Hydrogeology of the Floridan Aquifer System at a C-24 Canal Test Site in St. Lucie County, Florida

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ACRONYMS AND ABBREVIATIONS

APPZ	Avon Park permeable zone
APT	aquifer performance test
bls	below land surface
FAS	Floridan aquifer system
FGS	Florida Geological Survey
ft	foot
ICU	intermediate confining unit
LFA	Lower Floridan aquifer
MCU	middle confining unit
OCAPlpz	Ocala/Avon Park low-permeability zone
SAS	surficial aquifer system
SCADA	supervisory control and data acquisition
SFWMD	South Florida Water Management District
TDS	total dissolved solids
UEC	Upper East Coast
UFA	Upper Floridan aquifer
UFA-upper	upper permeable zone of the Upper Floridan aquifer

INTRODUCTION

In 1990, the South Florida Water Management District (SFWMD) began construction of Floridan aquifer system (FAS) test wells on the south side of the C-24 Canal in central St. Lucie County, Florida (**Figure 1**). The testing program focused on the vertical distribution of flow within the FAS and hydrologic characteristics of producing zones. Data collected during construction and testing were used to develop a numerical flow model of the FAS in the Upper East Coast (UEC) Planning Area (Lukasiewicz 1992) and for other SFWMD projects. Portions of the hydrogeologic data from the site were published in a compendium of data from the planning area (Lukasiewicz and Smith 1996). This report is intended to provide more comprehensive coverage of the site's hydrogeology by combining the data collected during initial construction with subsequent testing and data collection efforts through 2020.

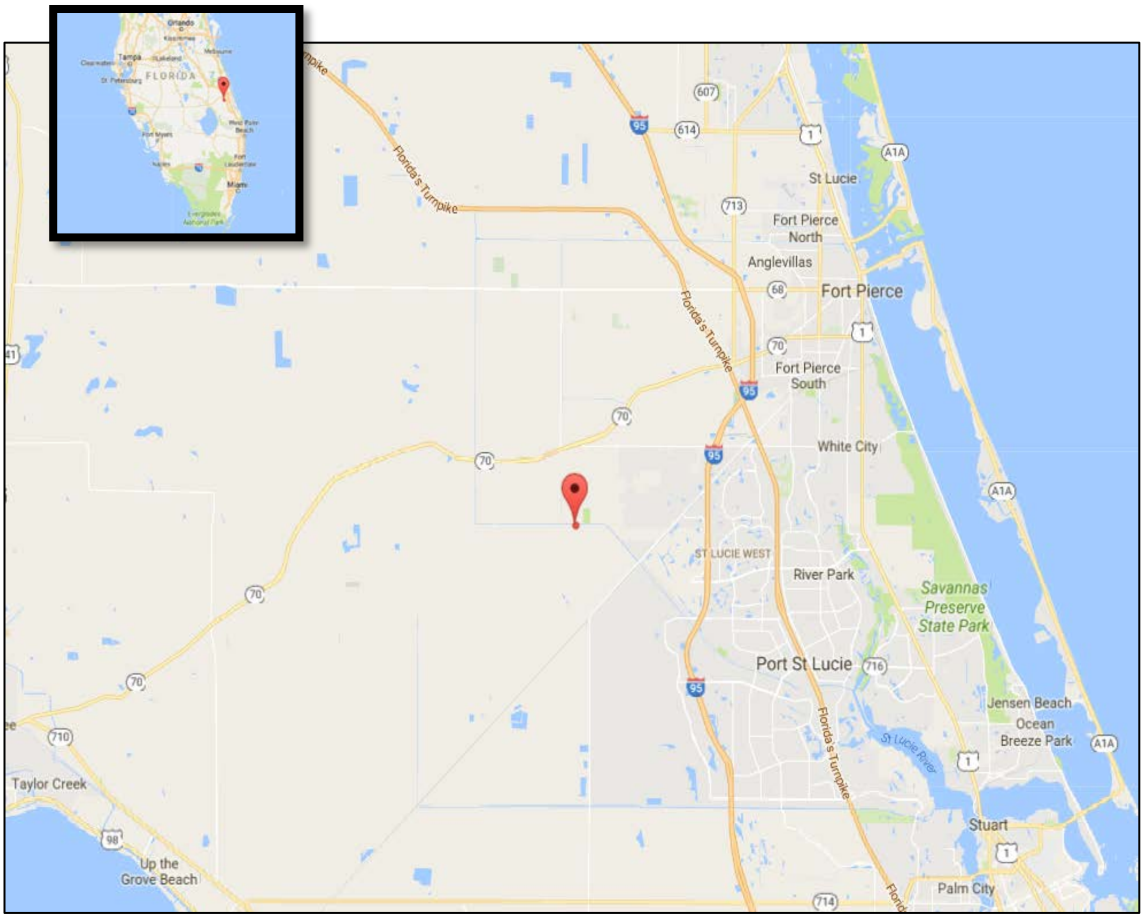


Figure 1. Location of the C-24 Canal test site in St. Lucie County, Florida.

Well Construction and Wellhead Configurations

The SFWMD constructed six FAS wells at the C-24 Canal test site, representing three distinct depth intervals (**Table 1**). At each depth interval, two wells (a monitor well and a production well) were constructed approximately 300 feet (ft) apart (**Figure 2**) to facilitate aquifer performance tests (APTs). The monitor wells (SLF-73, SLF-77, and SLF-78) were abandoned once hydraulic testing was complete. The production wells (SLF-74, SLF-75, and SLF-76) were incorporated into the SFWMD's regional groundwater monitoring network. A well completion diagram showing the well design of each of these three wells is shown in **Figure 3**.

Table 1. Well completion summary for the C-24 Canal site.

Well Name	Diameter of Final PVC Casing (inches)	Cased Depth (ft bls)	Total Depth (ft bls)	Current Status
SLF-77	4	480	700	Abandoned
SLF-75	8	480	700	Active
SLF-78	4	790	860	Abandoned
SLF-76	8	790	860	Active
SLF-73	8	1,070	1,540	Abandoned
SLF-74	8	1,070	1450	Active

ft bls = feet below land surface; PVC = polyvinyl chloride.

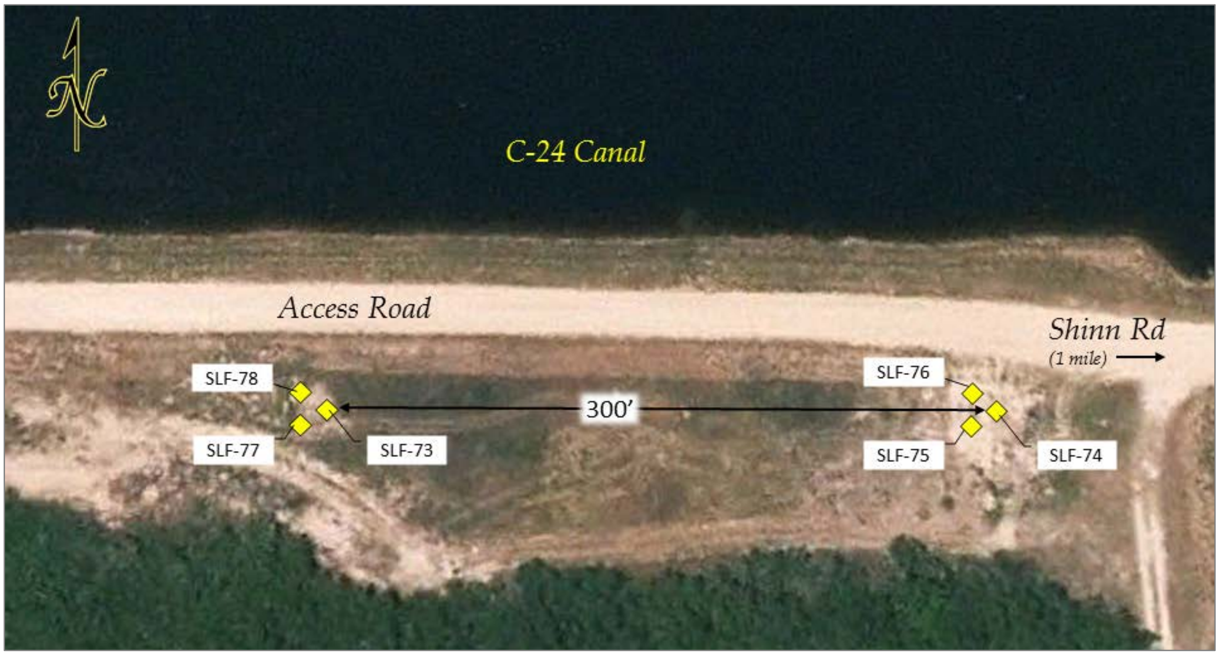


Figure 2. Location of monitor and production wells at the C-24 Canal test site.

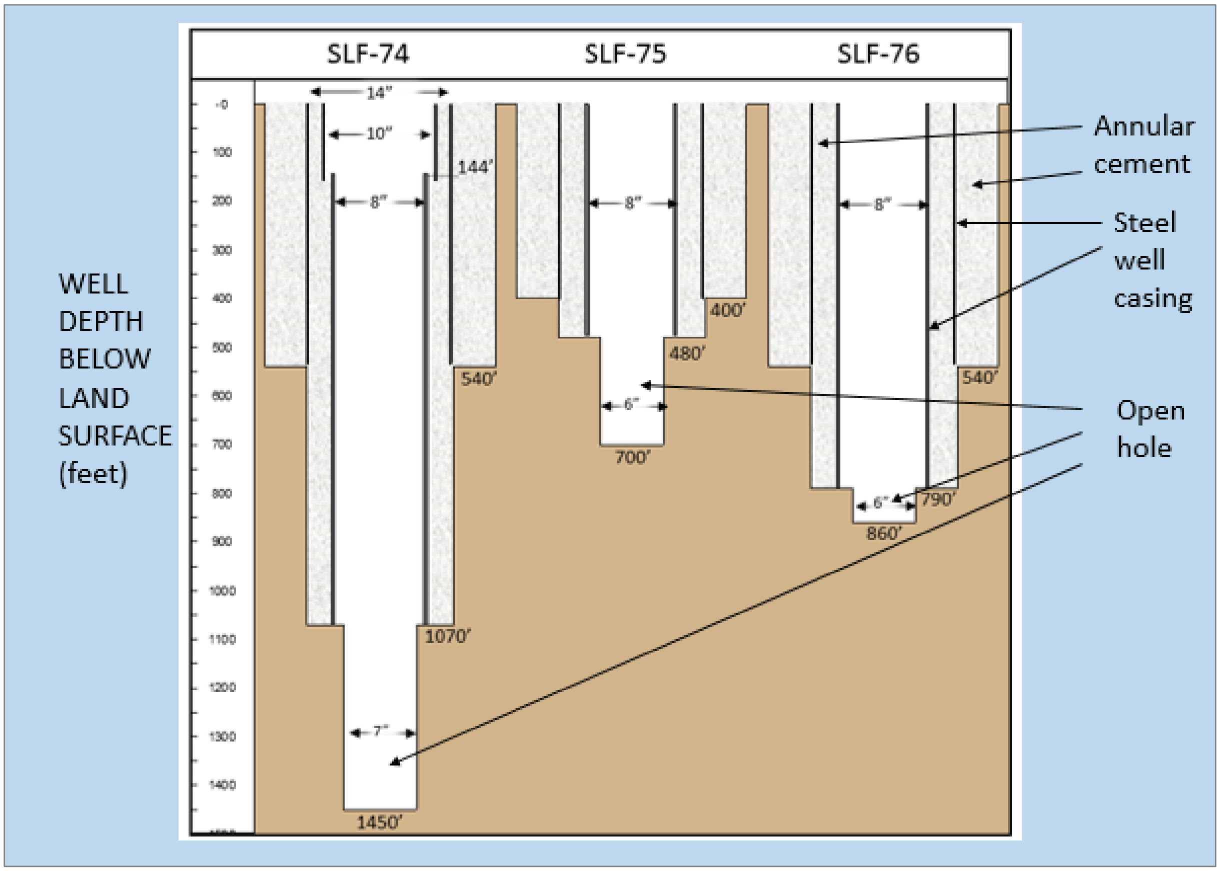


Figure 3. Well completion diagram for production wells SLF-74, SLF-75, and SLF-76.

The three production wells initially were outfitted with black steel wellheads. Under artesian pressure and in constant contact with the corrosive waters of the FAS, the wellheads began to leak. They were repaired multiple times and finally replaced with more corrosion-resistant stainless steel risers and valves. Each wellhead is centered on an 8-inch thick reinforced concrete slab and outfitted with a 4-inch diameter discharge line, equipped with a stainless steel ball valve for water quality sampling. However, variations in the configuration of each wellhead affect accessibility, data retrieval, and long-term maintenance requirements.

SLF-74

SLF-74 has an 8-inch diameter stainless steel riser from pad level to 7 inches above pad surface, where it is reduced to 4-inch stainless steel and sealed with a threaded cap. In addition to the 4-inch discharge line, a 2-inch line extends in the opposite direction and is configured for supervisory control and data acquisition (SCADA) pressure transducer instrumentation and equipped with a small valve for water quality sampling (**Figure 4**).

Figure 4. Photo of the SLF-74 wellhead (January 2020).

SLF-75

SLF-75 is equipped with an 8-inch diameter painted steel riser to 11 inches above the well pad. It is bolted to an 8-inch stainless steel spool piece. The spool is approximately 22 inches long and capped with a flange containing three 2-inch threaded access ports. A 2-inch line configured for SCADA pressure transducer instrumentation is mounted onto the 4-inch discharge line at a 90° angle from the discharge line and capped with a 2-inch diameter threaded plug (**Figure 5**).

Figure 5. Photo of the SLF-75 wellhead (January 2020).

SLF-76

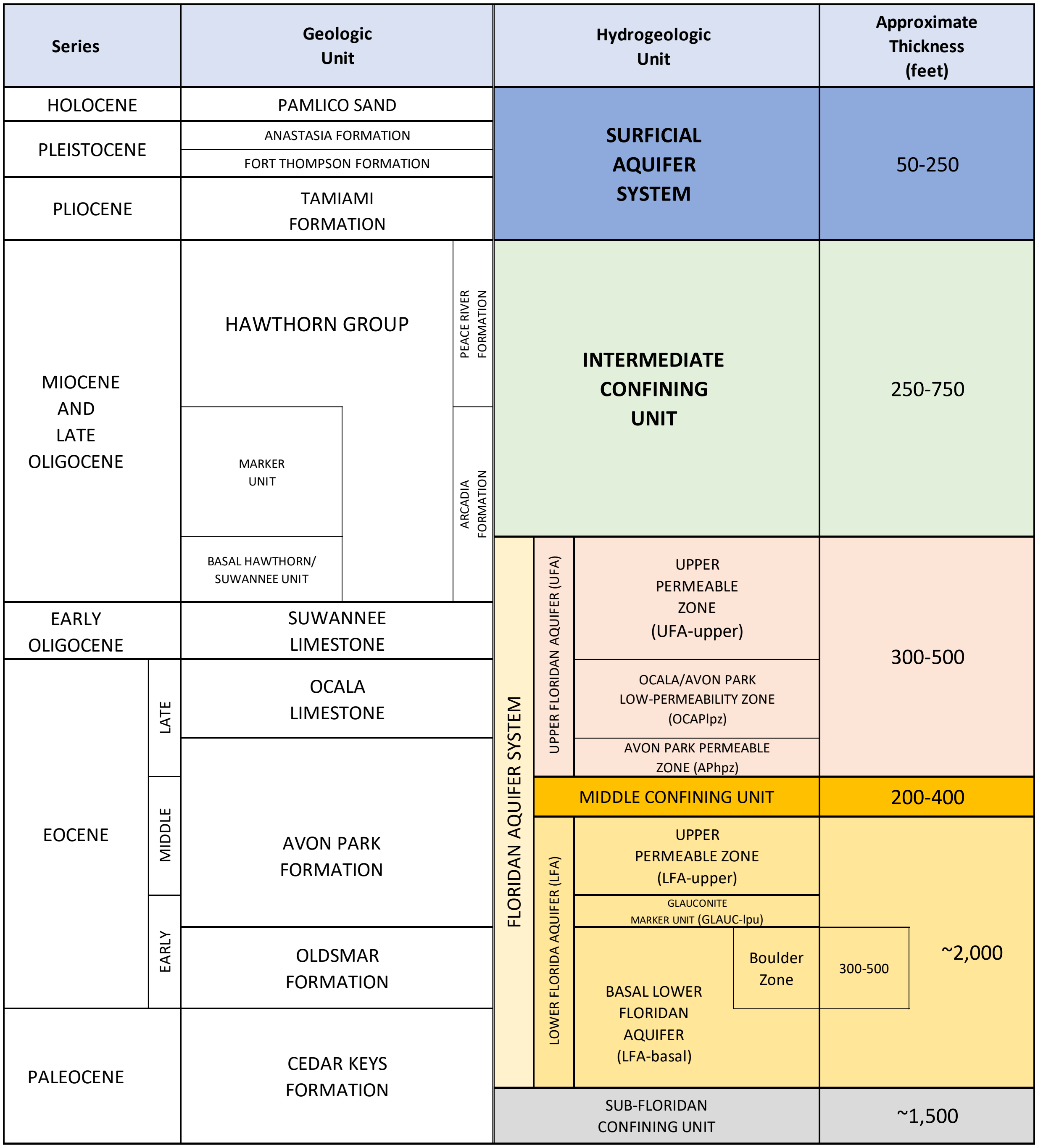
SLF-76 is equipped with an 8-inch diameter painted steel riser to 11 inches above the well pad, where it is bolted to a 6-inch stainless steel spool piece. The spool is approximately 22 inches in length and capped with a blind flange. A 2-inch line configured for SCADA pressure transducer instrumentation is mounted onto the 8-inch spool piece opposite the discharge line and capped with a 2-inch diameter threaded plug (**Figure 6**).

Figure 6. Photo of the SLF-76 wellhead (January 2020).

GEOLOGIC FRAMEWORK

SFWMD staff collected lithologic samples (well cuttings) during drilling of the SLF-73 pilot hole, the initial exploratory well. The samples were shipped to the Florida Geological Survey (FGS) in Tallahassee, who described them in 1993 using the Folk (1959) classification scheme. The FGS's complete description (using alternate well identification W-16543) from 0 to 1,540 feet below land surface (ft bls) is presented in **Appendix A**. The FGS selected stratigraphic formation boundaries based on the lithologic descriptions.

SFWMD staff working independently of the FGS selected slightly different geologic formation boundaries based on more recent, regionally available data. This report uses the geologic formation delineations identified by the SFWMD. **Figure 7** is a generalized identification of geologic and hydrogeologic units for the area. Note that while the middle confining unit, Lower Floridan aquifer, and Sub-Floridan confining unit are shown in **Figure 7**, these units were not penetrated by the wells drilled at the C-24 Canal test site, with the possible exception of the middle confining unit. Further discussion is provided in the *Hydrogeologic Characterization* section of this report. **Table 2** identifies the depth of each formation encountered at the site.



NOTES: Middle confining unit and below were not penetrated by the wells drilled at the site.
Middle confining unit seperates the Upper Floridan aquifer from the Lower Floridan aquifer.
Abbreviations in parentheses represent ECFTX model documentation.

Figure 7. Generalized geologic and hydrogeologic units at the C-24 Canal test site.

Table 2. Summary of geologic formations encountered at the C-24 Canal test site.

Stratigraphic Unit	From Depth (ft bls)	To Depth (ft bls)
Undifferentiated sand and clay (Holocene)	0	15
Plio-Pleistocene Formations	15	120
Hawthorn Group	120	513
Suwannee Limestone	513	564
Ocala Limestone	564	707
Avon Park Formation	707	1,540/TD

ft bls = feet below land surface; TD = total depth.

Plio-Pleistocene Formations

Plio-Pleistocene formations were found at the site from land surface to 120 ft bls. Geologic units include the Tamiami Formation of Pliocene age; units of Pleistocene age in southeastern Florida such as the Fort Thompson Formation, Anastasia Formation, and Miami Limestone; and undifferentiated sediments of Holocene age. Limestone of Pliocene to Pleistocene age was identified at 15 ft bls in SLF-73 (the exploratory well). In nearby well SLF-50, Wedderburn and Knapp (1983) identified the same rock as part of the Anastasia Formation. The identification of the Anastasia Formation is consistent with Lovejoy (1992). The base of the Plio-Pleistocene formations was estimated to be 120 ft bls.

Hawthorn Group

The Hawthorn Group was encountered from 120 to 564 ft bls. The Hawthorn Group includes the lower Arcadia Formation and the upper Peace River Formation. It consists of an interbedded sequence of widely varying lithologies and components, including limestone, mudstone, dolomite, dolosilt, shell, quartz sand, clay, abundant phosphate grains, and mixtures of these materials. No distinction was made between the Peace River and Arcadia formations by the initial FGS interpretation (**Appendix A**). However, the lithologic description shows a change approximately 310 ft bls from mostly siliciclastic rock, characteristic of the Peace River Formation, to an underlying, mostly carbonate rock, characteristic of the Arcadia Formation. The characteristics that distinguish the Hawthorn Group from underlying units are: 1) high and variable siliciclastic and phosphatic content; 2) color, which can be green, olive-gray, or light gray; and 3) gamma-ray log response. Intervals high in phosphate sand or gravel content were present and had high gamma-ray log activity, with peaks of 100 to 200 American Petroleum Institute standard units or more. The base of the Hawthorn Group was estimated to be 564 ft bls.

Suwannee Limestone

Suwannee Limestone of early Oligocene age (Scott et al. 1994) in southwestern and west-central Florida underlies the Hawthorn Group. It predominantly consists of pale orange to tan, fossiliferous, medium-grained calcarenite (carbonate packstone to grainstone) with minor amounts of quartz sand and rare to absent phosphate mineral grains. Suwannee Limestone has been mapped in Martin, St. Lucie, and adjacent counties; however, the occurrence of Suwannee Limestone in southeastern Florida is debatable. Lukasiewicz (1992), following precedent established by previous SFWMD publications (Brown and Reece 1979, Brown 1980, Reece et al. 1980), mapped the position of Suwannee Limestone and the underlying Ocala Limestone across the UEC Planning Area and identified Suwannee Limestone in SLF-73 from 490 to 584 ft bls. Reese (2004) also recognized Suwannee Limestone in SLF-73, from 513 to 590 ft bls, but acknowledged considerable uncertainty in this identification.

The thickness of the Suwannee Limestone unit ranges from 15 ft (well STL-360) in southwestern St. Lucie County to 310 ft (well PB-652) in northeastern Palm Beach County. In central St. Lucie County, the thickness of the Suwannee Limestone is approximately 50 to 60 ft; however, it is more than 100 ft thick near the coast. Based on the lithologic description of SLF-73 (**Appendix A**), the Suwanee Limestone was estimated to be approximately 77 ft thick at the C-24 Canal test site. The base of the Suwanee Limestone was estimated to be 564 ft bls at the site.

Ocala Limestone

Ocala Limestone was found from 564 to 707 ft bls. In SLF-73, the top of the Ocala Limestone was approximately 564 ft bls, based on the first occurrence of the Ocala index fossil *Lepidocyclina ocalana*. Ocala Limestone consists of micritic or chalky limestone, calcarenitic limestone, and coquinoid limestone. It is characterized by abundant large benthic foraminifera such as *Operculinoides* sp., *Camerina* sp., and *Lepidocyclina* sp. (Peacock 1983). Presence of these foraminifera aids in distinguishing Ocala Limestone from the overlying Suwannee Limestone, where present, and the underlying Avon Park Formation. The base of the Ocala Limestone was estimated to be 707 ft bls.

Avon Park Formation

The Avon Park Formation was found from 707 to 1,540 ft bls (total pilot hole depth). SLF-73 was plugged and replaced by SLF-74, which terminated at 1,450 ft bls. The Avon Park Formation consists of micritic to fossiliferous limestone, dolomitic limestone, and dolostone or dolomite. Fine- to medium-grained calcarenite that is moderately to well sorted is present in places. Foraminifera characteristic of the Avon Park Formation are cone-shaped *Dictyoconus* sp. (Duncan et al. 1994). The top of the Avon Park Formation is marked in some places by light brown, finely crystalline to fossiliferous dolomitic limestone or dolomite thinly interbedded with limestone. A thick interval mostly containing dolomite but commonly interbedded with limestone often is present in the middle to lower part of the Avon Park Formation. Given the available data, the 707-ft depth most closely matches the formal criteria for distinguishing this upper contact at the site. The thickness of the formation ranges from less than 900 to more than 1,600 ft (Miller 1986). The lithologic description of SLF-73 from 1,450 ft bls to the total depth drilled of 1,540 ft bls suggests it also terminated in the Avon Park Formation.

HYDROGEOLOGIC CHARACTERIZATION

The principal water-bearing units in the study area are the surficial aquifer system (SAS) and FAS. The SAS and FAS are separated by the intermediate confining unit (ICU), which contains sediments of lower permeability. The FAS has two major water-bearing zones, the Upper and Lower Floridan aquifers (UFA and LFA), which are separated by a less permeable middle confining unit (MCU). The base of the FAS is marked by impermeable, massive anhydrite beds of the Cedar Keys Formation. Hydrogeologic units encountered at the C-24 Canal test site are shown in **Figure 8**.

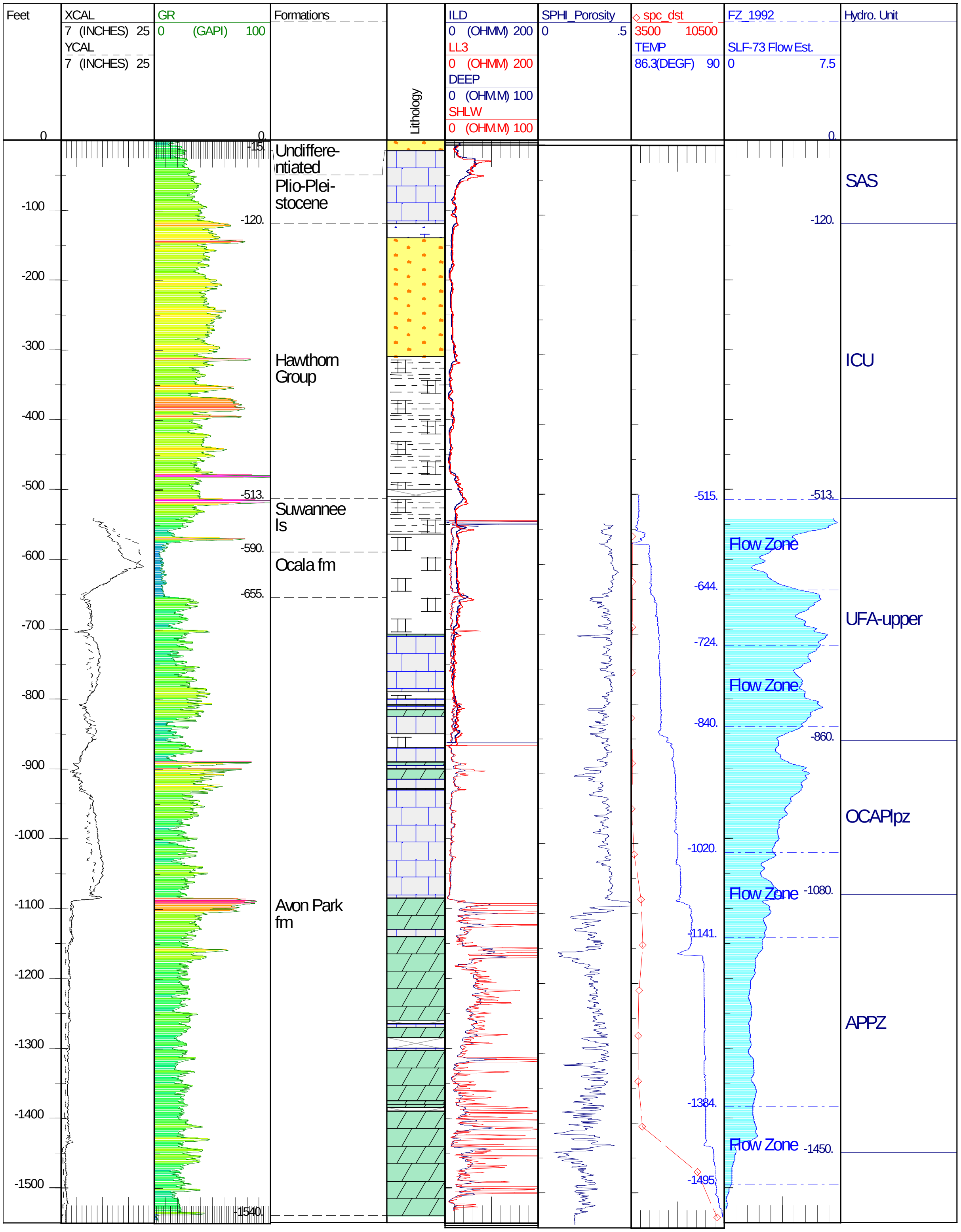


Figure 8. Borehole geophysical logs and delineation of lithologic and hydrogeologic units at the C-24 Canal site.

Surficial Aquifer System (0 to 120 ft bls)

The thickness of the SAS varies from less than 50 ft to more than 250 ft at the site (Brown and Reece 1979). The SAS consists of quartz sand, silt, clay, shell beds, coquina, calcareous sandstone, and sandy, shelly limestone. The base of the SAS commonly is defined where sediments grade from sand into clayey sand or clay; however, basal sediments also can consist of limestone within the Tamiami Formation (**Figure 7**). This occurs at the C-24 Canal site at a depth of 120 ft bls.

The UEC Planning Area, which encompasses Martin, St. Lucie, and a portion of eastern Okeechobee counties, relies on groundwater from the SAS and FAS for urban uses. In 2013, the SAS accounted for approximately 40% of public water supply use in the UEC Planning Area, and the FAS accounted for the remaining 60% (SFWMD 2016). Use of the SAS for public water supply is not anticipated to increase. The SAS is unconfined and recharged by rainfall, canals, lakes, reservoirs, irrigation water, and possibly some upward leakage from the FAS.

Intermediate Confining Unit (120 to 513 ft bls)

The ICU extends from the base of the SAS to the top of the FAS (Southeastern Geological Society Ad Hoc Committee on Florida Hydrostratigraphic Unit Definition 1986). The top of the ICU often is equivalent to the top of the Hawthorn Group but can extend into the overlying Tamiami Formation. The lithology of the ICU varies and includes fine-grained sediments such as clay, marl, micritic limestone, and silt, which provide good confinement. The upper contact of the ICU ranges from less than 80 ft bls in northwestern St. Lucie County to more than 200 ft bls in southeastern Martin and northeastern Palm Beach counties (Lukasiewicz 1992). Throughout much of St. Lucie County, the ICU is approximately 400 to 500 ft thick. The ICU is not known to have permeable water-bearing zones.

Site lithology shows a transition to the Hawthorn Group around 120 ft bls. The top 20 ft (120 to 140 ft bls) are described as sandstone, which may suggest a thin layer of the Tamiami Formation. The transition from sandstone to a light olive-gray sand between 140 and 310 ft bls denotes the top of the ICU. The base of the ICU at the site is delineated at 513 ft bls, characterized by the beginning of flow at the top of the FAS based on borehole geophysical logs.

Floridan Aquifer System

The FAS is defined as a vertically continuous sequence of permeable carbonate rocks of Tertiary age that are hydraulically connected in varying degrees and whose permeability generally is several orders of magnitude greater than that of the rocks bounding the system above and below (Miller 1986). The FAS in southern Florida predominantly consists of limestone with dolomitic limestone and dolomite common with depth.

Upper Floridan Aquifer (513 to 1,432 ft bls)

In general, the UFA is delineated based on permeability characteristics determined by lithologic descriptions and interpretation of geophysical logs. Therefore, neither the top nor the base of the UFA necessarily conforms to formation or time-stratigraphic boundaries. Groundwater occurs under flowing artesian conditions, except where the UFA underlies the Osceola Plain (Bradner 1994). At the C-24 Canal site, the UFA is divided into the upper permeable zone (UFA-upper), the Ocala/Avon Park low-permeability zone (OCAPlpz), and the Avon Park permeable zone (APPZ). The top of the UFA approximately coincides with the base of the Hawthorn Group, except in coastal areas where it lies within the Hawthorn Group at the base of a section with high clay and phosphate grain content. The basal boundary of the UFA commonly appears to be gradational with the MCU and difficult to define objectively (Reese and Richardson 2008). The thickness of the UFA at the site was estimated to be approximately 900 ft, assuming the MCU was encountered near the base of SLF-74 (**Figure 8**).

The UFA generally comprises multiple thin flow zones of high-permeability rock interlayered with thicker zones of low-permeability material. Flow zones can be defined in a borehole using flowmeter, water temperature, and caliper logs. Some UFA flow zones are areally extensive and seem to coincide with formation boundaries. Three to four producing zones in the UFA were mapped by Brown and Reece (1979). Two areally extensive and mappable flow zones are present at the base of the Suwannee Limestone and Ocala Limestone (Brown and Reece 1979, Lukasiewicz 1992).

Transmissivity of the UFA was mapped using APTs and specific capacity tests. Transmissivity varied from approximately 7,000 to more than 70,000 ft^2/day. A large area with high transmissivity (50,000 to 70,000 ft^2/day) was reported in northwestern St. Lucie County. The coastal area had transmissivities of less than 13,000 ft^2/day. The transmissivity of the UFA at the site is discussed in the *Hydrogeologic Testing* section.

Upper Permeable Zone (513 to 860 ft bls)

At the C-24 Canal test site, the top of the UFA-upper was identified at 513 ft bls, in conjunction with contact between the Hawthorn Group and Suwannee Limestone (Reese and Richardson 2008). Lukasiewicz (1992) identified two distinct flow zones within the UFA-upper: one extending from 513 to 644 ft bls and the second from 724 to 840 ft bls (**Figure 8**). SLF-75 and SLF-76 were constructed to discretely monitor these zones. There were minor differences in water quality and water level between the two flow zones, suggesting some degree of internal confinement. The differences are discussed in the *Hydrogeologic Testing* section.

In 2016, new geophysical logs were collected in the completed monitor wells. The new logs provided additional detail on the degree of heterogeneity within the two major flow zones. In the upper flow zone, greatest production was centered in a 20-ft interval around the contact between the Suwannee and Ocala Limestone formations (553 to 573 ft bls), but the well produced continuously from 553 to 687 ft bls (total logged depth). Fluid temperature and conductance logs indicated the deepest portion of SLF-76 (below 645 ft bls) produced hotter and fresher water than shallower portions. SLF-75 is open to the bottom 70 ft of the deeper flow zone identified by Lukasiewicz (1992). The 2016 logs indicated that all flow from SLF-75 was produced between 830 and 860 ft bls.

Ocala/Avon Park Low-permeability Zone (860 to 1,080 ft bls)

At the C-24 Canal test site, the OCAPlpz ranges from 860 to 1,080 ft bls (**Figure 8**). The limestone changes from white to orange and gray. The OCAPlpz is not lithologically distinct from the UFA-upper but distinguished only by the lack of large-scale secondary permeability, which provides the majority of flow in the UFA-upper. There is a head drop of approximately 0.8 ft across this unit.

Avon Park Permeable Zone (1,080 ft bls to Total Depth)

The APPZ is characterized by well indurated dolostone with low matrix porosity and productivity, primarily from fractures or bedding plane solution features. Other characteristics of the geophysical logs include increases in gamma-ray detection and formation resistivity logs; overall decrease in porosity, but more erratic response due to localized fracturing and secondary permeability features; and the caliper is closer to gauge, indicating greater consolidation. At the C-24 Canal site, the top of the APPZ is delineated by the presence of a bedding plane solution feature at the limestone-dolostone contact, as shown on the caliper log at 1,080 ft bls. The lower boundary of the APPZ is less readily defined. Permeability within the APPZ is inherently non-uniform. Lukasiewicz (1992) suggested two primary producing zones in this portion of the exploratory well (SLF-73), 1,020 to 1,141 ft bls and 1,384 to 1,495 ft bls. Reese and Richardson (2008) identified the APPZ at the site from 1,080 to 1,450 ft bls (**Figure 8**) based on the SLF-73 data set and correlation between SLF-73 and deeper wells to the north and south. The geophysical logs conducted at SLF-74 in 2016 provide additional detail on the discretization of production within the APPZ but are not sufficient to ascertain whether the MCU is present within the penetrated depth.

The MCU and LFA, while generally present throughout the region, were not believed to be encountered (except for possibly the uppermost portion) at the C-24 Canal site based on the deepest well (SLF-73) penetrating a total depth of 1,540 ft bls. SLF-73 may have terminated in the upper portion of the MCU; however, the well was abandoned and further testing is not possible. The deepest existing well (SLF-74) was drilled to a depth of 1,450 ft bls and, based on the data shown in **Figure 8**, likely terminates near the base of the APPZ.

HYDROGEOLOGIC TESTING

Water Quality and Inorganic Chemistry

Several sampling methods were used to assess the chemistry of the formation water at the C-24 Canal test site. Drill-stem sampling and fluid conductance and temperature logs were used to provide a continuous vertical profile of the water within the SLF-73 pilot hole and completed monitor wells SLF-74, SLF-75, and SLF-76. Straddle packer tests at four select intervals during pilot hole drilling gave more accurate assessment of discrete zones, and numerous composite samples of the completed monitor wells provided a picture of the vertical variation of water quality within the FAS.

Water Quality Sampling During Drilling

Lukasiewicz and Switanek (1995) reported that drill-stem samples were collected approximately every 30 ft from 560 to 1,540 ft bls during reverse-air drilling of SLF-73. Samples were analyzed for chloride, specific conductance, temperature, and pH in the field, then sent to the SFWMD laboratory for those same parameters plus sodium, sulfate, total iron, hardness, aluminum carbonate, and total dissolved solids (TDS). Original data from the samples are not available, but a large portion of the data is included in Lukasiewicz and Switanek (1995). Water quality samples were collected during the packer test from four discrete intervals (**Table 3**). Results from the drill-stem samples are plotted in **Figure 9**, along with the borehole temperature, caliper adjusted flow, and estimated formation water conductance logs, to illustrate changes in salinity at different depths within the borehole.

The drill-stem TDS data indicated an increase in salinity of more than 4,000 milligrams per liter (mg/L) between 560 and 1,540 ft bls. While there were minor changes in sulfate concentrations, chloride was the dominant anion. The depth assigned to a drill-stem sample is the maximum depth drilled at the time the sample was acquired, but the sample will not necessarily represent the exact composition of water at that depth. Drill-stem samples represent a composite of the entire open portion of the borehole from casing to maximum depth and are more strongly influenced by the water quality in productive zones. This is seen in the comparison between the drill-stem, packer test, and log estimated conductance shown in **Figure 9**.

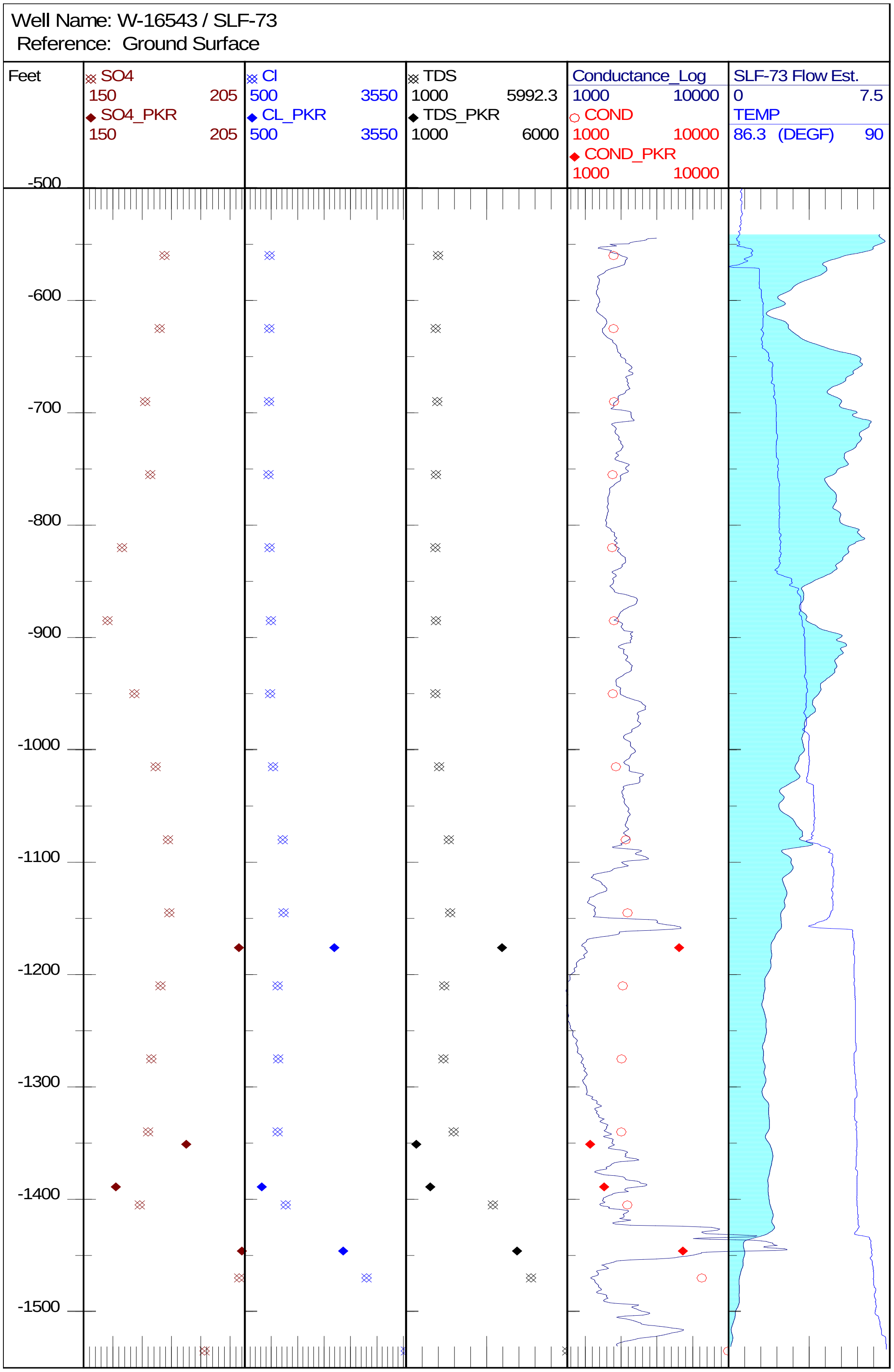


Figure 9. Comparison of drill-stem and packer test results with geophysical logs from pilot hole drilling at well SLF-73.

Table 3. Analytical results from packer test samples.

Depth from (ft bls)	Depth to (ft bls)	Specific Cond. (µS/cm)	Temp. (°C)	pH	Na (mg/L)	Ca (mg/L)	Cl (mg/L)	SO_4 (mg/L)	Total Alkalinity (mg/L)	Fe (mg/L)	TDS (mg/L)
1,138	1,176	7,240	20.1	7.2	979	202	2,194	203	119	1.3	3,976
1,313	1,351	2,280	30.3	7.4	251	85	556	185	137	0.6	1,320
1,351	1,389	3,060	30.6	7.4	384	104	821	161	138	0.5	1,747
1,408	1,446	7,450	30.3	7.2	1,027	252	2,362	204	115	1.2	4,440

°C = degrees Celsius; µS/cm = microsiemens per centimeter; Ca = calcium; Cl = chloride; Cond. = conductance; Fe = iron; ft bls = feet below land surface; mg/L = milligrams per liter; Na = sodium; SO_4 = sulfate; TDS = total dissolved solids.

Water Quality Sampling from Permanent Monitor Wells

SLF-74, SLF-75, and SLF-76 have been sampled numerous times for major cations and anions since they were incorporated into the SFWMD's Regional Floridan Groundwater (RFGW) monitoring network in 2004. The wells were most recently sampled in January 2020. The results of samples collected from 2001 to 2020 are summarized in **Table 4**. The complete data set of water chemistry is provided in **Appendix B**.

Table 4. Statistical summary of analytical tests from monitor wells at the C-24 Canal test site, based on samples from 2001 to 2020.

	Alkalinity, as HCO_3 (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Calcium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	TDS (mg/L)	Specific Conductance (µS/cm)	pH	Temperature (°C)
SLF-74											
Mean	164	219	2,160	163	226	20	937	4,329	7,150	7.28	30.47
Median	162	220	2,126	162	220	21	930	4,480	7,173	7.33	30.50
Minimum	151	200	2,000	150	210	18	882	3,756	6,876	6.90	29.80
Maximum	171	240	2,400	181	249	23	1,024	5,000	7,565	7.40	30.80
25th Percentile	158	211	2,100	159	219	20	916	4,000	7,043	7.24	30.44
75th Percentile	171	220	2,200	168	230	21	938	4,512	7,229	7.40	30.66
# Samples	13	13	13	13	13	13	13	13	13	13	13
SLF-75											
Mean	174	187	942	80	111	15	461	2,018	3,627	7.40	28.01
Median	171	190	938	81	112	15	462	2,000	3,620	7.38	27.75
Minimum	163	157	851	72	96	14	442	1,852	3,506	7.20	27.20
Maximum	183	210	1,100	86	121	17	489	2,118	3,793	7.70	30.40
25th Percentile	171	176	910	77	108	15	450	1,950	3,578	7.28	27.52
75th Percentile	180	198	974	83	116	15	470	2,100	3,664	7.50	28.15
# Samples	18	18	18	18	18	18	18	17	18	18	18
SLF-76											
Mean	166	176	1,311	112	156	16	597	2,763	4,729	7.30	28.71
Median	166	175	1,300	112	157	16	591	2,788	4,737	7.32	29.32
Minimum	149	156	1,172	100	140	14	565	2,532	4,505	7.02	24.40
Maximum	183	200	1,424	121	170	17	644	2,942	4,959	7.60	30.00
25th Percentile	162	169	1,271	109	151	15	584	2,706	4,686	7.20	28.88
75th Percentile	171	188	1,378	114	160	16	609	2,808	4,791	7.40	29.50
# Samples	18	18	18	18	18	18	18	16	18	18	18

°C = degrees Celsius; µS/cm = microsiemens per centimeter; HCO_3 = bicarbonate; mg/L = milligrams per liter; TDS = total dissolved solids.

Comparison of the water chemistry from the monitor wells shows many similarities as well as some distinct differences. All three wells may be classified as sodium-magnesium-chloride (Na-Mg-Cl) water type, based on a Piper diagram analysis (**Figure 10**), where the source of chloride is seawater. It is clear, however, that overall salinity increases with depth.

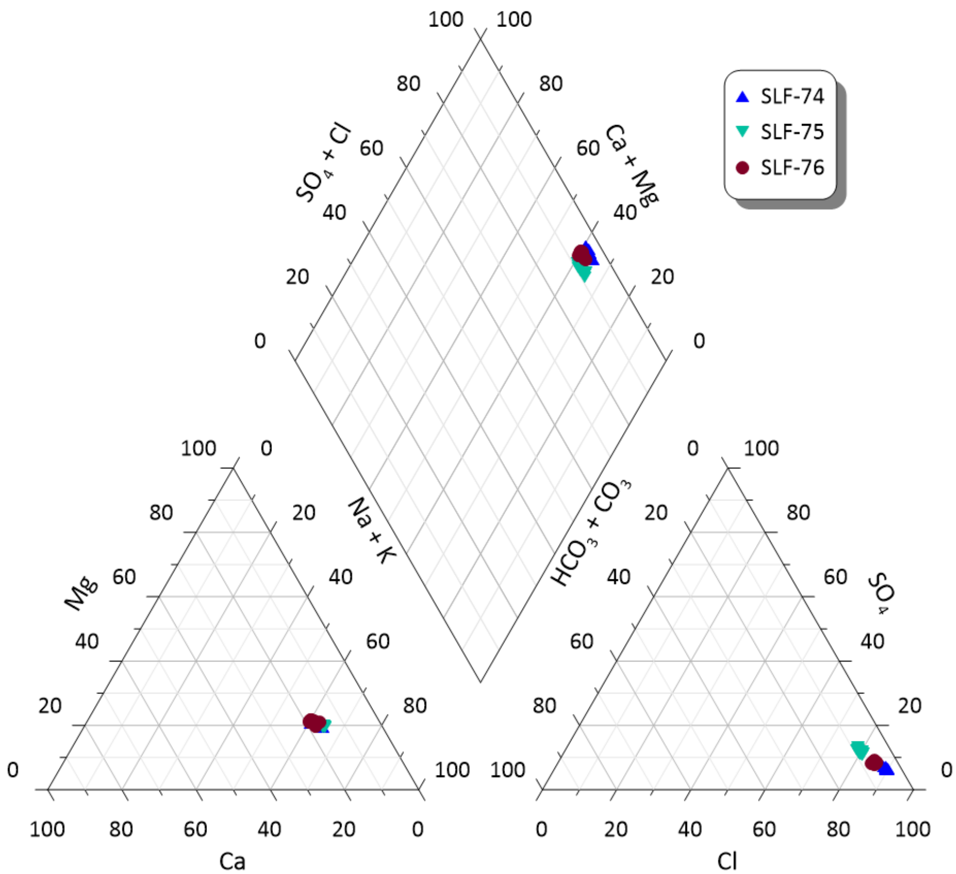


Figure 10. Piper diagram plot showing samples from the C-24 Canal site monitor wells (2001 to 2020).

Stiff diagram patterns also were produced for each well and are shown in **Figure 11**. The diagrams show that the groundwater is predominantly a Na-Cl-Mg water type, increasing with depth.

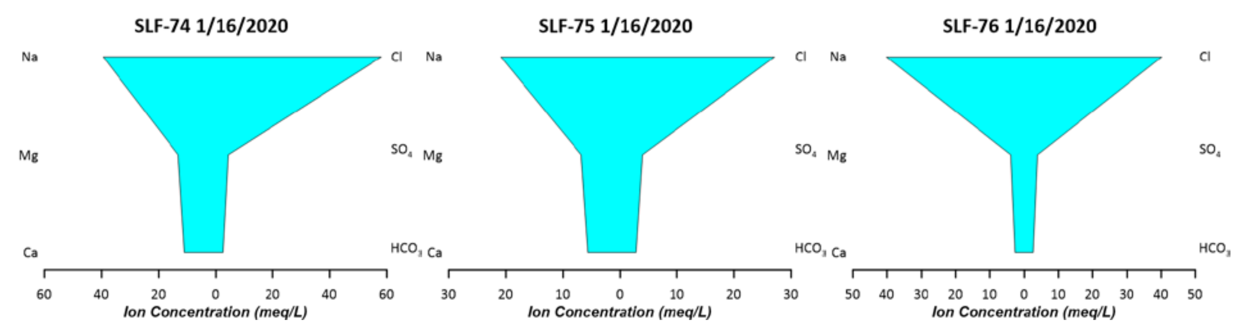


Figure 11. Stiff diagram patterns showing samples from the C-24 Canal site monitor wells (2020).

Except for alkalinity (measured as bicarbonate [HCO_3]), the distribution of primary cations and anions increase with depth (**Figure 12**). However, based on the pilot hole packer tests, this is not entirely accurate. All packer test water quality data (**Table 3**) fell within the depths encompassed by the open-hole interval of SLF-74 (1,068 to 1,450 ft bls), but the ion chemistry of the two packer tests between 1,313 and 1,389 ft bls was most similar to the composition of monitor well SLF-75 (480 to 700 ft bls). Ion chemistry from the SLF-74 samples was most similar to the uppermost and lowest packer intervals, reflecting the water chemistry of primary producing zones within the well.

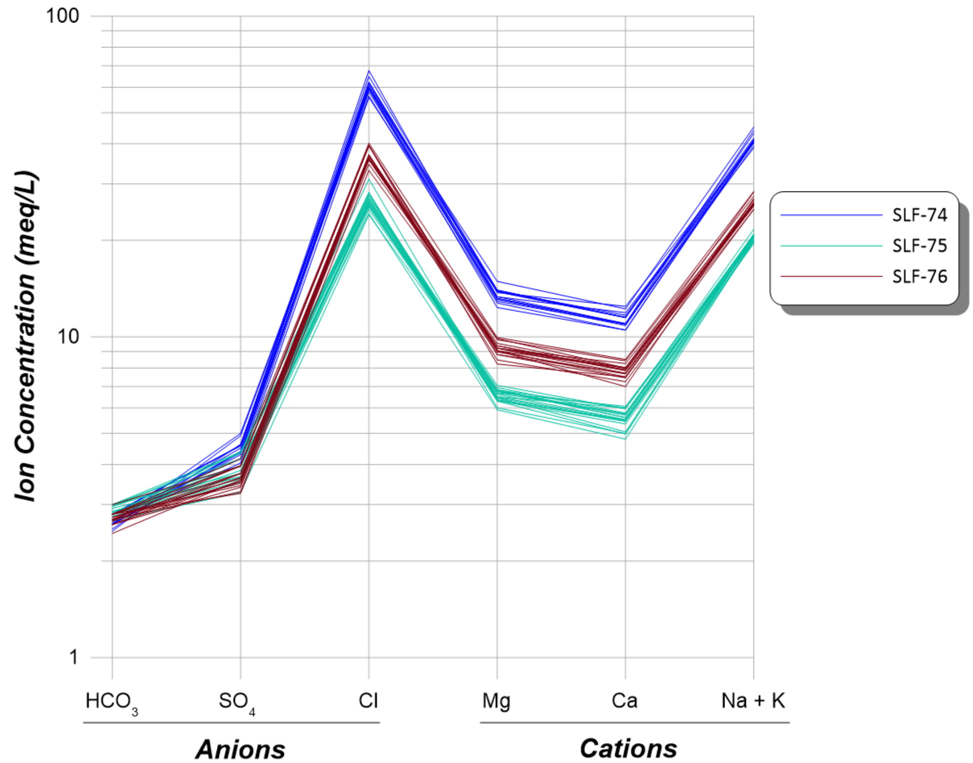


Figure 12. Distribution of primary cations and anions from the highest quality samples from the C-24 Canal site monitor wells.

Aquifer Performance Tests

Three APTs were conducted within the UFA at the C-24 Canal test site (**Table 5**). The APTs represent two flow zones within the UFA-upper and one flow zone in the APPZ. A constant discharge rate during each APT was maintained for 24 hours. Drawdown data were analyzed using the Hantush (1964) type curve method.

Table 5. Summary of aquifer performance tests conducted at the C-24 Canal site.

Pumped Well	Observation Well*	Cased Depth (ft bls)	Total Depth (ft bls)	Aquifer Tested	Pumping Rate (gpm)	Hours Pumped	Max. Drawdown (ft)	Transmissivity (ft^2/day)	Storage Coefficient	Leakance (per day)
SLF-75	SLF-77	480	700	UFA-upper	640	27.0	0.7	23,430	0.00089	0.030
SLF-76	SLF-78	790	860	UFA-upper	373	28.6	3.3	29,553	0.00016	0.006
SLF-74	SLF-73	1,070	1,460**	APPZ	622	33.6	1.3	64,866	0.00018	0.001

APPZ = Avon Park Permeable Zone; ft = foot; ft bls = feet below land surface; ft^2/day = feet squared per day; gpm = gallons per minute; UFA-upper = Upper Floridan aquifer-upper permeable zone.
* Observation wells were approximately 300 ft from production wells in each zone.
** SLF-73 was completed to 1,540 ft bls.

The APT results indicated the most transmissive interval at the site was from the APPZ (1,070 to 1,460 ft bls). The two flow zones within the UFA-upper had similar transmissivities. Leakance decreased with depth for each flow zone. **Figure 13** compares the flow log completed in SLF-73 in 1990 to those completed in 2016 in the three remaining monitor wells (SLF-74, SLF-75, and SLF-76), which correspond to each of the APT intervals. Based on the flow log data, production was not evenly distributed across the tested intervals. For example, in the deeper UFA-upper test, there were 70 ft of open borehole, but the logs indicate only the bottom 30 ft yielded water under artesian pressure. This type of heterogeneity, which complicates APT analysis, is common in the FAS. Additional information regarding the APT can be found in Lukasiewicz and Smith (1996).

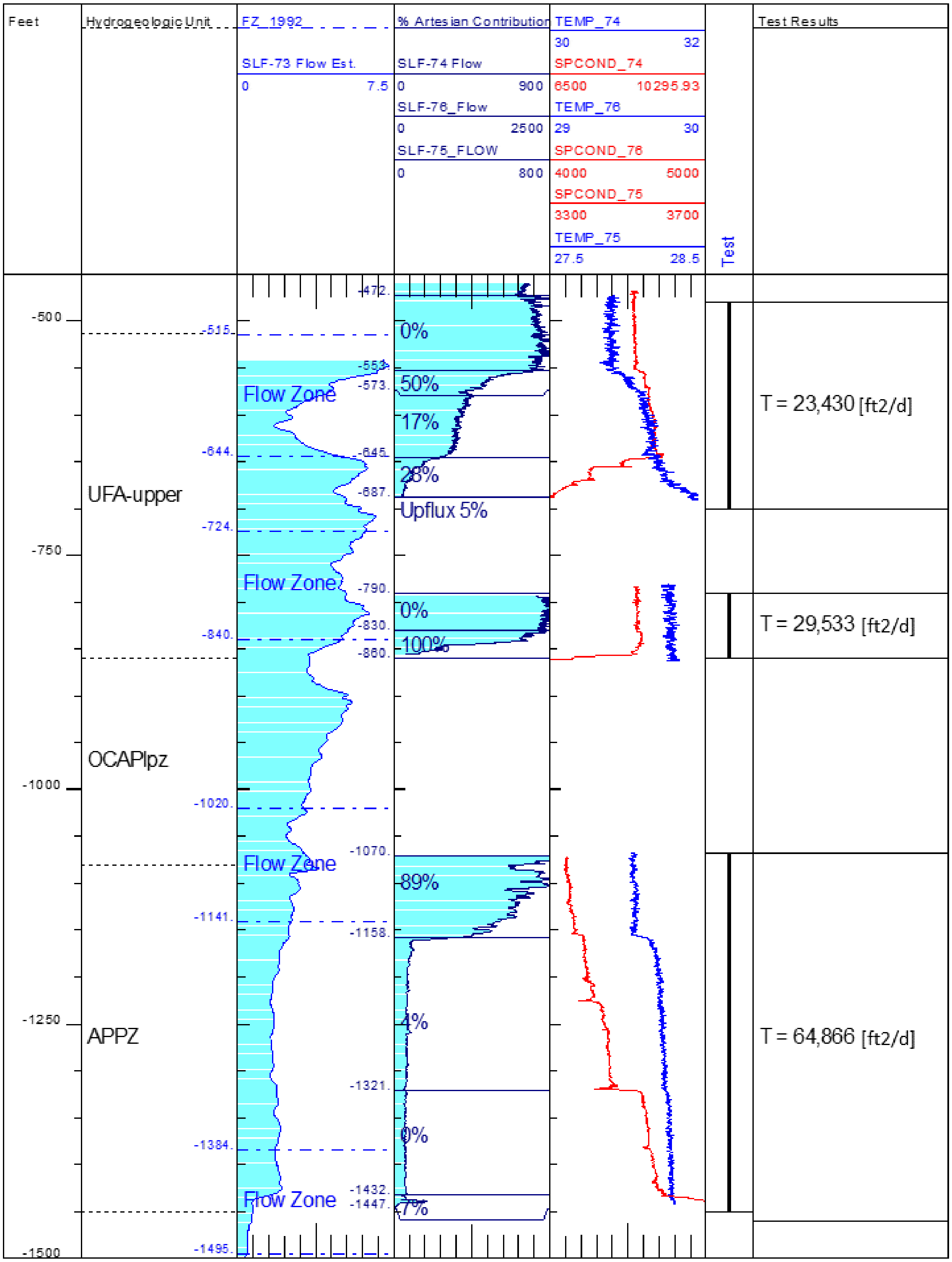


Figure 13. Comparison of flowmeter logs from SLF-73 (1990) and SLF-74, SLF-75, and SLF-76 (2016).

Geophysical Logging

Geophysical logging was conducted in the SLF-73 pilot hole during its construction in 1990. The logs provide a continuous record of physical properties of the subsurface formations and the fluids they contain. The log data were used to assist with casing seat selection and lithologic determination and to identify potential production and confining zones. In 2016, additional logging was conducted on monitor wells SLF-74, SLF-75, and SLF-76 to verify well construction and integrity, identify discrete producing zones within the open-hole intervals, and assist in correlation between wells.

With advances in flowmeter logging, data manipulation, and availability of discrete-depth monitor wells, there is a pronounced difference in the flowmeter logs from 1990 and 2016. Lukasiewicz and Smith (1996) identified four separate flow zones within the UFA (**Figure 13**). By performing separate flowmeter testing on the three remaining monitor wells (SLF-74, SLF-75, and SLF-76), a better discretization of the flow data showed there are two major flow zones within the UFA-upper. The upper flow zone is near the contact with the ICU and the lower flow zone is near the contact with the OCAPlpz. The third flow zone is in the APPZ, with the majority of flow in the upper portion of the APPZ (1,070 to 1,158 ft bls), although some flow occurred at the bottom of the well, believed to be slightly above the MCU. A complete summary of the logging program at the C-24 Canal test site is provided in **Table 6**.

Table 6. Geophysical logs conducted at the C-24 Canal site.

Parameter	SLF-73	SLF-74	SLF-76	SLF-75
Logged Date	July 5, 1990	September 14, 2016	November 8, 2016	November 9, 2016
Logging Company	Schlumberger	RM Baker	RM Baker	RM Baker
Logged Interval (ft bls)	544 – 1,536	1,050 – 1,445	0 – 861	461 – 697
Caliper	X	X	X	X
Natural Gamma	X	X	X	X
Dual Induction	X	X	X	X
Normal Resistivity	X	X		X
Neutron/Density	X			
Sonic	X			
Flowmeter	X	X	X	X
Fluid Temperature	X	X	X	X
Fluid Conductivity		X	X	X
Borehole Video			X	X

ft bls = feet below land surface.

The original log data are available online through the SFWMD's DBHYDRO database. Brief descriptions of the information provided by each log type are as follows:

- **XY Caliper** – A mechanical measure of the dimensions of the borehole in two planes 90° from each other. The caliper is required for correction of borehole flowmeter logs and indicates the presence of secondary permeability (vugs, caverns, or fractures). The caliper curve's shape and degree of deviation from the nominal bit size also indicate the relative induration of the rock and are important for selection of casing setting depths.

- **Natural Gamma** – Measures the presence of natural gamma radiation produced by the decay of potassium (^{40}K) and uranium (^{238}U) as well as its daughter product thorium (^{232}Th) in the rock formation. Clay and phosphatic rocks generally are rich in these elements. This tool was used to confirm lithologic determination, identify bed boundaries, correlate among wells, and provide depth control for different logging instruments.
- **Resistivity Log** – Measures the combined electrical properties of the rock matrix and the fluids within it. In a formation of uniform water quality, resistivity is a good indicator of the rock's porosity, with resistivity decreasing as the water content (porosity) increases. The instrument also is affected by water quality, providing an excellent indication of changes in salinity within the formation.
- **Normal Resistivity** – Measures resistivity at two extents within the formation (16 and 64 inches) and is best applied in freshwater environments.
- **Dual Induction** – Measures the resistivity at three extents, the shallowest within and immediately adjacent to the borehole and the deepest being the best representation of native rock and water resistivity. This tool provides important information on water quality and extent of drilling fluid invasion into the formation, and it is a qualitative indicator of possible confining and producing zones and permeability.
- **Neutron/Density** – Measures two parameters strongly related to the lithology and porosity of the formation. The neutron log measures the hydrogen content of the formation, which generally is equivalent to the liquid-filled porosity. The density log measures the bulk density of the formation (rock and fluid-filled pore space). It is helpful in identifying lithologic changes, and when the lithology is known, can be used to calculate porosity.
- **Borehole Compensated Sonic and Variable Density Log** – Measures the velocity of sound waves through the rock adjacent to the borehole and is directly correlated to the porosity of the rock. The more porous a formation, the slower the travel time. The sonic log measures only matrix porosity; therefore, sonic-derived porosity can be underestimated in vuggy or fractured formations. The variable density log provides a visual representation of the borehole wall, indicating the presence of fractures and solution features.
- **Temperature and Fluid Resistivity** – Measures the temperature and resistivity of the fluids filling the borehole. These generally are run under both static and dynamic (pumped) conditions. They provide information on the points of influx into the borehole, confinement and production horizons, and salinity variation with depth.
- **Flowmeter Log** – Measures the vertical velocity of fluids in the borehole. Ideally, this log is run under both static and dynamic conditions. Under static conditions, the log indicates crossflow, which is water moving vertically between different aquifers intersecting the borehole due to the head difference between the units. Under dynamic conditions, the log indicates the primary production zones within the borehole. At the C-24 Canal site, only dynamic flow logs were available. In the monitor wells, station measurements, in which the flowmeter tool is stopped at a single position, were used to interpret the flow logs.
- **Borehole Video** – Where possible, a digital video of the complete borehole is taken under pumping conditions: downhole view from land surface to total depth and side view from total depth to the base of the casing. The video provides qualitative information on lithologic bedding and secondary permeability (solution features and fractures) that may not be obvious from the cuttings and formation logs. The borehole video also is used to inspect the integrity of the casing joints.

Water Level Data

Monitor wells SLF-74, SLF-75, and SLF-76 were incorporated into the SFWMD's regional water level monitoring network in August 2002. Because the wells are artesian, they are equipped with externally mounted pressure transducers, which measure the formation pressure at a surveyed measuring point. Historical water level fluctuations, as daily mean uncorrected head, from 2003 to 2020 are shown in **Figure 14**. The SFWMD monitoring network uses one standard multiplier (2.3068) to convert from raw pounds per square inch to feet of water. The true conversion factor varies somewhat as a function of the density of water in a particular well. In DBHYDRO, the water levels are labeled as uncorrected head (UNHD) when they have not been specifically compensated for variations in water density. The effect of density variation in SLF-74, SLF-75, and SLF-76 was evaluated as part of this report.

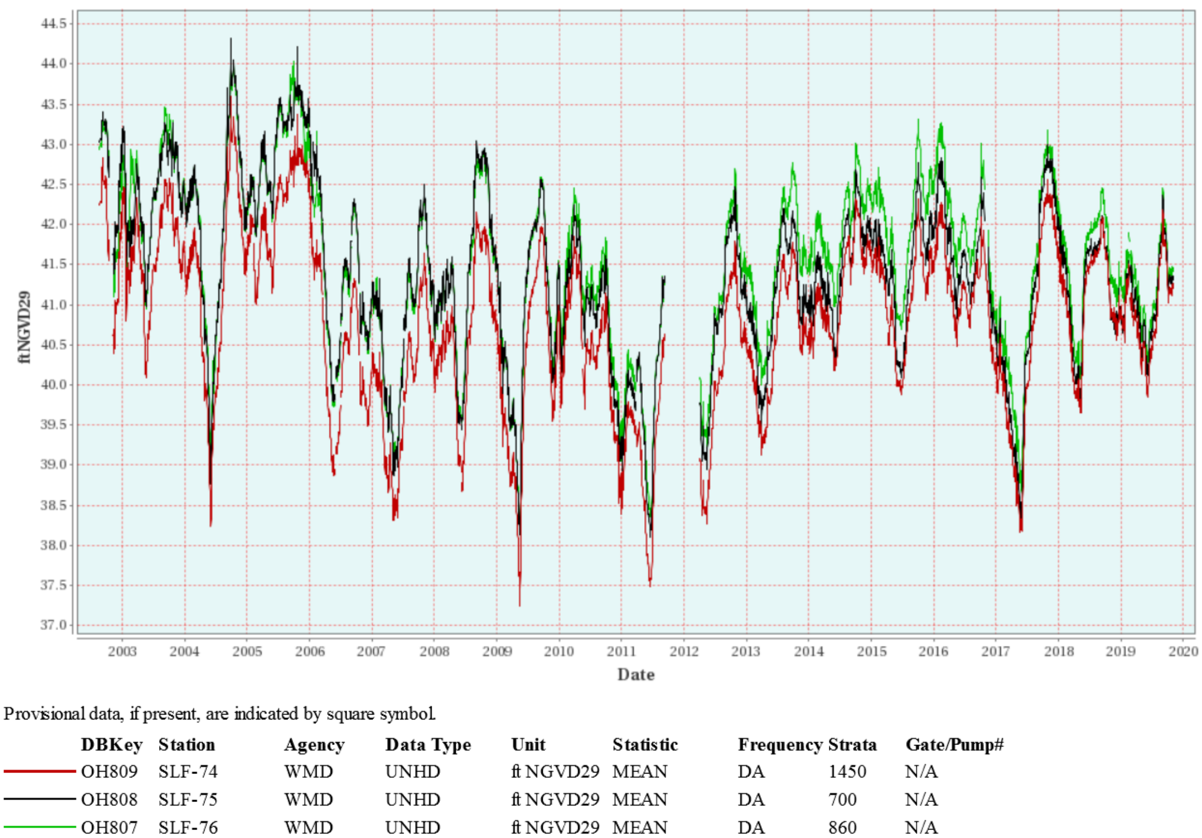


Figure 14. Historical water levels for SLF-74, SLF-75, and SLF-76 at the C-24 Canal site.

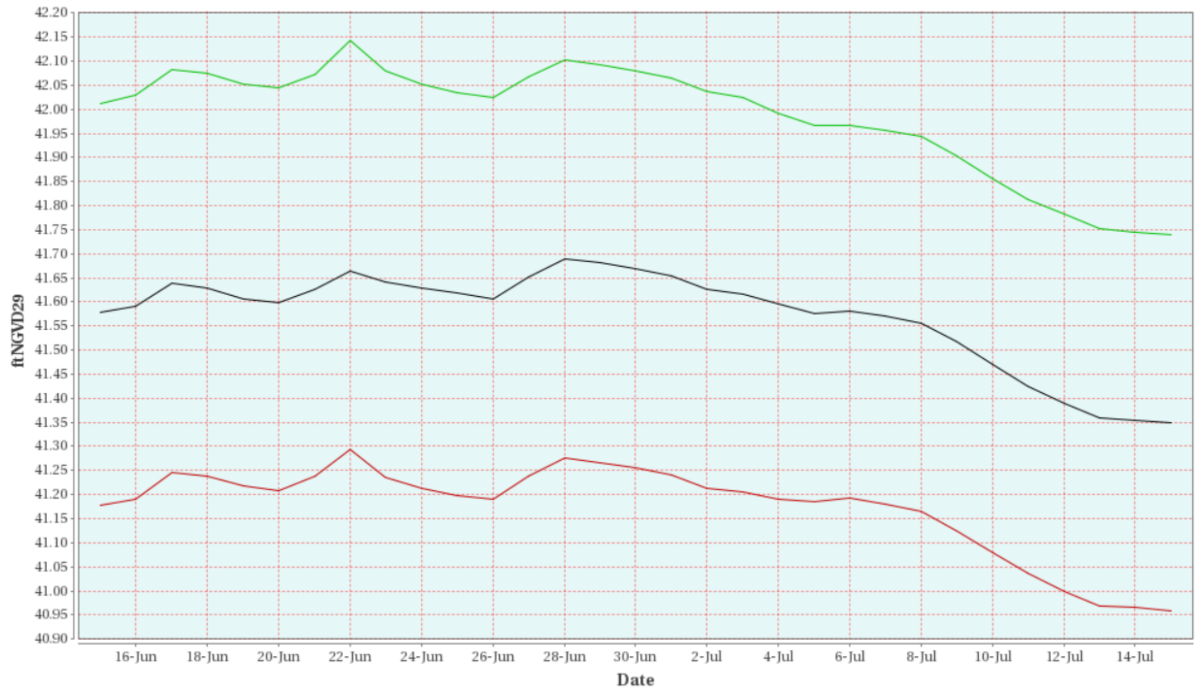
Water density in each well was calculated based on the mean water temperature and TDS concentration from all samples with both ion balance and mass balance errors of less than 5%. It was determined that no density correction was necessary. The calculations are included in **Appendix C** and show the correction error was less than 0.01 ft. **Table 7** compares the calculated and standard SFWMD correction factors, using the maximum historical pounds per square inch to determine the maximum error factor in feet.

Table 7. Maximum error (in feet) between SFWMD standard and calculated correction factors.

Well Name	Calculated Correction Factor	SFWMD Correction Factor	Maximum psi	Correction using Calculated Factor	Correction using SFWMD Standard Factor	Maximum Error (ft)
SLF-74	2.3122	2.3068	4.77	11.003	11.029	0.026
SLF-75	2.3139	2.3068	5.23	12.102	12.005	0.037
SLF-76	2.3137	2.3068	6.05	13.998	13.956	0.042

ft = foot; psi = pounds per square inch; SFWMD = South Florida Water Management District.

Water levels in all three flow zones fluctuated in a similar manner. In general, the deepest well, SLF-74, had the lowest heads while the mid-level well, SLF-76, had the highest heads, and the shallowest well, SLF-75, was in between the other two wells. The apparent anomaly of a "head reversal" may be due to a smaller open-hole interval in SLF-76 than SLF-75 (70 ft versus 225 ft, respectively). A close-up of this is shown in **Figure 15**, which displays the same data as **Figure 14** but over a shorter duration (June 15 to July 15, 2015).



Provisional data, if present, are indicated by square symbol.

DBKey	Station	Agency	Data Type	Unit	Statistic	Frequency	Strata	Gate/Pump#
OH809	SLF-74	WMD	UNHD	ft NGVD29	MEAN	DA	1450	N/A
OH808	SLF-75	WMD	UNHD	ft NGVD29	MEAN	DA	700	N/A
OH807	SLF-76	WMD	UNHD	ft NGVD29	MEAN	DA	860	N/A

Figure 15. Historical groundwater levels for wells SLF-74, SLF-75, and SLF-76 at the C-24 Canal site over a 1-month period.

Elevation Survey

In November/December 2016, a third-order elevation survey was conducted to establish a reference elevation level to both the North American Vertical Datum of 1988 (NAVD88) and the National Geodetic Vertical Datum of 1929 (NGVD29). The site survey was conducted to support migration of water level data from NGVD29 to the more accurate NAVD88 and coincided with the most recent wellhead repair. A copy of the survey report is included in **Appendix D**.

DISCUSSION AND CONCLUSIONS

In 1990, six UFA wells were drilled in St. Lucie County along the southern bank of the C-24 Canal. Three wells of varying depths were drilled in one location and “paired” wells were drilled 300 ft away. The shallowest well pair (SLF-75 and SLF-77) was drilled to 700 ft bls and cased to 480 ft bls. The mid-level wells (SLF-76 and SLF-78) were drilled to 860 ft bls and cased to 790 ft bls. The deepest pair (SLF-73 and SLF-74) was cased to 1,070 ft bls; however, SLF-73 (the deepest well drilled at the site) was completed to 1,540 ft bls and SLF-74 was completed to 1,450 ft bls. Drill cuttings from SLF-73 were sent to the FGS for lithologic interpretation. In addition to obtaining detailed lithologic and geophysical data, the purpose of the well pairs was to allow for three APTs (Lukasiewicz and Smith 1996).

One well from each pair was plugged and abandoned, leaving monitor wells SLF-74, SLF-75, and SLF-76 active. Advances in the mapping of hydrogeologic units suggested refinements could be made to the data interpretation from the 1990 investigation and Lukasiewicz and Smith (1996). Therefore, in 2016, new geophysical logs were performed in monitor wells SLF-74, SLF-75, and SLF-76. A summary of the logging performed in 2016 compared to the geophysical logging at SLF-73 in 1990 is provided in **Table 6**. The 2016 logs allowed for better discretization of flow zones by collecting flow measurements from individual wells set at different depths. Lukasiewicz and Smith (1996) delineated four flow zones; however, the data were affected by flow entering the well from 544 to 1,536 ft bls. Interpretation of individual flow logs conducted in monitor wells SLF-74, SLF-75, and SLF-76 suggests greater complexity in the UFA flow system than originally suggested (**Figure 13**).

There also have been changes in the interpretation of the area’s geology since the cuttings were first described by the FGS in 1990. An updated interpretation of the geology is provided in this report and geologic formational picks are summarized on **Table 2**. Based on the initial cutting description in 1990, the bottom of SLF-73 was identified as the Avon Park Formation.

Multiple interpretations of the hydrogeologic units have been made since the C-24 Canal site was drilled. This report follows the interpretation first documented in Reese and Richardson (2008), but with updated terminology. There remains uncertainty, particularly with the base of the APPZ unit. The APPZ is characterized by fracture flow. In many areas, including the C-24 Canal site, the APPZ is composed of multiple discrete, fractured intervals separated by less permeable rock. The degree of hydraulic connection between the two fractured flow zones observed in SLF-73 and SLF-74 and the spatial extent of the deeper fracture set (1,432 ft bls to total depth) cannot be established with currently available data. Drilling and testing at the site did not penetrate deeply enough to allow for definitive correlation with areas where the MCU has been well established. When trying to delineate the hydrogeologic units penetrated by the deepest well (SLF-73), it is difficult to ascertain whether the MCU was penetrated, as it is not lithologically distinct from the APPZ. Should more investigation in the region occur as a result of a greater interest in the LFA, it may be possible to establish a cross-section of the site to determine where the contact between the UFA and MCU occurs.

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APPENDIX A:
LITHOLOGIC DESCRIPTIONS – FLORIDA GEOLOGICAL SURVEY
(SLF-73/W-16543)

LITHOLOGIC WELL LOG PRINTOUT SOURCE - FGS

WELL NUMBER: W-16543 COUNTY - ST LUCIE
TOTAL DEPTH: 1540 FT. LOCATION: T.36S R.38E S.24
262 SAMPLES FROM 0 TO 1540 FT. LAT = 27D 20M 17S
LON = 80D 29M 01S
COMPLETION DATE: 07/01/90 ELEVATION: 25 FT
OTHER TYPES OF LOGS AVAILABLE - OTHER

OWNER/DRILLER:SOUTH FLORIDA WATER MANAGEMENT DISTRICT/HYDROWELL TECH.

WORKED BY:__JOE AYLOR (7/93), 10' INTERVALS TO 590', THEN 5' INTERVALS.
SFWMD ID# FOR CUTTINGS IS 111-55 (HOLE # **SLF-73**), ST. LUCIE COUNTY.
LOCATED IN THE NE 1/4,NE 1/4,NE 1/4, SEC 24, T36S, R38E.
FLORIDIA POLYCONIC EAST ZONE IN FEET PLANAR X=667652; PLANAR Y=1092360.
SFWMD GEOPHYSICAL LOG #1110000077 BY SCHLUMBERGER FOR THIS MONITOR WELL.
INJECTION WELL IS LOCATED IN THE FORT PIERCE S.W. 7.5 MINUTE QUADRANGLE
THE OKEECHOBEE FORMATION IS PROPOSED FOR THE PLIO-PLEISTOCENE INTERVAL
(SCOTT, 1992, P. 23, FLORIDA GEOLOGICAL SURVEY SPECIAL PUBLICATION 36).
THE SUWANNEE FORMATION WAS NOT RECOGNIZED.

0. - 15. 090UDSC UNDIFFERENTIATED SAND AND CLAY
15. - 120. 121PCPC PLIOCENE-PLEISTOCENE
120. - 560. 122HTRN HAWTHORN GROUP
560. - 707. 124OCAL OCALA GROUP
707. - 1540. 124AVPK AVON PARK FM.
500. - 510. 000NOSM NO SAMPLES
1260. - 1265. 000NOSM NO SAMPLES
1285. - 1300. 000NOSM NO SAMPLES
1385. - 1390. 000NOSM NO SAMPLES

0 - 15 SAND; DARK YELLOWISH ORANGE
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: COARSE
ROUNDNESS: SUB-ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-05%
FOSSILS: MOLLUSKS

15 - 40 LIMESTONE; LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: SHELL-20%, PHOSPHATIC SAND-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
TOP OF OKEECHOBEE FORMATION AT 15 FEET.

40 - 80 LIMESTONE; MODERATE LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, SPARRY CALCITE CEMENT
CLAY MATRIX
SEDIMENTARY STRUCTURES: FISSILE
ACCESSORY MINERALS: SHELL-20%, PHOSPHATIC SAND-01%
SHALE-20%, PYRITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION, CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

80 - 100 LIMESTONE; LIGHT GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-50%, CLAY-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, ECHINOID

100 - 120 LIMESTONE; VERY LIGHT GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-20%, CLAY-20%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

120 - 140 SANDSTONE; LIGHT OLIVE GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: SUB-ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-20%, PHOSPHATIC SAND-01%
SPAR-20%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
TRANSITION, TOP OF HAWTHORN AT 120 FEET.

140 - 310 SAND; LIGHT OLIVE GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY

GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: SUB-ROUNDED TO SUB-ANGULAR; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-10%, SPAR-01%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
POOR SORTING

310 - 340 CALCILUTITE; LIGHT GREENISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE, CRYSTALS
45% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-10%, SILT- %
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

340 - 360 CALCILUTITE; LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE, CRYSTALS
45% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-30%, SILT- %
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
GASTROPOD, LOST CIRCULATION GRASS AT 340-360'

360 - 370 CALCILUTITE; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE; 40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-20%, QUARTZ SAND-10%, SPAR-05%
PHOSPHATIC SAND-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

370 - 380 CALCILUTITE; LIGHT GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE; 45% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: SHELL-30%, QUARTZ SAND-05%
PHOSPHATIC SAND-03%, SPAR-05%
OTHER FEATURES: CALCAREOUS

FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
LOST CIRCULATION GRASS AND STICKS

380 - 420 CALCILUTITE; VERY LIGHT GRAY TO LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE; 40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: SHELL-10%, DOLOMITE-10%
PHOSPHATIC SAND-02%, SPAR-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
PLANKTONIC FORAMINIFERA

420 - 430 CALCILUTITE; LIGHT OLIVE GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE; 60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: SHELL-50%, PHOSPHATIC SAND-02%
QUARTZ SAND-05%, SPAR-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
LOST CIRCULATION GRASS AND STICKS

430 - 440 CALCILUTITE; YELLOWISH GRAY
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: CALCILUTITE; 40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: SHELL-25%, PHOSPHATIC SAND-05%
SPAR-01%, QUARTZ SAND-05%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

440 - 490 CALCILUTITE; GREENISH GRAY
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: CALCILUTITE; 20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: FINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: SHELL-15%, PHOSPHATIC SAND-02%
QUARTZ SAND-05%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA

490 - 500 CALCILUTITE; YELLOWISH GRAY
20% POROSITY: MOLDIC, LOW PERMEABILITY

GRAIN TYPE: CALCILUTITE; 10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO FINE; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: SHELL-05%, PHOSPHATIC SAND-02%
SPAR-01%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, ECHINOID

500 - 510 NO SAMPLES

510 - 520 CALCILUTITE; YELLOWISH GRAY
20% POROSITY: MOLDIC, LOW PERMEABILITY
GRAIN TYPE: CALCILUTITE; 10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO FINE; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: SHELL-05%, PHOSPHATIC SAND-02%
SPAR-01%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, ECHINOID

520 - 530 CALCILUTITE; VERY LIGHT GRAY
20% POROSITY: MOLDIC, LOW PERMEABILITY
GRAIN TYPE: CALCILUTITE; 05% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO FINE; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-02%
SPAR-02%, SHELL-01%
OTHER FEATURES: CALCAREOUS
FOSSILS: FOSSIL FRAGMENTS

530 - 560 CALCILUTITE; YELLOWISH GRAY
30% POROSITY: MOLDIC, LOW PERMEABILITY
GRAIN TYPE: CALCILUTITE; 10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO FINE; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: LIMESTONE-10%, PHOSPHATIC SAND- %
SPAR-20%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, ECHINOID
PECTEN

560 - 564 CALCILUTITE; YELLOWISH GRAY
20% POROSITY: MOLDIC, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE; 5% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO FINE; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX

ACCESSORY MINERALS: LIMESTONE-05%, SPAR-10%
OTHER FEATURES: LOW RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BRYOZOA
1% MEDIUM LIGHT GRAY LIMESTONE, TOP OF OCALA GROUP AT 560'.

564 - 590 CALCARENITE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE, BIOGENIC
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-50%, SPAR-20%
PHOSPHATIC SAND-02%
OTHER FEATURES: COQUINA
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BARNACLES
ECHINOID, BRYOZOA
PACKSTONE, LEPIDIOCYCLINA, OPERCULINOIDES IN OCALA GROUP
CALCARENITIC LIMESTONE BELOW.

590 - 595 CALCARENITE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE, BIOGENIC
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-30%, SPAR-05%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BARNACLES
ECHINOID, FOSSIL FRAGMENTS
LEPIDIOCYCLINA, OPERCULINOIDES, 20% LIGHT GRAY LIMESTONE
WITH SECONDARY POROSITY FILLING OF YELLOWISH GRAY CALCITE

595 - 600 CALCARENITE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE, BIOGENIC
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-60%, SPAR-10%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS
LEPIDIOCYCLINA 50%, OPERCULINOIDES 10%, NUMMULITES
CRIBROBULIMINA, 5% LIGHT GRAY LIMESTONE, 5% COQUINA

600 - 645 CALCARENITE; WHITE
40% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY

GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-90%, SPAR-10%
OTHER FEATURES: COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA
FOSSIL FRAGMENTS, BARNACLES
ONE CENTIMETER LEPIDOCYCLINA 50%, OPERCULINOIDES 10%
BRYOZOANS 5%, MINOR GRAY LIMESTONE, MOLLUSKS, GYPSINA
GLOBULA, DICTYOCONUS COOKEI, ECHINOIDS 5%, EPONIDES (?)

645 - 660 CALCARENITE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-50%, SPAR-20%, LIMESTONE- %
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS
LEPIDOCYCLINA 40%, ECHINOIDS 5%, MOLLUSKS 5%, DICTYCONUS
COOKEI, NUMMULITES, 50% COQUINA

660 - 665 CALCARENITE; VERY LIGHT GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-50%, LIMESTONE- %
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION, SUCROSIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS
30% (37) SUCROSIC, RECRYSTALLIZED LIMESTONE, LEPIDOCYCLINA
30%, ECHINOIDS, GYPSINA GLOBULA, 10% COQUINA

665 - 670 CALCARENITE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-50%, SPAR-10%, LIMESTONE- %
OTHER FEATURES: COQUINA, CALCAREOUS
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS

LEPIDOCYCLINA 40%, NUMMULITES, 10% LIGHT GRAY LIMESTONE
20% COQUINA

670 - 685 CALCARENITE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MICROCRYSTALLINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-40%, SPAR-10%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS
LEPIDOCYCLINA 40%, NUMMULITES 5%, ECHINOIDS 3%, BRYOZOANS 1%, DICTYCONUS COOKEI, COQUINA 40%, COSKINOLINA FLORIDANA(?).

685 - 690 CALCARENITE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-70%, SPAR-20%
OTHER FEATURES: COQUINA, CALCAREOUS
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS
BARNACLES
LEPIDOCYCLINA 60%

690 - 705 CALCARENITE; WHITE
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-30%, SPAR-10%
OTHER FEATURES: COQUINA, CALCAREOUS
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS
FOSSIL MOLDS
LEPIDOCYCLINA 20%, MUMMULITES 2%, DICTYOCONUS COOKEI, 60% COQUINA MEDIUM-GRAINED SAND SIZE IN LIMESTONE.

705 - 707 CALCARENITE; VERY LIGHT ORANGE
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRANULE
MODERATE INDURATION

CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-10%
OTHER FEATURES: COQUINA, CALCAREOUS
FOSSILS: FOSSIL FRAGMENTS

707 - 710 DOLOSTONE; YELLOWISH GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-05%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION, SUCROSIC
FOSSILS: FOSSIL FRAGMENTS
REFERENCE W-4086, SEVEN MILES EAST LOGGED BY CHEN, 1965, P. 59. CONTACT IS ALSO SIMILAR TO W-16951. SEE ALSO USGS PROFESSIONAL PAPER 1403-B, 1986, FOR AVON PARK CONTACT.

710 - 715 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-25%, DOLOMITE-05%
OTHER FEATURES: COQUINA, CALCAREOUS
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, ECHINOID
BRYOZOA
DICTYOCONUS COOKEI, LEPIDOCYCLINA, MILIOLID FORAMS

715 - 720 LIMESTONE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-10%, SPAR-10%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, ECHINOID
DICTYOCONUS COOKEI 2%, SCALENOHEDRAL CALCITE IN ECHINOID DISKS ONE X 0.5 CM, COQUINA LIMESTONE AND MILIOLID FORAMS 80%.

720 - 725 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRANULE
MODERATE INDURATION

CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-15%, SPAR-20%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, ECHINOID
MOLLUSKS
RECRYSTALLIZED DOLOSTONE SIMILAR TO 707'-710' 35%
LEPIDOCYCLINA 10%, 50% COQUINA

725 - 730 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-10%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: ECHINOID
RECRYSTALLIZED LIMESTONE IS 20% MIXED WITH COQUINA 60%.

730 - 740 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: VERY FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-50%, CALCARENITE- %
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, ECHINOID
MOLLUSKS
LEPIDOCYCLINA 30%, NUMMULITES 10%, RECRYSTALLIZED
LIMESTONE.

740 - 750 LIMESTONE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, CRYSTALS
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: VERY FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-10%, CALCARENITE-50%
OTHER FEATURES: COQUINA, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
LEPIDOCYCLINA 10%, COQUINA 30%, DICTYOCONUS COOKEI.

750 - 755 LIMESTONE; WHITE

30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL- %
OTHER FEATURES: CALCAREOUS
FOSSILS: BENTHIC FORAMINIFERA
MILIOLID FORAMS AND PELLETAL STRUCTURES.

755 - 760 LIMESTONE; VERY LIGHT ORANGE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%
OTHER FEATURES: CALCAREOUS, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA
MILIOLID FORMAS, COSKINOLINA, LITUONELLA FLORIDANA
PELLETAL SEDIMENTS

760 - 770 LIMESTONE; VERY LIGHT ORANGE
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%
OTHER FEATURES: CALCAREOUS, DOLOMITIC, MUDDY, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA, ECHINOID
MILIOLID FORAMS, PELLETAL SEDIMENTS, NUMMULITES.

770 - 780 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-05%, CALCARENITE-10%
SPAR-01%
OTHER FEATURES: CALCAREOUS, DOLOMITIC, MUDDY, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA
LEPIDOCYCLINA 5%, NUMMULITES, MILIOLID FORAMS, PELLETAL
SEDIMENTS, DICTYOCONOUS COOKEI.

780 - 785 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE- %, SPAR-05%
OTHER FEATURES: CALCAREOUS, DOLOMITIC, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
MELIOLID FORMAS, DICTYOCONUS COOKEI, CRIBROBULIMINA

785 - 790 LIMESTONE; VERY LIGHT ORANGE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE- %, SPAR-10%
OTHER FEATURES: CALCAREOUS, DOLOMITIC, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
NUMMULITES, DICTYOCONUS COOKEI.

790 - 795 CALCARENITE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, CLAY-05%, SPAR-20%
OTHER FEATURES: CALCAREOUS, DOLOMITIC, SUCROSIC
FOSSILS: BENTHIC FORAMINIFERA
MILIOLID FORAMS, RECRYSTALLIZED VERY PALE ORANGE DOLOSTONE
RHOMBS VISIBLE.

795 - 800 CALCARENITE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, SPAR-20%, CLAY-02%
OTHER FEATURES: CALCAREOUS, DOLOMITIC, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
10% PINKISH GRAY AND LIGHT GRAY RECRYSTALLIZED DOLOSTONE
DICTYOCONUS COOKEI, MILIOLID FORAMS.

800 - 808 LIMESTONE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, SPAR-30%
OTHER FEATURES: CALCAREOUS, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
PINKISH GRAY AND LIGHT GRAY RECRYSTALLIZED DOLOSTONE
NUMMULITES, MILIOLID FORAMS, LEPIDOCYCLINA, DICTYOCONUS COOKEI.

808 - 810 DOLOSTONE; GRAYISH ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-80%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
20% MILIOLID FORAMS 2 PHI IN SIZE IN LIMESTONE, 20% MEDIUM LIGHT GRAY DOLOSTONE.

810 - 815 LIMESTONE; WHITE
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-25%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
25% VERY PALE ORANGE RECRYSTALLIZED DOLOSTONE AND MINOR MEDIUM GRAY DOLOSTONE, CRINOID, LEPIDOCYCLINA.

815 - 825 DOLOSTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
EUHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: LIMESTONE-30%
OTHER FEATURES: HIGH RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS, BRYOZOA
MILIOLID FORAMS, PELLETAL SEDIMENTS 1 PHI IN SIZE
LEPIDOCYCLINA.

825 - 830 LIMESTONE; VERY LIGHT ORANGE

25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%
OTHER FEATURES: HIGH RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA
MILIOLID FORAMS

830 - 835 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA
20% VERY LIGHT ORANGE DOLOSTONE, MILIOLID FORAMS
DICTYOCONUS COOKEI, NUMMULITES, LEPIDOCYCLINA, CRIBROBULINA
(?), COSKINOLINA.

835 - 840 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA, ECHINOID
CRIBROBULIMINA (?), COSKINOLINA, DICTYOCONUS AMERICANUS
10% VERY LIGHT ORANGE DOLOSTONE, MILIOLID FORAMS
LITUONELLA FLORIDANA.

840 - 850 LIMESTONE; VERY LIGHT GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-02%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
LIGHT GRAY NONFOSSILFEROUS LIMESTONE 20%, MILIOLID FORAMS
IN LIMESTONE 60%, NONRECRYSTALLIZED DOLOSTONE 20%.

850 - 855 CALCARENITE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA, MOLLUSKS
MILIOLID FORAMS, PELLETAL SEDIMENTS.

855 - 860 CALCARENITE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-02%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
MILIOLID FORAMS, DICTYOCONUS COOKEI, CRIBROBULIMINA
CUSHMANI (?), ECHINOID 2%.

860 - 870 CALCARENITE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
MILIOLID FORAMS.

870 - 875 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-35%, SPAR-02%, SHELL-10%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
MILIOLID FORAMS, PELETAL SEDIMENTS, CRIBROBULIMINA
CUSHMANI(?), FORAMS AND ECHINOIDS 10%, DICTYOCONUS COOKEI
LIGHT GRAY LIMESTONE, 2%, SPIROLINA CORYENSIS.

875 - 890 LIMESTONE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-15%, SPAR-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
MILIOLID FORAMS, 30% MASSIVE DOLOSTONE, PELETAL SEDIMENTS
SPIROLINA CORYENSIS, AND IN ADDITION FROM 885-890'
DICTYOCONUS COOKEI, PLENTIFUL ECHINOIDS, AND LITUONELLA
FLORIDANA.

890 - 895 DOLOSTONE; GRAYISH BROWN
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
EUHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
MILIOLID FORAMS IN WHITE LIMESTONE, DICTYOCONUS COOKEI

895 - 900 LIMESTONE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SPAR-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
MILIOLID FORAMS, CRIBROBULIMINA CUSMANI(?).

900 - 910 DOLOSTONE; GRAYISH BROWN
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-10%, SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
IN WHITE LIMESTONE, CRIBROBULIMINA CUSHMANI, MILIOLID
FORAMS, COSKINOLINA FLORIDANA, CRIBROSPIRA (?)
BUSHNELLENSIS, DICTYOCONUS COOKEI, BULIMINELLA

ELEGANTISGIMA (?).

910 - 915 DOLOSTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-40%, SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
MILIOLID FORAMS IN WHITE LIMESTONE

915 - 925 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-25%, SPAR-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
MILIOLID FORAMS, PELETAL SEDIMENTS IN WHITE LIMESTONE, VERY PALE ORANGE DOLOSTONE, GUNTERIA FLORIDANA.

925 - 928 LIMESTONE; VERY LIGHT GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, SPAR-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
30% PALE YELLOWISH BROWN DOLOSTONE, MILIOLID FORAMS CRIBROSPIRA (?) BUSHNELLENSIS, 20% MASSIVE WHITE DOLOSTONE 10% MEDIUM LIGHT GRAY LIMESTONE, CRIBROBULIMINA CUSHMANI LITUONELLA FLORIDANA.

928 - 930 DOLOSTONE; GRAYISH BROWN
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
EUHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-20%
OTHER FEATURES: HIGH RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA

IN WHITE LIMESTONE, MILIOLID FORAMS, PELETAL SEDIMENTS.

930 - 935 LIMESTONE; VERY LIGHT GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, CLAY- %
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
MILIOLID FORAMS, 10% MEDIUM LIGHT GRAY LIMESTONE, 20% PALE
YELLOWISH BROWN RECRYSTALLIZED DOLOSTONE.

935 - 945 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA, MOLLUSKS
WHITE LIMESTONE 20%, MILIOLID FORAMS, NUMMULITES
DICTYOCONUS COOKEI, CRIBROBULIMINA CUSHMANI, VERY LIGHT
GRAY, MASSIVE DOLOSTONE 5%, AMPHISTEGINA SP., FOSSILS
PLENTIFUL.

945 - 950 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, SPAR-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
5% VERY LIGHT GRAY LIMESTONE, 2% PALE YELLOWISH BROWN
DOLOSTONE, MILIOLID FORAMS, CRIBROBULIMINA CUSHMANI
SPRIOLINA CORYENSIS, AMPHISTEGINA SP., NUMMULITES
COSKINOLINA ELONGATA, LITUONELLA FLORIDANA, AND GUNTERIA
FLORIDANA.

950 - 960 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY

MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-10%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
5% WHITE MASSIVE DOLOSTONE, COSKINOLINA ELONGATA, SPIROLINA CORYENSIS, NUMMULITES SP., MILIOLID FORAMS, PELETAL SEDIMENTS, DICTYOCONUS COOKEI, AND AMPHISTEGINA SP.

960 - 965 LIMESTONE; WHITE
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-05%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
25% LIGHT GRAY MASSIVE DOLOSTONE, 10% WHITE MASSIVE DOLOSTONE, MICRO-COQUINA LIMESTONE 40%, NUMMULITES, AND AMPHISTEGINA SP.

965 - 975 LIMESTONE; VERY LIGHT ORANGE
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, SPAR-05%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
20% MEDIUM LIGHT GRAY MASSIVE DOLOSTONE, MILIOLID FORAMS CRIBROSPIRA (?) BUSHNELLENSIS, AND DICTYOCONUS COOKEI.

975 - 985 LIMESTONE; WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-05%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA

FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA
MILIOLID FORAMS, NUMMULITES SP., DICTYOCONUS COOKEI 3MM DIAMETER X 2MM HEIGHT WITH DOMED TOPS, SOME NORMAL 1MM CONES, LITUENELLA FLORIDANA, AND AMPHISTEGINA SP.

985 - 1000 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, SPAR-05%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA
SOME NORMAL 2 MM AND SOME 2 X 3MM DICTYOCONUS COOKEI 5% SOME HAVE DOMED TOPS, SOME HAVE DIMPLES (INVERTED): URCHINS (?), MILIOLID FORAMS, NUMMULITES SP., AMPHISTEGINA SP. 2MM COSKINOLINA

1000 - 1005 LIMESTONE; PINKISH GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-25%, SPAR-02%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
20% LIGHT GRAY DOLOSTONE, 5% WHITE MASSIVE DOLOSTONE
MILIOLID FORAMS, LITUENDELLA FLORIDANA.

1005 - 1010 LIMESTONE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%, SPAR- %
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
10% LIGHT GRAY DOLOSTONE, 10% WHITE MASSIVE DOLOSTONE
MILIOLID FORAMS, NUMMULITES SP.

1010 - 1015 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY

MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%, SPAR-01%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
30% 6MM DIAMETER DICTYOCONUS SPP., SOME ELONGATE AND SOME FLAT 2MM HIGH WITH INVERTED TOPS, MILIOLID FORAMS COSKINOLINA ELONGATA.

1015 - 1025 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%, SPAR-01%
OTHER FEATURES: LOW RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
MILIOLID FORAMS, DICTYOCONUS COOKEI, D. SPP. MINOR, PELETAL SEDIMENTS, 5% LIGHT GRAY MASSIVE DOLOSTONE, MACRO FOSSILS 1%.

1025 - 1030 LIMESTONE; VERY LIGHT GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-40%, SPAR-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA
30% LIGHT GRAY MASSIVE DOLOSTONE, 10% WHITE DOLOSTONE WHITE MILIOLID LIMESTONE, DICTYOCONUS COOKEI, D. SPP. ALGAL SPINE (?).

1030 - 1035 LIMESTONE; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX

ACCESSORY MINERALS: DOLOMITE-20%, SPAR-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA
UP TO 6 MM IN DIAMETER DICTYOCONUS SPP. 30%, MILIOLID
FORAMS

1035 - 1040 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
UP TO 8 MM IN DIAMETER DICTYOCONUS SPP. 30%, D. COOKEI, D.
AMERICANUS, FABULARI VAUGHANI.

1040 - 1085 LIMESTONE; VERY LIGHT ORANGE
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%, SPAR-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, COQUINA
FOSSILS: BENTHIC FORAMINIFERA
10% WHITE MASSIVE DOLOSTONE, DICTYOCONUS COOKEI, D. SPP.
5% LIGHT GRAY MASSIVE DOLOSTONE, MILIOLID FORAMS, PELETAL
SEDIMENTS.

1085 - 1100 DOLOSTONE; DARK YELLOWISH BROWN TO MODERATE YELLOWISH
BROWN
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: PEAT-01%, LIMESTONE-10%
OTHER FEATURES: REEFAL
FOSSILS: NO FOSSILS
10% PINKISH GRAY MICROQUINA LIMESTONE, DICTYOCONUS COOKEI
1085- 1090, BLACK ORGANICS.

1100 - 1110 DOLOSTONE; GRAYISH BROWN
30% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE

GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-10%
OTHER FEATURES: REEFAL
FOSSILS: NO FOSSILS
20% MASSIVE, VERY PALE ORANGE DOLOSTONE, REMAINDER IS VUGGY DOLOSTONE.

1110 - 1130 DOLOSTONE; LIGHT GRAYISH BROWN TO VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: LIMESTONE-10%
OTHER FEATURES: REEFAL
FOSSILS: NO FOSSILS
20% PALE BROWN, MASSIVE DOLOSTONE, REMAINDER IS VUGGY DOLOSTONE.

1130 - 1140 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC
GRAIN TYPE: BIOGENIC, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: LIMESTONE-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, ECHINOID
MILIOLID FORAMS, PELETAL SEDIMENTS, AND 20% MASSIVE DOLOSTONE.

1140 - 1150 DOLOSTONE; GRAYISH ORANGE
40% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MOLDIC; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: LIMESTONE- %
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
MILIOLID FORAMS, PELETAL SEDIMENTS, AND 10% MASSIVE DOLOSTONE.

1150 - 1155 DOLOSTONE; GRAYISH BROWN
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY; SUBHEDRAL

GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
ABOUT 70-30 PALE YELLOW BROWN AND MEDIUM GRAY DOLOSTONE
AND 30% MASSIVE DOLOSTONE.

1155 - 1160 DOLOSTONE; MODERATE DARK GRAY
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
ABOUT 20-80 PALE YELLOW BROWN AND MEDIUM GRAY DOLOSTONE
MOSTLY MASSIVE DOLOSTONE.

1160 - 1165 DOLOSTONE; GRAYISH BROWN
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-20%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
MILIOLID FORAMS, PELETAL SEDIMENTS, AND 20% MASSIVE YELLOW
BROWN DOLOSTONE.

1165 - 1168 DOLOSTONE; MODERATE YELLOWISH BROWN
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS

1168 - 1170 DOLOSTONE; MODERATE GRAY
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
SAMPLE MARKED 1160-1170, MOSTLY MASSIVE DOLOSTONE.

1170 - 1235 DOLOSTONE; GRAYISH ORANGE
40% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY

SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: LIMESTONE-02%, CALCITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
MILIOLID FORAMS AND PELETAL SEDIMENTS, 20% MASSIVE
DOLOSTONE.

1235 - 1250 DOLOSTONE; GRAYISH ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
POOR INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE- %
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, SUCROSIC
PORES SMALLER THAN PREVIOUS INTERVAL, PUNKY, 20% MASSIVE
DOLOSTONE.

1250 - 1260 DOLOSTONE; GRAYISH BROWN
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
PELETAL SEDIMENT, AND 10% VERY PALE ORANGE MASSIVE
DOLOSTONE.

1260 - 1265 NO SAMPLES

1265 - 1270 LIMESTONE; GRAYISH ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: DOLOMITE-30%, CALCITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
2% DARK GRAY DOLOMINTE.

1270 - 1285 DOLOSTONE; GRAYISH ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, SUCROSIC

MILIOLID FORAMS.

1285 - 1300 NO SAMPLES

1300 - 1303 LIMESTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC; 95% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
ACCESSORY MINERALS: DOLOMITE- %, CALCITE-10%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA
DICTYOCONUS COOKEI, D. AMERICANUS, 20% 3 MM FLATTENED CONES WITH MINOR SADDLE AND SOMBRERO SHAPES, 10% NORMAL SHAPED CONES.

1303 - 1305 DOLOSTONE; MODERATE GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: LIMESTONE-20%, CALCITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
20% VERY PALE ORANGE LIMESTONE WITH MILIOLID FORAMS AND PELETAL SEDIMENTS.

1305 - 1345 DOLOSTONE; GRAYISH BROWN TO GRAYISH ORANGE
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %, CALCITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
20% MASSIVE DOLOSTONE, 40% MASSIVE DOLOSTONE AT 1315-1320'.

1345 - 1360 DOLOSTONE; TAN TO VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS

1360 - 1363 DOLOSTONE; VERY LIGHT ORANGE TO VERY LIGHT GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY

SUBHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
30% PALE YELLOW BROWN, 40%VERY LIGHT GRAY, 30% VERY PALE ORANGE DOLOSTONE.

1363 - 1365 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
20% MASSIVE WHITE AND PALE YELLOWISH BROWN DOLOSTONE, MINOR MM LAMINATIONS.

1365 - 1375 DOLOSTONE; GRAYISH ORANGE
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
MINOR MM ALGAE LAMINATED AND ALTERNATING WITHH DOLOSTONE
10% LIGHT GRAY DOLOSTONE.

1375 - 1380 PACKSTONE; MODERATE PINK
45% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
5% LIGHT GRAY, VASSIVE DOLOSTONE, 2 MM VUGS.

1380 - 1385 DOLOSTONE; VERY LIGHT ORANGE
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE

ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
5% MEDIUM DARK GRAY VUGGY DOLOSTONE, 10% LIGHT BROWN VUGGY DOLOSTONE.

1385 - 1390 NO SAMPLES

1390 - 1395 DOLOSTONE; LIGHT BROWNISH GRAY
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY; SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
20% PALE YELLOWISH BROWN MASSIVE DOLOSTONE, 10% PALE YELLOWISH BROWN VUGGY DOLOSTONE.

1395 - 1398 DOLOSTONE; LIGHT GRAY
25% POROSITY: INTERGRANULAR, LOW PERMEABILITY; SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
30% VERY PALE ORANGE MASSIVE DOLOSTONE.

1398 - 1415 DOLOSTONE; GRAYISH BROWN
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
15% MEDIUM LIGHT GRAY FROM 1398-1400' AND 30% FROM 1400-1405' MASSIVE DOLOSTONE.

1415 - 1420 DOLOSTONE; GRAYISH BROWN
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE, LAMINATED
ACCESSORY MINERALS: SPAR- %

OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
15% VUGGY DOLOSTONE, MINOR MM LAMINATIONS OF ALGAE ALTERNATING WITH DOLOSTONE.

1420 - 1430 DOLOSTONE; GRAYISH BROWN TO DARK YELLOWISH ORANGE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
40% DARK YELLOWISH-ORANGE,VUGGY DOLOSTONE AND MEDIUM LIGHT GRAY MASSIVE DOLOSTONE.

1430 - 1432 DOLOSTONE; DARK YELLOWISH ORANGE
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS

1432 - 1435 DOLOSTONE; LIGHT GRAYISH BROWN
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE, LAMINATED
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
MINOR MM LAMINATIONS OF ALTERNATING ALGAE AND DOLOSTONE
5% MEDIUM LIGHT GRAY DOLOSTONE, 20% VUGS.

1435 - 1440 DOLOSTONE; GRAYISH ORANGE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
20% DARK YELLOWISH ORANGE VUGGY DOLOSTONE, 30% WHITE

MASSIVE DOLOSTONE AND 50% GRAYISH ORANGE MASSIVE DOLOSTONE.

1440 - 1445 DOLOSTONE; MODERATE YELLOWISH BROWN
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
35% PALE YELLOWISH BROWN MASSIVE DOLOSTONE AND 65% MODERATE YELLOWISH BROWN BUGGY DOLOSTONE, AND MINOR WHITE MASSIVE DOLOSTONE.

1445 - 1450 DOLOSTONE; GRAYISH BROWN
30% POROSITY: INTERGRANULAR, LOW PERMEABILITY; SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE, MOTTLED
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
10% VERY PALE ORANGE,MASSIVE DOLOSTONE.

1450 - 1455 DOLOSTONE; VERY LIGHT ORANGE
35% POROSITY: INTERGRANULAR, FRACTURE
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
30% GRAYISH ORANGE SLIGHTLY VUGGY AND MASSIVE DOLOSTONE.

1455 - 1460 DOLOSTONE; GRAYISH BROWN
30% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MASSIVE
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: NO FOSSILS
50% PALE YELLOWISH BROWN MASSIVE DOLOSTONE, 10% VERY PALE ORANGE MASSIVE DOLOSTONE, AND 40% GRAYISH ORANGE VUGGY DOLOSTONE.

1460 - 1465 DOLOSTONE; MODERATE LIGHT GRAY
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
20% PALE YELLOWISH BROWN, VUGGY DOLOSTONE.

1465 - 1470 DOLOSTONE; MODERATE YELLOWISH BROWN TO DARK YELLOWISH ORANGE
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %, SILT-SIZE DOLOMITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, ECHINOID
10% MOTTLED DOLOSTONE, 20% MASSIVE DOLOSTONE.

1470 - 1485 DOLOSTONE; GRAYISH ORANGE
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION, SUCROSIC
FOSSILS: FOSSIL MOLDS, ECHINOID
20% MASSIVE DOLOSTONE.

1485 - 1500 DOLOSTONE; GRAYISH BROWN
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %, SILT-SIZE DOLOMITE-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION, SUCROSIC
FOSSILS: FOSSIL MOLDS
10% LIGHT GRAY DOLOSTONE, 10% SUCROSIC DOLOSILTSTONE.

1500 - 1505 DOLOSTONE; MODERATE YELLOWISH BROWN
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION

CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %, SILT-SIZE DOLOMITE-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
10% VERY LIGHT GRAY MASSIVE DOLOSTONE.

1505 - 1508 DOLOSTONE; MODERATE LIGHT GRAY TO LIGHT BROWNISH GRAY
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
20% PALE YELLOWISH BROWN DOLOSTONE, AND 20% LIGHT GRAY MASSIVE DOLOSTONE.

1508 - 1510 DOLOSTONE; GRAYISH BROWN TO GRAYISH ORANGE
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %, SILT-SIZE DOLOMITE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
SIMILAR TO 1500-1505', 20% MASSIVE DOLOSTONE, 5% VERY LIGHT GRAY DOLOSTONE.

1510 - 1515 DOLOSTONE; LIGHT GRAY
35% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
20% PALE YELLOWISH BROWN DOLOSTONE AND 20% MASSIVE DOLOSTONE.

1515 - 1520 DOLOSTONE; DARK YELLOWISH ORANGE
30% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %, SILT-SIZE DOLOMITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
30% LIGHT GRAY MASSIVE DOLOSTONE, AND 70% DARK YELLOWISH

ORANGE VUGGY DOLOSTONE.

1520 - 1525 DOLOSTONE; GRAYISH BROWN
25% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SPAR- %
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
10% 3 PHI, MODERATE YELLOWISH BROWN DOLOSTONE, 10% DARK YELLOWISH ORANGE VUGGY DOLOSTONE.

1525 - 1535 DOLOSTONE; GRAYISH BROWN
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: LAMINATED
ACCESSORY MINERALS: SPAR- %, SILT-SIZE DOLOMITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
20% LIGHT GRAY, MOTTLED, MASSIVE DOLOSTONE, 10% WHITE DOLOSTONE, MM LAMINATIONS IN ONE CHIP.

1535 - 1540 DOLOSTONE; MODERATE YELLOWISH BROWN
40% POROSITY: INTERGRANULAR, VUGULAR
POSSIBLY HIGH PERMEABILITY; SUBHEDRAL
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: MOTTLED
ACCESSORY MINERALS: SPAR- %, SILT-SIZE DOLOMITE- %
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
5% VERY LIGHT GRAY MASSIVE DOLOSTONE, 20% MASSIVE DOLOSTONE OVERALL, AND 80% PALE TO MODERATE YELLOWISH BROWN VUGGY DOLOSTONE.

1540 TOTAL DEPTH

APPENDIX B:
WATER CHEMISTRY

Station	Date	HCO_3	SO_4	Cl	Mg	Ca	K	Na	SC (μS/cm)	pH	Temp. (°C)
SLF-74	2/9/2005	159.72	240	2,100	159	217	19.1	922	7,266	7.34	30.48
	4/18/2005	158.50	210	2,100	157	219	18.4	916	7,263	7.31	30.66
	6/21/2005	170.69	220	2,300	170	230	20.6	979	7,016	7.19	30.5
	10/10/2005	170.69	220	2,000	155	210	19.4	932	6,969	7.34	30.44
	3/17/2006	170.69	220	2,400	162	220	19.6	938	7,080	7.24	30.1
	6/2/2006	170.69	220	2,200	160	220	22	1000	7,213	7.33	30.47
	11/29/2006	170.69	220	2,200	170	230	22	930	7,064	7.4	29.8
	6/20/2007	170.69	200	2,100	150	210	21	920	7,173	7.4	30.5
	9/21/2007	158.50	209	2,126	181	244.5	22.8	1024	7,565	7.4	30.8
	6/10/2008	153.62	222	2,209	168	229.5	20.5	932.1	7,229	7.4	30.7
	5/19/2010	163.37	194	1,976	168	230.2	20.6	931.3	7,138	7.2	30.5
	3/29/2011	159.72	206	2,137	169	233.6	20.1	946.6	7,344	7.2	30.3
	3/30/2015	158.50	211	2,167	167	249	20.6	912.1	7,193	7.3	30.3
	9/14/2016	151.18	236	2,122	162	238	19.8	881.9	7,043	6.9	30.8
	1/16/2020	162.16	216	2,058	160	219.3	20	895	6,876	7.1	30.6
SLF-75	6/16/2004	171.91	173	910	83.2	112	14.9	473	3,600	7.35	27.2
	10/5/2004	168.25	168	885	82.2	114	15	458	3,727	7.24	27.8
	2/9/2005	180.44	190	960	76.8	107	13.5	442	3,646	7.4	27.62
	4/18/2005	170.69	190	940	81.1	115	14.7	462	3,726	7.44	28.2
	6/21/2005	170.69	200	980	79.1	110	14.3	461	3,584	7.32	27.59
	10/10/2005	182.88	180	930	78.5	109	14.4	460	3,523	7.34	27.57
	3/17/2006	182.88	190	1,000	77.5	109	13.6	445	3,605	7.34	27.23
	6/2/2006	182.88	200	980	77	110	15	450	3,684	7.27	27.98
	10/3/2006	182.88	210	1,100	79	120	15	470	3,619	7.33	27.59
	11/29/2006	170.69	190	900	83	120	15	450	3,644	7.6	27.5
	3/16/2007	170.69	200	1,000	73	100	14	450	3,648	7.4	27.4
	6/20/2007	170.69	180	860	72	96	16	450	3,506	7.5	29.2
	9/21/2007	170.69	170	936	85.8	119.3	16.2	488.5	3,793	7.7	30.4
	6/10/2008	170.69	210	918	76.6	99.5	16.8	465.9	3,549	7.6	29.2
	9/23/2008	180.44	208	950	78.4	101.1	16.5	466.4	3,529	7.5	28.4
	5/12/2009	178.01	176	911	84.4	115.7	15.3	469.9	3,669	7.6	27.5
	5/19/2010	174.35	176	922	80.4	110.5	14.4	455.4	3,605	7.2	27.8
	3/29/2011	170.69	184	978	82.7	114.9	14.6	469.2	3,570	7.3	27.7
	11/8/2016	163.37	157	851	81.4	121.4	15	461.3	3,620	7.25	27.6
	1/16/2020	173.13	190	958	82.6	112.1	14.9	471.2	3,546	7.2	27.9
SLF-76	6/16/2004	162.16	170	1,270	112	154	15.9	596	4,812	7.13	29.4
	10/5/2004	148.74	172	1,280	112	158	15.9	584	4,793	7.15	29.4
	2/9/2005	164.59	180	1,300	103	145	14.3	567	4,682	7.36	29.17
	10/10/2005	158.50	180	1,300	107	149	15.2	610	4,505	7.38	29.24
	3/17/2006	182.88	190	1,400	107	154	14.5	580	4,624	7.25	28.84
	6/2/2006	170.69	190	1,400	100	150	15	590	4,804	7.34	29.72
	10/3/2006	170.69	200	1,400	110	160	16	580	4,697	7.25	28.38
	11/29/2006	170.69	180	1,300	120	160	17	640	4,726	7.4	29.1
	3/16/2007	170.69	190	1,400	110	140	16	610	4,711	7.3	27.5
	6/20/2007	158.50	170	1,300	110	150	16	590	4,729	7.4	29.5
	9/21/2007	164.59	158	1,268	119	168.4	17	621.8	4,897	7.6	30
	6/10/2008	167.03	168	1,262	114	157.7	15.8	591	4,783	7.4	29.5

Station	Date	HCO_3	SO_4	Cl	Mg	Ca	K	Na	SC (µS/cm)	pH	Temp. (°C)
SLF-76	9/23/2008	170.69	156	1,172	114	156.8	16.1	590.4	4,751	7.4	29
	5/12/2009	170.69	165	1,224	116	159.6	16	604.6	4,745	7.5	24.9
	5/19/2010	167.03	174	1,304	109	153.3	14.9	565.2	4,526	7.2	29.6
	3/29/2011	163.37	175	1,313	112	160.5	15.2	585.8	4,625	7.2	24.4
	11/9/2016	158.50	163	1,272	112	165.1	15.6	591.9	4,750	7.02	29.42
	1/16/2020	164.59	190	1,424	121	170.1	16.7	643.8	4,959	7.1	29.7

°C = degrees Celsius; µS/cm = microsiemens per centimeter; Ca = calcium; Cl = chloride; HCO_3 = bicarbonate; K = potassium; Mg = magnesium; Na = sodium; SC = specific conductance; SO_4 = sulfate.
Note: All values presented in milligrams per liter unless noted otherwise. pH is unitless.

APPENDIX C:
DENSITY CORRECTION CALCULATIONS

Calculating density corrected conversion factor (psi to ft H_2O):

1. Convert from density (kg/m^3) to specific weight (N/m^3) (density × acceleration due to gravity)
    a. Density × 9.8 m/s^2
    b. Example: 1,000 kg/m^3 × 9.8 m/s^2 = 9,800 N/m^3
2. Convert metric specific weight to English specific weight
    a. Conversion factor metric × (1/157.1) = specific weight in lb/ft^3
    b. 9,800 N/m^3 × (1/157.1) = 62.38 lb/ft^3
3. Calculate psi to ft H_2O conversion factor
    a. 144 (in.^{2}/ft^2) ÷ specific weight = conversion factor
    b. 144 ÷ 62.38 = 2.308
    c. psi × conversion factor = ft H_2O

SLF-74

Specific conductance = 6,739 µmhos/cm

Temperature = 29.4 °C

Sigma = -1.658

1,000 kg/m^3 – 1.658 = 998.342 kg/m^3

998.342 kg/m^3 × 9.8 m/s^2 = 9,783.7516 N/m^3

9783.7516 N/m^3 × (1/157.1) = 62.2772 lb/ft^3

144 ÷ 62.2772 = 2.3122

psi × 2.3122 = ft H_2O

SLF-75

Specific conductance = 3,717 µmhos/cm

Temperature = 28.0 °C

Sigma = -2.385

1,000 kg/m^3 – 2.385 = 997.615 kg/m^3

997.615 kg/m^3 × 9.8 m/s^2 = 9,776.627 N/m^3

9,776.627 N/m^3 × (1/157.1) = 62.2318 lb/ft^3

144 ÷ 62.2318 = 2.3139

psi × 2.3139 = ft H_2O

SLF-76

Specific conductance = 4,530 µmhos/cm

Temperature = 28.7 °C

Sigma = -2.292

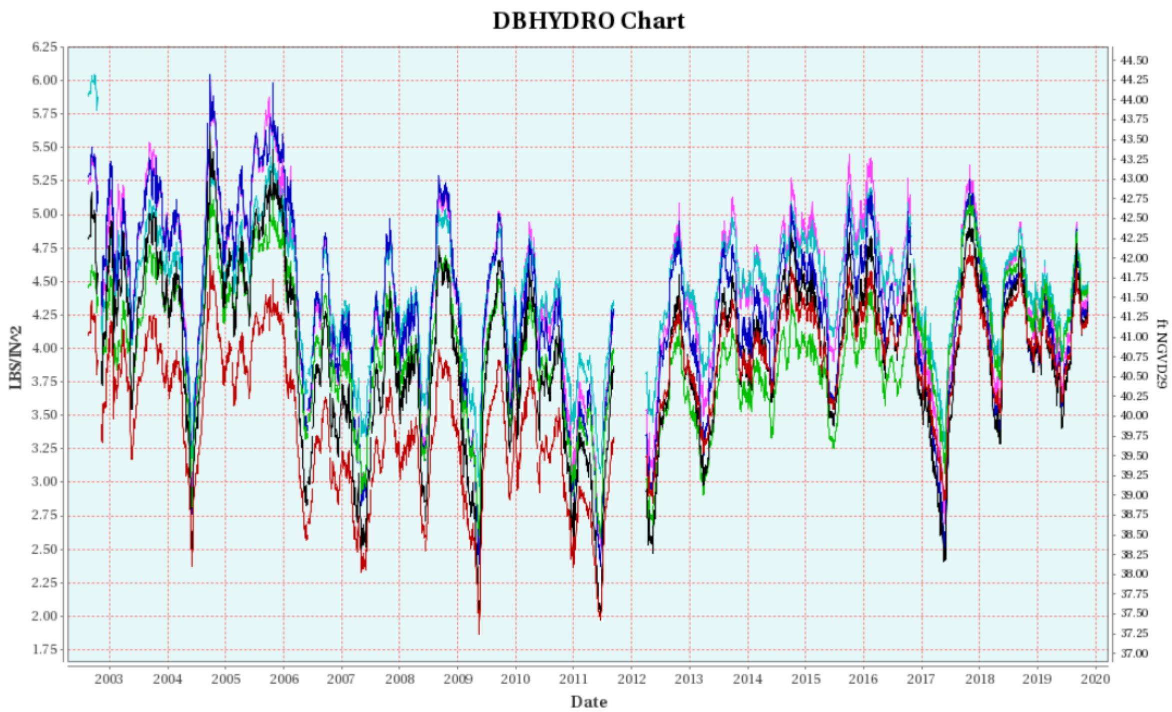
1,000 kg/m^3 – 2.292 = 997.708 kg/m^3

997.708 kg/m^3 × 9.8 m/s^2 = 9,777.5384 N/m^3

9,777.5384 N/m^3 × (1/157.1) = 62.2377 lb/ft^3

144 ÷ 62.2377 = 2.3137

psi × 2.3137 = ft H_2O



Provisional data, if present, are indicated by square symbol.

DBKey	Station	Agency	Data Type	Unit	Statistic	Frequency	Strata	Gate/Pump#
87483	SLF-74	WMD	PSI	LBS/IN^2	MEAN	DA	1450	N/A
OH809	SLF-74	WMD	UNHD	ft NGVD29	MEAN	DA	1450	N/A
87485	SLF-75	WMD	PSI	LBS/IN^2	MEAN	DA	700	N/A
OH808	SLF-75	WMD	UNHD	ft NGVD29	MEAN	DA	700	N/A
87487	SLF-76	WMD	PSI	LBS/IN^2	MEAN	DA	860	N/A
OH807	SLF-76	WMD	UNHD	ft NGVD29	MEAN	DA	860	N/A

APPENDIX D:
SPECIFIC PURPOSE SURVEY C-24FAS GW WELL CLUSTER REFERENCE ELEVATION

SPECIFIC PURPOSE SURVEY
C-24FAS GW WELL CLUSTER
REFERENCE ELEVATION

December 2016

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
SURVEY SECTION

3301 Gun Club Road West Palm Beach, Florida 33406

Phone: 561.686.8800 Fax: 561.682.0066

TABLE OF CONTENTS

Surveyor’s Report

Report Date: 12/29/16

Submittal: Final

Prepared for: Hydrogeology

South Florida Water Management District

South Florida Water Management District
SURVEY SECTION
3301 Gun Club Road West Palm Beach, Florida 33406
Phone; 561.686.8800 Fax: 561.682.0066

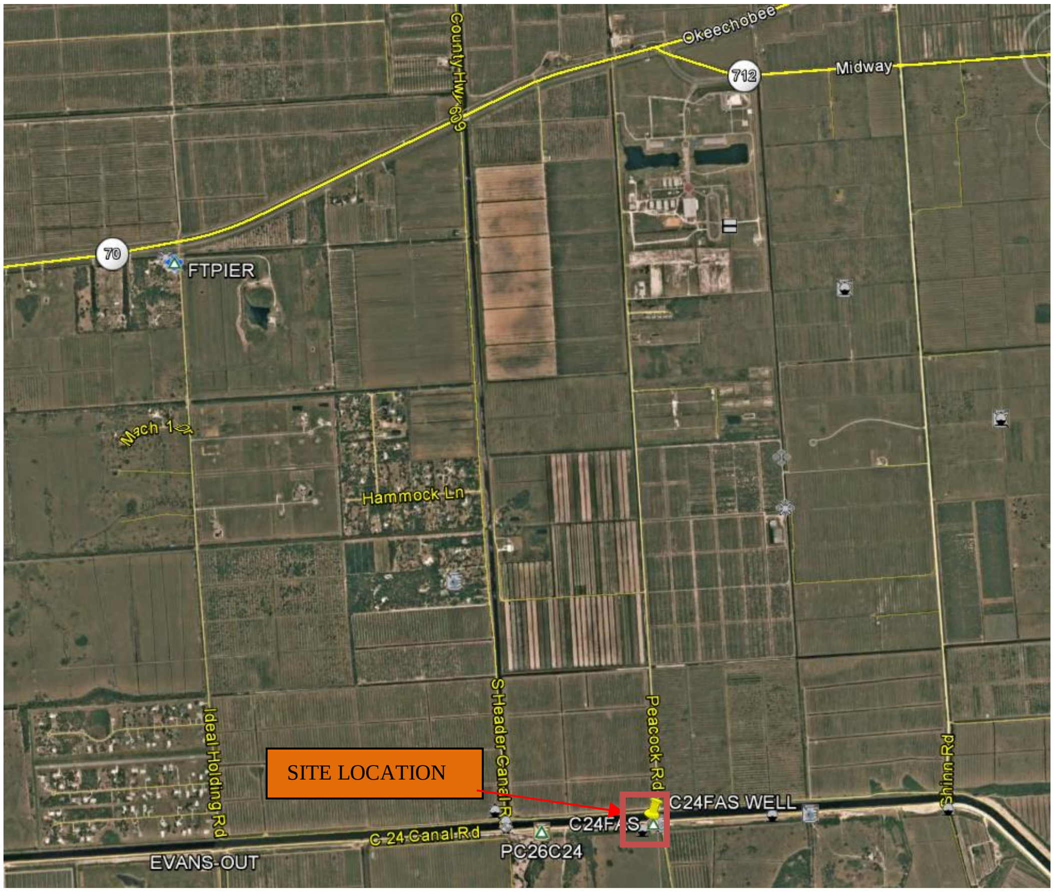
OVERVIEW OF THE PROJECT

PURPOSE

The purpose of this Survey is to establish Reference Elevation for Groundwater wells monitored by the USGS and South Florida Water Management District (SFWMD). Third order elevations referring to both the North American Vertical Datum of 1988 (NAVD88) and the National Geodetic Vertical Datum of 1929 (NGVD29). NGVD 29 elevation shall be based on offset from NAVD 88 using USACE Corpscon 6.0.1.

Location of Project

The project is located in St. Lucie County, Florida. Following is a map of Location.



General Location (Not to Scale)

VERTICAL DATUM FOR THE PROJECT

The vertical datum for the project is the North American Vertical Datum of 1988. For correlation with older data sets, the elevations of the benchmarks are also shown in the National Geodetic Vertical Datum (NGVD) of 1929. The NGVD 29 elevations were derived using data from published NGS superseded values when applicable, otherwise values provided by the South Florida Water Management District in a file named "NGVD29.txt" were used. The linear unit for all elevations is the U.S. survey feet unless otherwise stated.

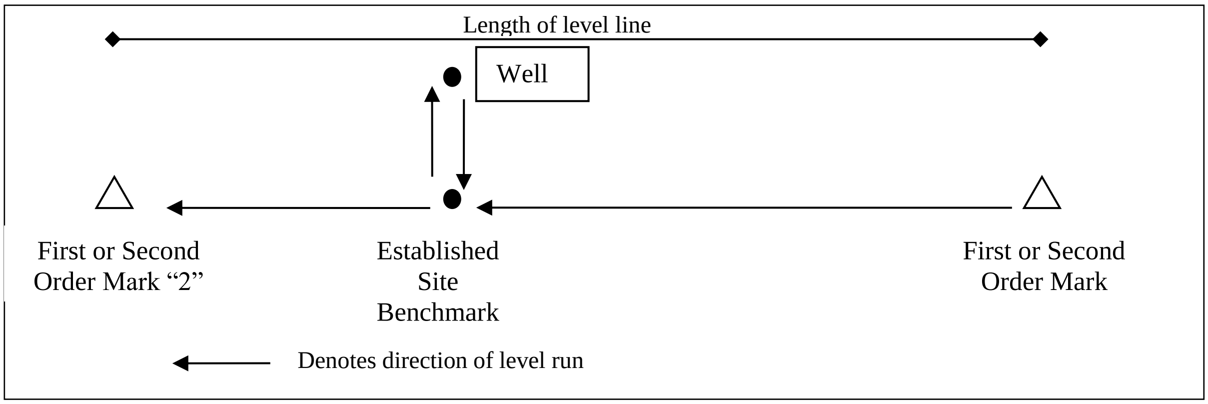
LEVELING METHODS

CONFIGURATION OF LEVEL RUNS

The leveling for the project was performed in accordance with the Federal Geodetic Control Subcommittee standard for Second-Order, Class II geodetic leveling. A brief description of the procedures used is as follows. The run was started at one of the First or Second Order marks and continued through the Site Benchmark (Found or Established) at the well and closed on the original or additional First or Second Order NGS vertical mark. (See Figure 1. below).

For each well site, a closed loop was run from an established Third Order vertical mark (Site Benchmark).

Figure 1 Typical Level Run Pattern



The FGCS maximum allowable misclosure for this type of run is 0.03' multiplied by the square root of the length of the line in miles.

EQUIPMENT USED

All leveling was performed with a Topcon Digital Level.

BENCHMARKS USED

INTRODUCTION

The following instrument was used for GPS observations:

(1) Garmin GPS Map 78.

Description	X, (Easting) 83/86 Coordinates	Y, (Northing) 83/86 Coordinates	Latitude	Longitude
BM HAWK	827090.730	1092521.449	27 20 18	80 28 24.6
BM S-544	818217.449	1092383.991	27 20 17	80 30 03.0
BM C-24FAS	821748.20	1092269.39	27 20 15.72	80 29 23.85

CONTROL BENCHMARKS

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.11
1        National Geodetic Survey,   Retrieval Date = DECEMBER 21, 2016
 AJ8590 ***********************************************************************
 AJ8590  DESIGNATION -  HAWK
 AJ8590  PID         -  AJ8590
 AJ8590  STATE/COUNTY-  FL/ST LUCIE
 AJ8590  COUNTRY     -  US
 AJ8590  USGS QUAD   -  FORT PIERCE SW (1953)
 AJ8590
 AJ8590                       *CURRENT SURVEY CONTROL
 AJ8590  ______________________________________________________________________
 AJ8590* NAD 83(1986) POSITION- 27 20 18.     (N) 080 28 25.     (W)   SCALED
 AJ8590* NAVD 88 ORTHO HEIGHT -     8.695 (meters)       28.53  (feet) ADJUSTED
 AJ8590  ______________________________________________________________________
 AJ8590  GEOID HEIGHT    -        -27.209 (meters)                     GEOID12B
 AJ8590  DYNAMIC HEIGHT  -          8.681 (meters)       28.48  (feet) COMP
 AJ8590  MODELED GRAVITY -    979,126.4   (mgal)                       NAVD 88
 AJ8590
 AJ8590  VERT ORDER      -  FIRST     CLASS II
 AJ8590
 AJ8590.The horizontal coordinates were scaled from a topographic map and have
 AJ8590.an estimated accuracy of +/- 6 seconds.
 AJ8590.
 AJ8590.The orthometric height was determined by differential leveling and
 AJ8590.adjusted by the NATIONAL GEODETIC SURVEY
 AJ8590.in August 2009.
 AJ8590
 AJ8590.Significant digits in the geoid height do not necessarily reflect accuracy.
 AJ8590.GEOID12B height accuracy estimate available here.
 AJ8590
 AJ8590.The dynamic height is computed by dividing the NAVD 88
 AJ8590.geopotential number by the normal gravity value computed on the
 AJ8590.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 AJ8590.degrees latitude (g = 980.6199 gals.).
 AJ8590
 AJ8590.The modeled gravity was interpolated from observed gravity values.
 AJ8590
 AJ8590;                    North         East     Units  Estimated Accuracy
 AJ8590;SPC FL E     -   333,000.      252,090.      MT  (+/- 180 meters Scaled)
 AJ8590
 AJ8590_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNL520240(NAD 83)
 AJ8590
 AJ8590                        SUPERSEDED SURVEY CONTROL
 AJ8590
 AJ8590  NAVD 88 (05/02/02)    8.701  (m)           28.55   (f) SUPERSEDED  1 2
 AJ8590
 AJ8590.Superseded values are not recommended for survey control.
 AJ8590
```

```
AJ8590.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AJ8590.See file dsdata.txt to determine how the superseded data were derived.
AJ8590
AJ8590_MARKER: DD = SURVEY DISK
AJ8590_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AJ8590_STAMPING: HAWK 2001
AJ8590_MARK LOGO: FL-111
AJ8590_PROJECTION: RECESSED 5 CENTIMETERS
AJ8590_MAGNETIC: O = OTHER; SEE DESCRIPTION
AJ8590_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AJ8590+STABILITY: SURFACE MOTION
AJ8590_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AJ8590+SATELLITE: SATELLITE OBSERVATIONS - August 17, 2006
AJ8590
AJ8590  HISTORY     - Date     Condition        Report By
AJ8590  HISTORY     - 2001     MONUMENTED       FL-111
AJ8590  HISTORY     - 20010923 GOOD             FOST
AJ8590  HISTORY     - 20050812 GOOD             GCYI
AJ8590  HISTORY     - 20060817 GOOD             FLDEP
AJ8590  HISTORY     - 20100204 GOOD             CREEI
AJ8590
AJ8590                          STATION DESCRIPTION
AJ8590
AJ8590'DESCRIBED BY CHARLEY FOSTER AND ASSOCIATES 2001 (JB)
AJ8590'THE MONUMENT IS LOCATED 22.9 MILES (36.80 KM) NORTHEAST OF OKEECHOBEE,
AJ8590'FL. AND 11.5 MILES (18.50 KM)
AJ8590'SOUTHWEST OF FT. PIERCE, SECTION 19, TOWNSHIP 36 SOUTH, RANGE 39 EAST.
AJ8590'OWNERSHIP IS SOUTH FLORIDA WATER MANAGEMENT DISTRICT.
AJ8590'
AJ8590'TO REACH THE MONUMENT FROM THE INTERSECTION OF STATE ROAD 70 AND
AJ8590'COUNTY ROAD 609A (SHINN
AJ8590'ROAD), 10.5 MILES (16.96 KM) WEST OF THE JUNCTION OF U.S. HIGHWAY 1
AJ8590'AND STATE ROAD 70 IN FT. PIERCE FL.,
AJ8590'GO SOUTH ON COUNTY ROAD 609A FOR 0.4 MILES (0.64 KM) TO THE
AJ8590'INTERSECTION OF SHINN ROAD AND COUNTY
AJ8590'ROAD 712 (MIDWAY ROAD), GO SOUTH (STRAIGHT) 2.5 MILES (4.02 KM) ON
AJ8590'SCHINN ROAD TO THE MONUMENT
AJ8590'LOCATION, ON THE NORTHWEST CORNER OF BRIDGE NO. 940018 (THE NORTH SIDE
AJ8590'OF RIM DITCH). THE
AJ8590'MONUMENT IS 0.05 MILES (0.08 KM) NORTH OF THE JUNCTION OF SCHINN ROAD
AJ8590'AND C-24 CANAL ROAD
AJ8590'(JUNCTION ON THE SOUTH SIDE OF RIM DITCH).
AJ8590'
AJ8590'THE MONUMENT IS 13.5 FEET (4.11 M) WEST OF THE CENTER OF BEND IN
AJ8590'GUARDRAIL, 3.5 FEET (1.07 M)
AJ8590'SOUTHEAST OF THE END OF GUARDRAIL, 9.0 FEET (2.74 M) NORTH OF THE WEST
AJ8590'POST OF A SIGN READING C-24
AJ8590'RIM DITCH SFLWMD PROTECTING OUR WATER RESOURCES, 15.5 FEET (4.72 M)
AJ8590'SOUTH OF THE CENTER OF A
AJ8590'DIRT ROAD RUNNING PARALLEL TO RIM DITCH, 27.5 FEET (8.38 M) WEST OF
AJ8590'THE CENTER OF SCHINN ROAD AND
AJ8590'3.0 FEET (0.91 M) NORTH OF A CARSONITE WITNESS POST. NOTE A MAGNET WAS
AJ8590'BURIED NEARBY AT AN
AJ8590'UNSPECIFIED POSITION.
AJ8590'
AJ8590
AJ8590                          STATION RECOVERY (2005)
AJ8590
AJ8590'RECOVERY NOTE BY G.C.Y., INCORPORATED 2005 (JES)
```

```
AJ8590'RECOVERED AS DESCRIBED.
AJ8590
AJ8590                          STATION RECOVERY (2006)
AJ8590
AJ8590'RECOVERY NOTE BY FL DEPT OF ENV PRO 2006 (BPJ)
AJ8590'RECOVERED AS DESCRIBED.
AJ8590
AJ8590                          STATION RECOVERY (2010)
AJ8590
AJ8590'RECOVERY NOTE BY CREECH ENGINEERS INC 2010
AJ8590'RECOVERED IN GOOD CONDITION.
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The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

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PROGRAM = datasheet95, VERSION = 8.11
1        National Geodetic Survey,   Retrieval Date = DECEMBER 21, 2016
 AJ8588 ***********************************************************************
 AJ8588  DESIGNATION -  S 544
 AJ8588  PID         -  AJ8588
 AJ8588  STATE/COUNTY-  FL/ST LUCIE
 AJ8588  COUNTRY     -  US
 AJ8588  USGS QUAD   -  NORTH OF BLUEFIELD (1970)
 AJ8588
 AJ8588                         *CURRENT SURVEY CONTROL
 AJ8588  ______________________________________________________________________
 AJ8588* NAD 83(1986) POSITION- 27 20 17.     (N) 080 30 03.     (W)   SCALED
 AJ8588* NAVD 88 ORTHO HEIGHT -     7.352 (meters)       24.12  (feet) ADJUSTED
 AJ8588  ______________________________________________________________________
 AJ8588  GEOID HEIGHT    -        -27.179 (meters)                     GEOID12B
 AJ8588  DYNAMIC HEIGHT  -          7.341 (meters)       24.08  (feet) COMP
 AJ8588  MODELED GRAVITY -    979,124.2   (mgal)                       NAVD 88
 AJ8588
 AJ8588  VERT ORDER      -  FIRST     CLASS II
 AJ8588
 AJ8588.The horizontal coordinates were scaled from a topographic map and have
 AJ8588.an estimated accuracy of +/- 6 seconds.
 AJ8588.
 AJ8588.The orthometric height was determined by differential leveling and
 AJ8588.adjusted by the NATIONAL GEODETIC SURVEY
 AJ8588.in May 2002.
 AJ8588
 AJ8588.Significant digits in the geoid height do not necessarily reflect accuracy.
 AJ8588.GEOID12B height accuracy estimate available here.
 AJ8588
 AJ8588.The dynamic height is computed by dividing the NAVD 88
 AJ8588.geopotential number by the normal gravity value computed on the
 AJ8588.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 AJ8588.degrees latitude (g = 980.6199 gals.).
 AJ8588
 AJ8588.The modeled gravity was interpolated from observed gravity values.
 AJ8588
```

```
AJ8588;                    North         East    Units  Estimated Accuracy
AJ8588;SPC FL E     -   332,960.      249,390.      MT  (+/- 180 meters Scaled)
AJ8588
AJ8588_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNL493239(NAD 83)
AJ8588
AJ8588                          SUPERSEDED SURVEY CONTROL
AJ8588
AJ8588.No superseded survey control is available for this station.
AJ8588
AJ8588_MARKER: DD = SURVEY DISK
AJ8588_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AJ8588_STAMPING: S 544 2001 CERP
AJ8588_MARK LOGO: USE
AJ8588_PROJECTION: RECESSED 8 CENTIMETERS
AJ8588_MAGNETIC: O = OTHER; SEE DESCRIPTION
AJ8588_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AJ8588+STABILITY: SURFACE MOTION
AJ8588_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AJ8588+SATELLITE: SATELLITE OBSERVATIONS - August 12, 2005
AJ8588
AJ8588  HISTORY     - Date     Condition        Report By
AJ8588  HISTORY     - 20010923 MONUMENTED       FOST
AJ8588  HISTORY     - 20050812 GOOD             GCYI
AJ8588
AJ8588                          STATION DESCRIPTION
AJ8588
AJ8588'DESCRIBED BY CHARLEY FOSTER AND ASSOCIATES 2001 (JB)
AJ8588'THE MONUMENT IS LOCATED 21.4 MILES (34.46 KM) NORTHEAST OF OKEECHOBEE,
AJ8588'FL. AND 12.9 MILES (20.83 KM)
AJ8588'SOUTHWEST OF FT. PIERCE, SECTION 14, TOWNSHIP 36 SOUTH, RANGE 38 EAST.
AJ8588'OWNERSHIP IS SOUTH FLORIDA WATER MANAGEMENT DISTRICT.
AJ8588'
AJ8588'TO REACH THE MONUMENT FROM THE INTERSECTION OF STATE ROAD 70 AND
AJ8588'COUNTY ROAD 609A (SHINN
AJ8588'ROAD), 10.5 MILES (16.96 KM) WEST OF THE JUNCTION OF U.S. HIGHWAY 1
AJ8588'AND STATE ROAD 70 IN FT. PIERCE FL.,
AJ8588'GO SOUTH ON COUNTY ROAD 609A FOR 0.4 MILES (0.64 KM) TO THE
AJ8588'INTERSECTION OF SHINN ROAD AND COUNTY
AJ8588'ROAD 712 (MIDWAY ROAD), GO SOUTH (STRAIGHT) 2.55 MILES (4.10 KM) ON
AJ8588'SCHINN ROAD TO JUNCTION OF
AJ8588'SCHINN ROAD AND C-24 CANAL ROAD, JUST SOUTH OF BRIDGE NO. 940018.
AJ8588'CONTINUE WEST ALONG C-24 CANAL
AJ8588'ROAD ON THE SOUTH SIDE OF RIM DITCH 1.65 MILES (2.66 KM) TO THE
AJ8588'MONUMENT LOCATION. THE MONUMENT IS
AJ8588'2.8 MILES (4.51 KM) EAST OF THE INTERSECTION OF CARLTON ROAD AND C-24
AJ8588'CANAL ROAD.
AJ8588'
AJ8588'THE MONUMENT IS 6.7 FEET (2.04 M) SOUTH OF THE SOUTH TOP OF BANK OF
AJ8588'RIM DITCH, 17.0 FEET (5.18 M)
AJ8588'NORTH OF THE CENTER OF C-24 CANAL ROAD, 28.5 FEET (8.69 M) NORTH OF
AJ8588'THE TOE OF THE LEVEE AND 6.7
AJ8588'FEET (2.04 M) SOUTH OF A CARSONITE WITNESS POST. NOTE A MAGNET WAS
AJ8588'BURIED NEARBY AT AN
AJ8588'UNSPECIFIED POSITION. NOTE ACCESS TO THE DATUM POINT (TOP OF A
AJ8588'STAINLESS STEEL ROD) IS HAD
AJ8588'THROUGH A 5 INCH LOGO CAP. NOTE A MAGNET WAS PLACED INSIDE THE PVC
AJ8588'PIPE.
AJ8588'
AJ8588
```

```
AJ8588                          STATION RECOVERY (2005)
AJ8588
AJ8588'RECOVERY NOTE BY G.C.Y., INCORPORATED 2005 (JES)
AJ8588'RECOVERED AS DESCRIBED.
```

COUNTY **ST LUCIE**	**PROJECT MISC**	**DESIGNATION C24FAS**
SECTION 24	**TOWNSHIP 36 SOUTH**	**RANGE 38 EAST**
NAME OF QUADRANGLE FORT PIERCE SW (1953)		
Established by SFWMD STRICKLAND (*Surveyor / Firm Name*) *or*	**Recovered by** ____________ *(Surveyor / Firm Name)*	
DATE 11/9/2016 *(Established or Recovered)*	**FIELD BOOK** **MISC 7B** **PAGE** 12 AND 13	
HORIZONTAL DATUM: **1927** ***1983*** **ADJ** _____ **Other**___ (circle one) ZONE **E** or **W**		
STATE PLANE COORDINATES	**N** ***1092269.39*** **FT**	**E 821748.20 FT**
LATITUDE: **N 27 20 15.72**	**LONGITUDE:** **W 80 29 23.85**	
VERTICAL DATUM: MSL **1929** ***1988*** **Other** __________ (circle one)		**EL. 26.611 ft**
VERTICAL DATUM: MSL ***1929*** **1988** **Other** __________ (circle one)		**EL. ft**
CONTROL ACCURACY: **HORIZONTAL** **1 2 3** ***SUB-METER*** (circle one) **VERTICAL 1 2 3**		
DESCRIPTION		

To Reach:

FROM THE INTERSECTION OF STATE ROAD 70 AND SHINN ROAD IN FT. PIERCE. PROCEED SOUTH ON SHINN ROAD (CR 609A) 0.40 MILE TO MIDWAY ROAD. CONTINUE SOUTH ON SHINN ROAD (DIRT ROAD AT THIS POINT) 2.55 MILES CROSSING OVER THE C 24 CANAL TO THE SOUTH BANK OF CANAL AND C 24 CANAL ROAD. TURN RIGHT AND PROCEED 1.0 MILE ALONG C 24 CANAL ROAD (DIRT) TO STATION LOCATION ON THE LEFT.

THE STATION IS LOCATED 58 FEET SOUTH OF THE CENTERLINE OF THE C 24 CANAL ROAD AND 75 WEST OF THE WEST EDGE OF CONCRETE PAD FOR SLF 75 WELL THE SW MOST WELL (ONE OF THREE WELLS AT THIS LOCATION).

THE STATION IS A FOUND 4” X 4” CONCRETE MONUMENT WITH A SFWMD ALUMINUM CAP STAMPED ” S R/W C-24 LB 6969 BM C24FAS” 0.15 FEET BELOW GROUND.

NOTE: THE COORDINATES ARE FROM C24 GATES.PDF

NGS Benchmarks Used:

Notable Land marks: C24 FAS WELL SITE AKA SLF 74, 75, 76 AND C 24 PC 25

SKETCH

PROJECT RESULTS

The following tables list the elevations established for each existing or new mark, the level run misclosure, "to-reach" description for each mark and a photo of the mark. All elevations and coordinates are in US Survey Feet.

SURVEYOR'S REPORT
VERTICAL CONTROL
WELL SLF-74

BM HAWK (AJ8590)	Elevation:	**28.53ft**	(NAVD 88)	29.99 ft	(NGVD 29)
BM S-544 (AJ8588)	Elevation:	**24.12ft**	(NAVD 88)	25.58ft	(NGVD 29)
Site BM	**C-24FAS**	**26.61 ft**	(NAVD 88)	**28.07ft**	(NGVD 29)
Reference Elevation Top of Well Pad Elevation Ground Elevation		29.93ft 27.42ft 26.8ft	(NAVD 88) (NAVD 88) (NAVD 88)	31.39ft 28.88ft 28.3ft	(NGVD 29) (NGVD 29) (NGVD 29)
Length of Run:	.01 mi	**To Reach WELL C-24FAS:**			
Max Allowable Misclosure:	0.00 ft				
Actual Misclosure:	0.00 ft				

TO REACH the Mark and Site from SR70 and SHINN RD. in FT. PIERCE. Go South on SHINN Rd. (CR609A) 0.4mls to MIDWAY Rd. Continue South on SHINN RD. (Shell Rock) for 2.55mls crossing over C-24 Canal to south bank and Shell Rock Rd. Turn Right and go 1.0ml to Station Location on Left. Located 58ft south of the centerline of the canal road and 75ft west of the west edge of the concrete pad for SLF 75 well pad. The Mark is a found 4" X 4" concrete monument with SFWMD Alum. Disk Stamped SR/W C-24 LB6969 BM C24FAS and is 0.15' below ground.

Benchmark Found at wellsite for wells SLF 74, SLF 75 and SLF 76

SURVEYOR'S REPORT
VERTICAL CONTROL
WELL SLF-75

BM HAWK (AJ8590)	Elevation:	**28.53ft**	(NAVD 88)	29.99 ft	(NGVD 29)
BM S-544 (AJ8588)	Elevation:	**24.12ft**	(NAVD 88)	25.58ft	(NGVD 29)
Site BM	**C-24FAS**	**26.61 ft**	(NAVD 88)	**28.07ft**	(NGVD 29)
Reference Elevation		29.50ft	(NAVD 88)	30.96ft	(NGVD 29)
Top of Well Pad Elevation		27.03ft	(NAVD 88)	28.49ft	(NGVD 29)
Ground Elevation		26.4ft	(NAVD 88)	27.9ft	(NGVD 29)
Length of Run:	.01 mi				
Max Allowable Misclosure:	0.00 ft				
Actual Misclosure:	0.00 ft				

To Reach WELL C-24FAS:

TO REACH the Mark and Site from SR70 and SHINN RD. in FT. PIERCE. Go South on SHINN Rd. (CR609A) 0.4mls to MIDWAY Rd. Continue South on SHINN RD. (Shell Rock) for 2.55mls crossing over C-24 Canal to south bank and Shell Rock Rd. Turn Right and go 1.0ml to Station Location on Left. Located 58ft south of the centerline of the canal road and 75ft west of the west edge of the concrete pad for SLF 75 well pad. The Mark is a found 4" X 4" concrete monument with SFWMD Alum. Disk Stamped SR/W C-24 LB6969 BM C24FAS and is 0.15' below ground.

Benchmark Found at wellsite for wells SLF 74, SLF 75 and SLF 76

SURVEYOR'S REPORT
VERTICAL CONTROL
WELL SLF-76

BM HAWK (AJ8590)	Elevation:	**28.53ft**	(NAVD 88)	29.99 ft	(NGVD 29)
BM S-544 (AJ8588)	Elevation:	**24.12ft**	(NAVD 88)	25.58ft	(NGVD 29)
Site BM	**C-24FAS**	**26.61 ft**	(NAVD 88)	**28.07ft**	(NGVD 29)
Reference Elevation Top of Well Pad Elevation Ground Elevation		29.58ft 27.18ft 26.6ft	(NAVD 88) (NAVD 88) (NAVD 88)	31.04ft 28.64ft 28.1ft	(NGVD 29) (NGVD 29) (NGVD 29)
Length of Run:	.01 mi				
Max Allowable Misclosure:	0.00 ft				
Actual Misclosure:	0.00 ft				

To Reach WELL C-24FAS:

TO REACH the Mark and Site from SR70 and SHINN RD. in FT. PIERCE. Go South on SHINN Rd. (CR609A) 0.4mls to MIDWAY Rd. Continue South on SHINN RD. (Shell Rock) for 2.55mls crossing over C-24 Canal to south bank and Shell Rock Rd. Turn Right and go 1.0ml to Station Location on Left. Located 58ft south of the centerline of the canal road and 75ft west of the west edge of the concrete pad for SLF 75 well pad. The Mark is a found 4" X 4" concrete monument with SFWMD Alum. Disk Stamped SR/W C-24 LB6969 BM C24FAS and is 0.15' below ground.

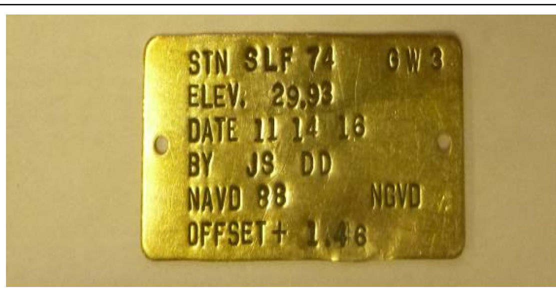
Benchmark Found at wellsite for wells SLF 74, SLF 75 and SLF 76

SURVEYOR’S REPORT
PROJECT RESULTS
WELL SLF-74

Site SLF-74 GW		**Date of Field Work** 11/9&14/16
Party Chief Strickland/Demonstranti	**Field Book Name/Number** Misc FB #7B	**Page Number(s)** Pg. 12&13
Site Benchmark Name C24FAS	**Benchmark Elevation (NAVD88)** 26.61ft	**Datum Offset to NGVD29** +1.46
Reference Elevation (NAVD 88) 29.93ft		**Existing Tag Elevation (Datum)** NA
Latitude **27° 20’ 15.9”**		**Longitude** **80° 29’ 22.8”**

Photographs

Overall Site	Benchmark Location	Benchmark Close Up
		

Brass Tag Close Up	Brass Tag + Reference Mark
	

SURVEYOR'S REPORT
PROJECT RESULTS
WELL SLF-75

Site SLF-75 GW		**Date of Field Work** 11/9&14/16
Party Chief Strickland/Demonstranti	**Field Book Name/Number** Misc FB #7B	**Page Number(s)** Pg. 12&13
Site Benchmark Name C24FAS	**Benchmark Elevation (NAVD88)** 26.61ft	**Datum Offset to NGVD29** +1.46

Reference Elevation (NAVD 88) 29.50ft	**Existing Tag Elevation (Datum)** NA
Latitude **27° 20' 15.8"**	**Longitude** **80° 29' 22.9"**

Photographs

Overall Site

Benchmark Location

Benchmark Close Up

Brass Tag Close Up

Brass Tag + Reference Mark

SURVEYOR'S REPORT
PROJECT RESULTS
WELL SLF-76

Site SLF-76 GW		**Date of Field Work** 11/9&14/16
Party Chief Strickland/Demonstranti	**Field Book Name/Number** Misc FB #7B	**Page Number(s)** Pg. 12&13
Site Benchmark Name C24FAS	**Benchmark Elevation (NAVD88)** 26.61ft	**Datum Offset to NGVD29** +1.46

Reference Elevation (NAVD 88) 29.58ft	**Existing Tag Elevation (Datum)** NA
Latitude **27° 20' 15.9"**	**Longitude** **80° 29' 22.9"**

Photographs

Overall Site	Benchmark Location	Benchmark Close Up
		

Brass Tag Close Up	Brass Tag + Reference Mark
	

SURVEYOR'S REPORT
PROJECT RESULTS
Field Notes


12 MISC FB# 78 11-9-16

SEC 29 TWP 56 RGE 38

CHECK BETWEEN FD BM'S G1 & G2

FOR C24 FAS SITE

STA / PT#

BM G1 1 25.55

C24FAS BM 2 26.611

BM G2 3 23.439 23.44

LINE 2

G2 5 23.44

CANAL C24G 1994 6 26.806

G2 7 23.443 23.44

MISC FB# 78 11-9-16

FILE NAME = C24 FAS

ECF C-24 GATES

COMMENTS

BM G1 SFWMD YELLOW PL CAP & 5/8" REBAR FD GOOD COND

BM C24 FAS IS A FD ALUMINUM CAP

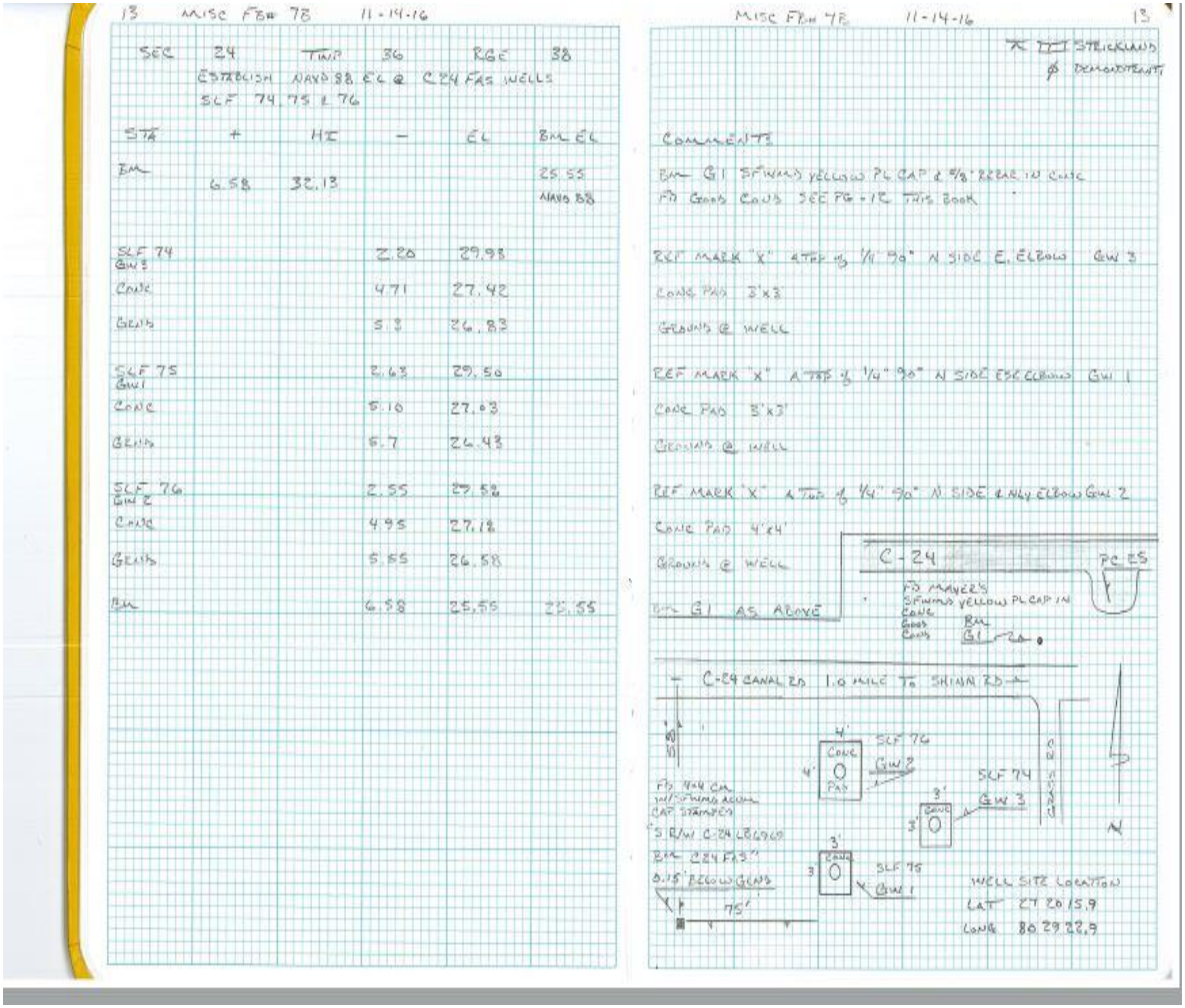
BM G2 SFWMD YELLOW PL CAP & 5/8" REBAR FD GOOD COND

BM G2 AS ABOVE

CANAL C24G 1994 FD SFWMD LARGE ALUM DISK

& PC 26

BM G2 AS ABOVE



13 MISC FB# 78 11-14-16

SEC 24 TWP 36 RGE 38
ESTABLISH NAVD 88 EL @ C24 FAS WELLS
SLF 74, 75 & 76

STA	+	HI	–	EL	BM EL
BM	6.58	32.13			25.55 NAVD 88
SLF 74 GW 3			2.20	29.93	
CONC			4.71	27.42	
GRND			5.3	26.83	
SLF 75 GW 1			2.63	29.50	
CONC			5.10	27.03	
GRND			5.7	26.43	
SLF 76 GW 2			2.55	29.58	
CONC			4.95	27.18	
GRND			5.55	26.58	
BM			6.58	25.55	25.55

MISC FB# 78 11-14-16 13

STRICKLAND
DEMONTREVILLE

COMMENTS

BM G1 SFWMD YELLOW PL CAP & 5/8" REBAR IN CONC
FD GOOD COND SEE PG 12 THIS BOOK

REF MARK "X" @ TOP of 1/4" 90° N SIDE E. ELBOW GW 3
CONC PAD 3'x3'
GROUND @ WELL

REF MARK "X" A TOP of 1/4" 90° N SIDE ESE ELBOW GW 1
CONC PAD 3'x3'
GROUND @ WELL

REF MARK "X" A TOP of 1/4" 90° N SIDE & NLY ELBOW GW 2
CONC PAD 4'x4'
GROUND @ WELL

BM G1 AS ABOVE

Abbreviation:

NAVD 88 – North American Vertical Datum of 1988
NGVD 29 – National Geodetic Vertical Datum of 1929
NAD 83/99- (Horizontal Datum) North American Datum
NGS – National Geodetic Survey.
SFWMD – South Florida Water Management District
PSM – Professional Surveyor & Mapper

SURVEYOR'S CERTIFICATION

I hereby certify that this Specific Purpose Survey was made under my responsible charge and meets applicable portions of the Standards of Practice set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 5J, Florida Administrative Code, pursuant to Section 472.027, Florida State Statutes.
This report is prepared for the sole and specific use of the South Florida Water Management District and is not assignable.

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Date of Survey	**Elvie D. Ebanks PSM**
November 14, 2016	**Professional Surveyor and Mapper**
	State of Florida
	Certificate No. 5765