECTION FROM WESTERN COLLIER TO EASTERN BROWARD COUNTIES

CDM
environmental engineers, scientists, planners, & management consultants

FIGURE C-2



SOURCE: SFWMD PUBLICATION 89-4, 1989

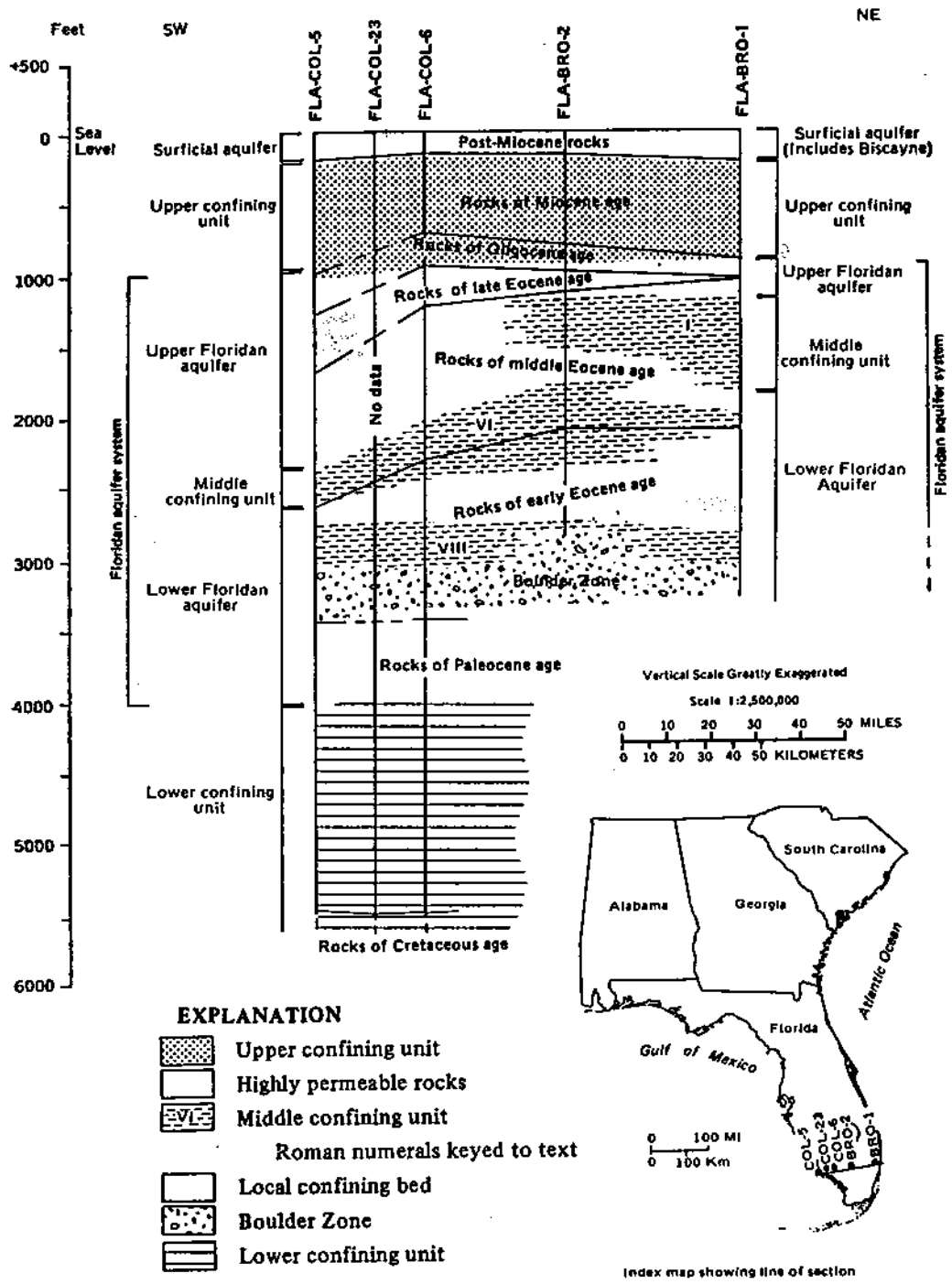
2820-001\G0000013 ALN 1/12/94

ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

CANALS AND PUMP STATION LOCATIONS

CDM
environmental engineers, scientists, planners, & management consultants

FIGURE C-5



SOURCE: USGS PROFESSIONAL PAPER 1403-B, 1986

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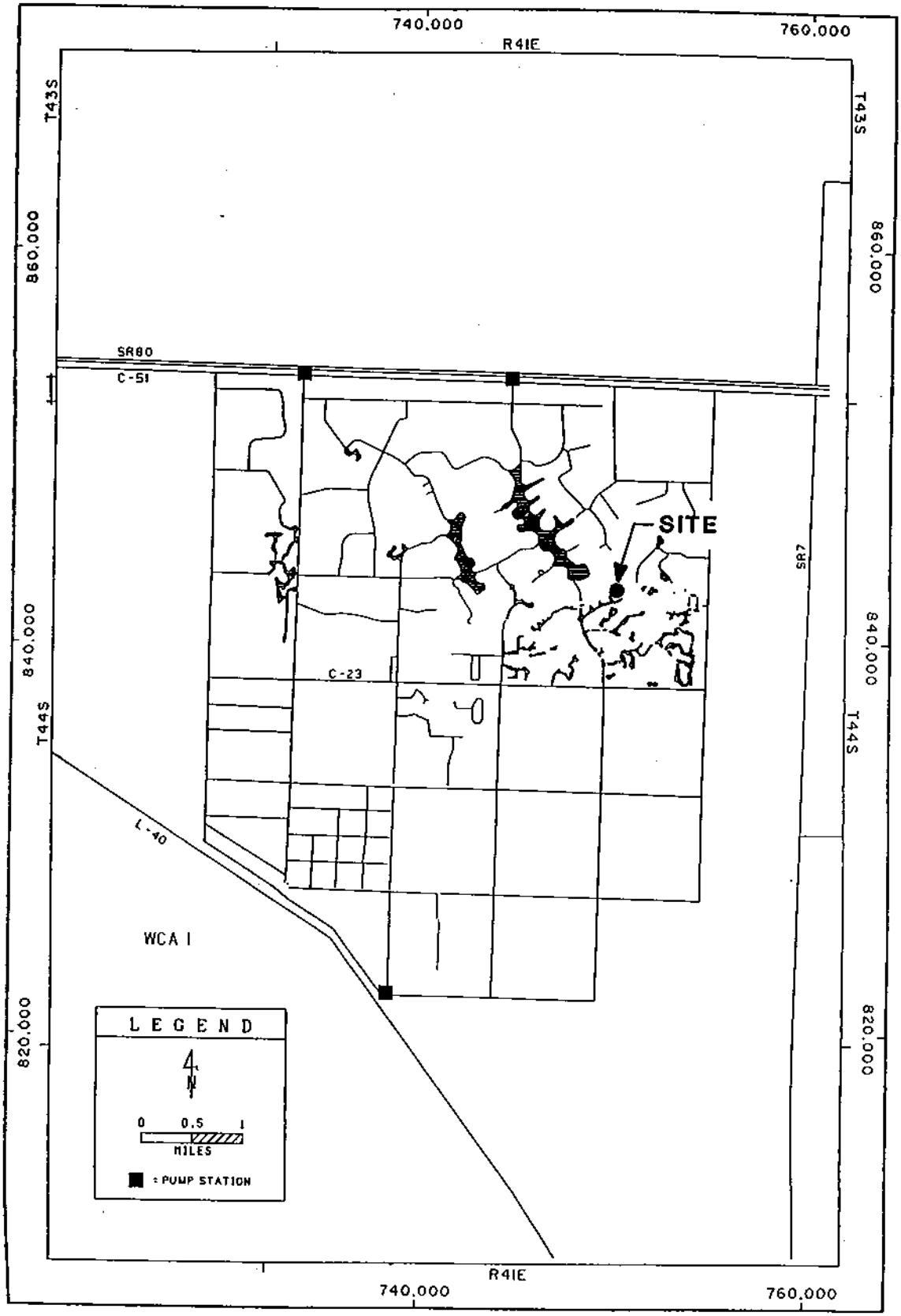
ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

GENERALIZED GEOHYDROLOGIC CROSS SECTION FROM WESTERN COLLIER TO EASTERN BROWARD COUNTIES

CDM
environmental engineers, scientists, planners, & management consultants

FIGURE C-2



SOURCE: SFWMD PUBLICATION 89-4, 1989

2820-001\G0000013 ALN 1/12/94

ACME IMPROVEMENT DISTRICT
PALM BEACH COUNTY, FLORIDA

CANALS AND PUMP STATION LOCATIONS

CDM
environmental engineers, scientists, planners, & management consultants

FIGURE C-5

Appendix D

APPENDIX D

PARAMETER LIST FOR BACKGROUND WATER QUALITY SAMPLES

GROUND WATER MONITORING PARAMETERS
INORGANICS

Aluminum
Ammonium
Antimony
Arsenic
Asbestos
Barium
Beryllium
Cadmium
Chloride
Chromium
Copper
Cyanide
Fluoride
Iron
Lead
Manganese
Mercury
Nickel
Nitrate
Nitrite
Nitrate and Nitrite (Total)
Nitrogen (organic)
Orthophosphate (soluble)
Selenium
Silver
Sodium
Sulfate
Total Dissloved Solids
Thallium
Zinc

VOLATILE ORGANICS

Benzene
Carbon Tetrachloride
Chloroethane
Chloroform
o-Dichlorobenzene
para-Dichlorobenzene
1,2-Dichloroethane
1,1-Dichloroethylene
1,2-Dichloroethylene
cis-1,2-Dichloroethylene
trans1,2-Dichloroethylene
Dichloromethane
1,2-Dichloropropane
Ethylbenzene
Monochlorobenzene

VOLATILE ORGANICS, cont'd

Styrene
Tetrachloroethylene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trihalomethanes (total)
Toluene
Vinyl Chloride
Xylenes

Base/Neutral Organics

Anthracene
Butylbenzylphtallate
Diethylphthallate
Dimethylphthallate
Naphalene
Phenanthrene

PESTICIDES AND PCBs

Alachlor
Aldrin
Atrazine
Benzo(a)pyrene
Carbofuran
Chlordane
2,4-D
Dalapon
Dibromochloropropane
Di(2-ethylhexyl)adipate
Di(2-ethylhexyl)phthálate
Dieldrin
Dinoseb
Dioxin
Diquat
EDB
Endothall
Endrin
Glyphosate
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Hexachlorocyclopentadiene
Lindane
Methoxychlor
Oxamyl (vydate)
PCB
Pentachlorophenol
Pichloram
Toxaphene
2,4,5-TP (silvex)
Simazine

Acid Extractables

2-chlorophenol
Phenol
2,4,6-trichlorophenol

Radionuclides

Radium-226
Radium-228
Gross Alpha

Microbiological

Total Coliform

Other

Color
Corrosivity
Foaming Agents
Odor
pH
Temperature
Turbidity

Appendix E

APPENDIX E

PLUGGING AND ABANDONMENT PLAN

APPENDIX E

PLUGGING AND ABANDONMENT PLAN FOR DUAL ZONE MONITOR WELL MW-1

The plugging and abandonment of the dual zone monitor well MW-1 would be performed by submitting the appropriate permit application in accordance with 17-28.350 FAC and then plugging the well. The plugging and abandonment would be performed in accordance with Chapter 17-28.270 FAC. FDEP would be notified at least 180 days before the abandonment activities were to take place.

Before plugging the well, the fluid pressure at the well head would have to be suppressed (killed) to prevent the escape of brackish groundwater. This activity would be done by pumping a pre-mixed salt solution into the well. About 200 to 400 bags of salt would be required to perform this task.

The dual zone monitor well would be plugged in two stages:

1. The open hole portion of the lower monitor zone (1,950 to 2,000 feet bpl) and the open hole portion of the upper monitor zone (1,420 to 1,470 feet bpl) will be filled with coarse aggregate or concrete with coarse aggregate. Fill will be emplaced with a tremie pipe. The volume estimated for filling the open hole sections is approximately 52 cubic feet and includes 50 percent loss to the formation.

2. The 6 5/8-inch and 12 3/4-inch casings will be filled by tremie from bottom to top with neat ASTM Type II cement. The total volume estimated for this task is approximately 1,160 cubic feet.

The estimated cost for plugging and abandonment of the dual zone monitor well (MW-1) is as follows:

1.	Mobilization and demobilization	$30,000
2.	Kill well	2,000
3.	Fill open hole portion(s) with coarse aggregate or concrete (52 ft^3 x $8/$ft^3$)	416
4.	Fill casing(s) with neat cement (1,160 ft^3 x $15 /$ft^3$)	17,400
	TOTAL	$49,816