Test Well Exploration of the Yorktown Aquifer beneath Roanoke Island Dare County, North Carolina

Yorktown Test Well Site at Skyco #5
N 35° 51.632', W 75° 38.930'

And

Groundwater Management Associates, Inc.

101-E Woodwinds Industrial Court
Cary, North Carolina 27511
Telephone: 919.481.2631
Fax: 919.481.3219

4300 Sapphire Court, Suite 100
Greenville, North Carolina 27834
Telephone: 252.758.3310
Fax: 252.758.8835

Test Well Exploration of the Yorktown Aquifer beneath Roanoke Island Dare County, North Carolina

Yorktown Test Well Site at Skyco #5
N 35° 51.632', W 75° 38.930'

And

Yorktown Exploratory Pilot Hole at the Skyco Water Treatment Plant
N 35° 53.146', W 75° 39.636'

Prepared for:

Mr. Ken Flatt
Utilities Director
Dare County Water
600 Mustian St.
Kill Devil Hills, NC 27948

Prepared by:

Groundwater Management Associates, Inc.
4300 Sapphire Court, Suite 100
Greenville, North Carolina 27834
Telephone 252-758-3310
Fax 252-758-8835

February 4, 2009

Table of Contents

1.0 Introduction

Groundwater Management Associates, Inc. (GMA) was tasked by Dare County Water to evaluate the yield potential and water quality of the Yorktown Aquifer beneath Roanoke Island (Figure 1). In June 2008, GMA completed a report titled "Hydrogeologic Evaluation of the Groundwater Resources of Roanoke Island". The report included a recommendation that the yield potential and water quality of the Yorktown Aquifer be explored as a possible source to supply a reverse osmosis (RO) treatment plant. This report presents the results of exploration of the Yorktown Aquifer at two sites on Roanoke Island. The two sites included the Skyco Water Treatment Plant and Skyco Well #5 (See Figure 1).

2.0 Scope of Work

GMA developed a work plan that the County used to solicit bids from North Carolina Certified Well Contractors to perform drilling and testing of the Yorktown Aquifer. GMA provided hydrogeological consulting support to the field drilling program to assist with successful evaluation of the Yorktown Aquifer. GMA's scope of work involved the following:

- GMA provided a qualified geologist on site to collect geologic data during the drilling of two pilot holes to depths up to 450 feet below land surface. We documented penetration rates, drilling characteristics, fluid loss zones, described drill cuttings, and recorded other indicators of aquifers and confining beds penetrated by the pilot hole.
- GMA reviewed geophysical logs collected by the well drilling contractor and used these logs, along with field drilling observations, to select appropriate screen placements for the construction of a single test well constructed at the Skyco #5 well site.
- We directed a 6-hour constant-rate pumping test on the test well at the Skyco #5 site. GMA deployed pressure transducers/data loggers and electronic water level meters to gather water level data during the pumping test. We also documented pumping rates and worked with the well drilling contractor to maintain a constant pumping rate for the duration of the test. Following completion of the pumping test, GMA collected one hour of recovering water level data.
- Water samples were collected at the end of the pumping test and submitted for a suite of laboratory analyses typical for a new water supply well for a RO plant.
- GMA analyzed the aquifer test data to determine aquifer properties and to establish design elements for a future production well at the Yorktown test well site.

3.0 Results

3.1 Exploratory Drilling and Test Well Construction

The County contracted Skippers Well Drilling Company to provide all Well Contractor services required for the project. On September 22, 2008, Skippers advanced a pilot hole to 450 feet depth at the Skyco Water Treatment Plant. A GMA geologist was present during the pilot hole drilling to prepare a lithologic log of the sediments penetrated (Figure 2). Upon completion of the pilot hole, Skippers ran a series of borehole geophysical logs, including: natural gamma, self potential, single point resistance, and normal resistivity. GMA interpreted the geophysical logs,

compared them with the lithologic log, and recommended screen depths for a test well. GMA interpreted the top of the Yorktown Aquifer to occur at 289 feet below land surface (bls), and the aquifer extends deeper than 450 feet below land surface at the Skyco Water Treatment Plant site. However, based upon the fine-grained nature of sediments in the Yorktown Aquifer, and the indications from the geophysical logs that high salinity occurred in the Yorktown Aquifer at the Skyco Water Treatment Plant, Dare County decided to abandon the borehole and attempt a second exploratory test hole at another property on Roanoke Island. Figure 2 presents the geophysical logs along with GMA's hydrostratigraphic interpretations of the pilot hole data from the borehole at the Skyco Water Treatment Plant site.

On October 6, 2008, Skippers advanced an exploratory borehole adjacent to the Skyco Well #5. Skyco Well #5 withdraws from the Lower Principal Aquifer, which overlies the Yorktown Aquifer. The pilot hole was advanced to 410 feet depth, and Skippers performed geophysical logging consistent with the Skyco Water Treatment Plant exploratory hole. A GMA geologist was present during the pilot hole drilling to prepare a lithologic log of the sediments penetrated (Figure 3). GMA interpreted the geophysical logs, compared them with the lithologic log, and selected the appropriate screen depths for the test well. Figure 2 presents the geophysical logs along with GMA's hydrostratigraphic interpretations of the pilot hole data. GMA interprets the top of the Yorktown Aquifer at the Skyco #5 well site to occur at 305 feet below land surface (bls), and the aquifer extends deeper than 410 feet below land surface. GMA recommended that the test well be constructed with a screened interval from 305 to 345 feet bls. Based upon the muted resistivity on the geophysical logs below 345 feet bls, GMA believes that this lower section of sediments in the Yorktown Aquifer contains pore waters with much higher salinity than the screened section.

Based upon GMA's recommendations, Skippers constructed a PVC test well. The test well was constructed with nominal 4-inch diameter PVC casing from the land surface down to 297 feet depth. Skippers then installed a 2-inch diameter stainless steel 30-slot screen placed from 285 feet to 345 feet bls. This screen section lapped up inside the 4-inch diameter outer casing. The annular spaces of the well screen sections were filled with #2 well gravel from 285 feet to 345 feet bls. Well construction details are presented in Figure 3. Upon completion of the well, Skippers developed the Yorktown test well until the turbidity was low and the water produced was free from excessive sand. Appendix I includes a copy of the well construction record.

3.2 Aquifer Testing and Analysis

Following development of the test well at the Skyco #5 well site, Skippers performed an aquifer test designed to evaluate the hydraulic properties and water quality of the zone screened at the Yorktown Aquifer test well. On October 30, 2008, the well was pumped at a constant flow rate of 91.5 gpm for 6-hours. The static water level prior to the pumping test was 12.79 feet below the top of the well casing (TOC). The pumping water level after 360 minutes of pumping at 91.5 gpm was 40.01 feet below TOC. The specific capacity of the well was 3.36 gallons per minute per foot of drawdown (gpm/ft).

GMA analyzed the drawdown and recovery data from the pumped well using the Cooper-Jacob and Theis Recovery Methods, respectively. Table 1 presents a summary of the results of the two tests. Appendix II includes details of the aquifer test data analyses.

Table 1. Summary of Aquifer Test Results from Yorktown Test Well at Skyco Well #5.

Test Date	Pumping Rate	6-hour Specific Capacity	Transmissivity (Cooper-Jacob Method)	Transmissivity (Theis Recovery Method)
10/30/08	91.5 gpm	3.36 gpm/ft	6500 ft^2/day	7100 ft^2/day

Aquifer test results indicate that the Yorktown Aquifer at the Skyco #5 well site has significant yield potential.

3.3 Laboratory Analyses

Near the end of the 6-hour pumping test at the Skyco #5 test well, GMA collected water samples for laboratory analyses. The sample from the test well was submitted to a North Carolina certified laboratory (Environmental Chemists, Inc.) for the following analyses:

- New Well Series Inorganics,
- Volatile Organic Compounds (VOCs)
- Synthetic Organic Compounds (SOCs)
- Trihalomethane Formation Potential (THMFP)
- Haloacetic Acid Formation Potential (HAAFP)
- Radiologicals
- Dissolved Arsenic
- Total Silica
- Strontium
- Coliform Bacteria

No VOCs or SOCs were detected at the Yorktown Aquifer test well. The chloride concentration was **1512 mg/L**. In addition, the iron concentration in the well sample (**0.116 mg/L**) was below the allowable limit of **0.3 mg/L**. The reported silica content was **71.9 mg/L**, and the strontium concentration was **0.56 mg/L**. Silica and strontium are important parameters for reverse osmosis systems and should be evaluated with regard to treatment system design. No arsenic was reported in the test well sample. This is an important consideration because other areas of the Yorktown Aquifer in Dare County have presented some arsenic treatment issues. Appendix III includes the full laboratory reports.

4.0 Conclusions and Recommendations

Based upon the exploratory drilling and testing results from the Yorktown Test Well at the Skyco Well #5 site, GMA makes the following conclusions and recommendations:

- The top of the Yorktown Aquifer occurs at a depth of approximately 300 feet below land surface near Skyco. The upper portion of the Yorktown Aquifer includes interbedded, medium to coarse, shelly quartz and phosphatic sands, and white to light gray clay.
- Based upon the muted resistivity on the geophysical logs below 345 feet bls at the Skyco #5 well site, GMA believes that this lower section of sediments in the Yorktown Aquifer contains pore waters with much higher salinity than the screened section.
- GMA anticipates that a Yorktown Aquifer production well at the Skyco #5 well site could easily produce 500 gallons per minute with a pump intake placed at about 175 feet depth. Higher flow rates could be supported by utilizing more of the available drawdown.
- Yield and water-quality data from the Yorktown test well at the Skyco Well #5 site are similar to wells at the Northern RO wellfield.
- The Yorktown Aquifer has significant variability in yield potential and water quality. Indications are that the salinity in the Yorktown Aquifer beneath the Skyco Water Treatment Plant is higher than at the Skyco #5 well site, however no laboratory analyses were collected from the Skyco Water Treatment Plant site to determine the amount of variation in water quality. The variability in salinity and yield potential is consistent with conditions observed by CDM in the Northern RO wellfield. Variations in yield potential and water quality will present design challenges for a successful wellfield to supply a RO treatment system. These design challenges can be addressed through an expanded test well exploration program to verify the locations of sites with suitable yield potential and water quality prior to constructing production wells.
- GMA concludes that the Yorktown Aquifer is a viable resource for development as a source of water supply to a new RO treatment facility.
- GMA recommends that Dare County perform additional hydrogeologic exploration and engineering evaluations necessary to develop a Yorktown Aquifer wellfield and RO treatment plant at Roanoke Island. We anticipate that the RO treatment facilities could be constructed as an expansion to the existing Skyco Water Treatment Plant.

5.0 Report Certification

This report was prepared by Groundwater Management Associates, Inc., a professional corporation licensed to practice geology and engineering in North Carolina.

James K. Holley, P.G.
Senior Hydrogeologist

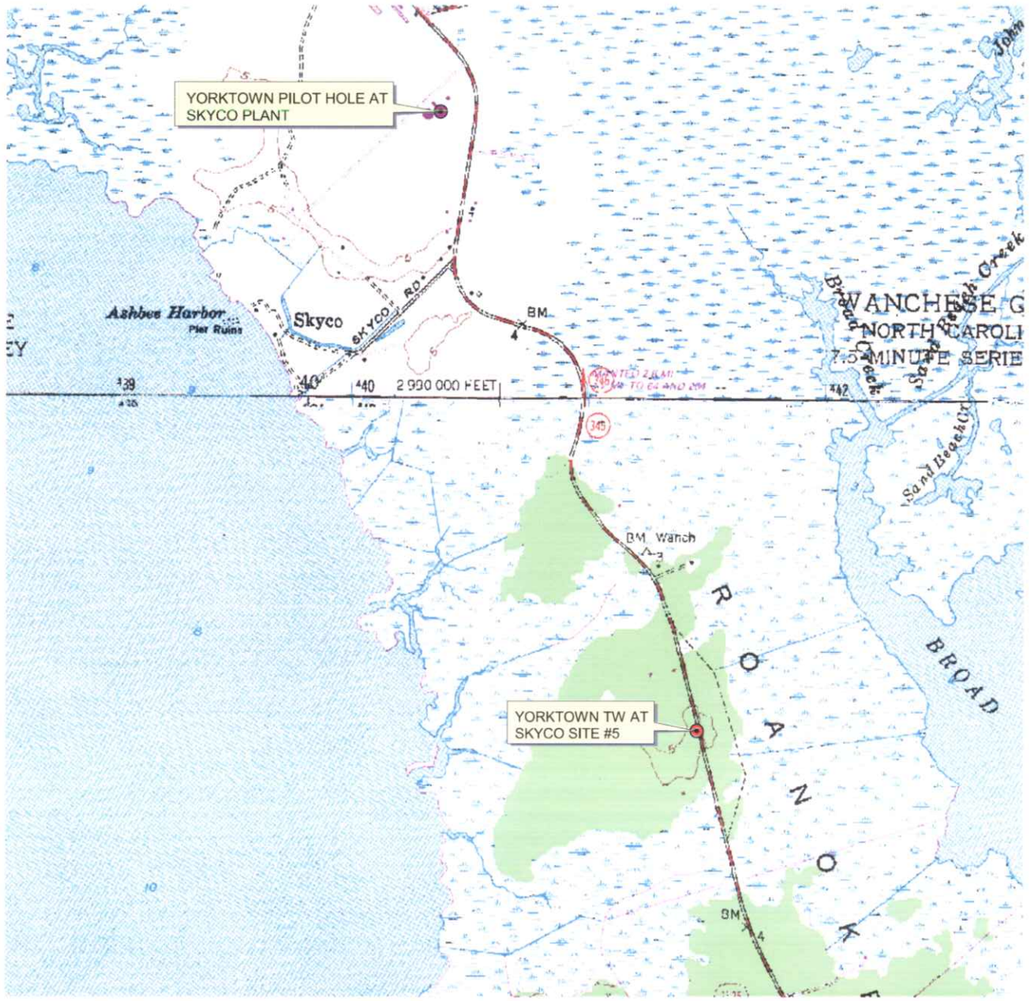
NORTH CAROLINA LICENSED SEAL 1060 GEOLOGIST JAMES K. HOLLEY

Dr. Richard K. Spruill, P.G.
Principal Hydrogeologist

Kelley A. Smith
Hydrogeologist

FIGURES

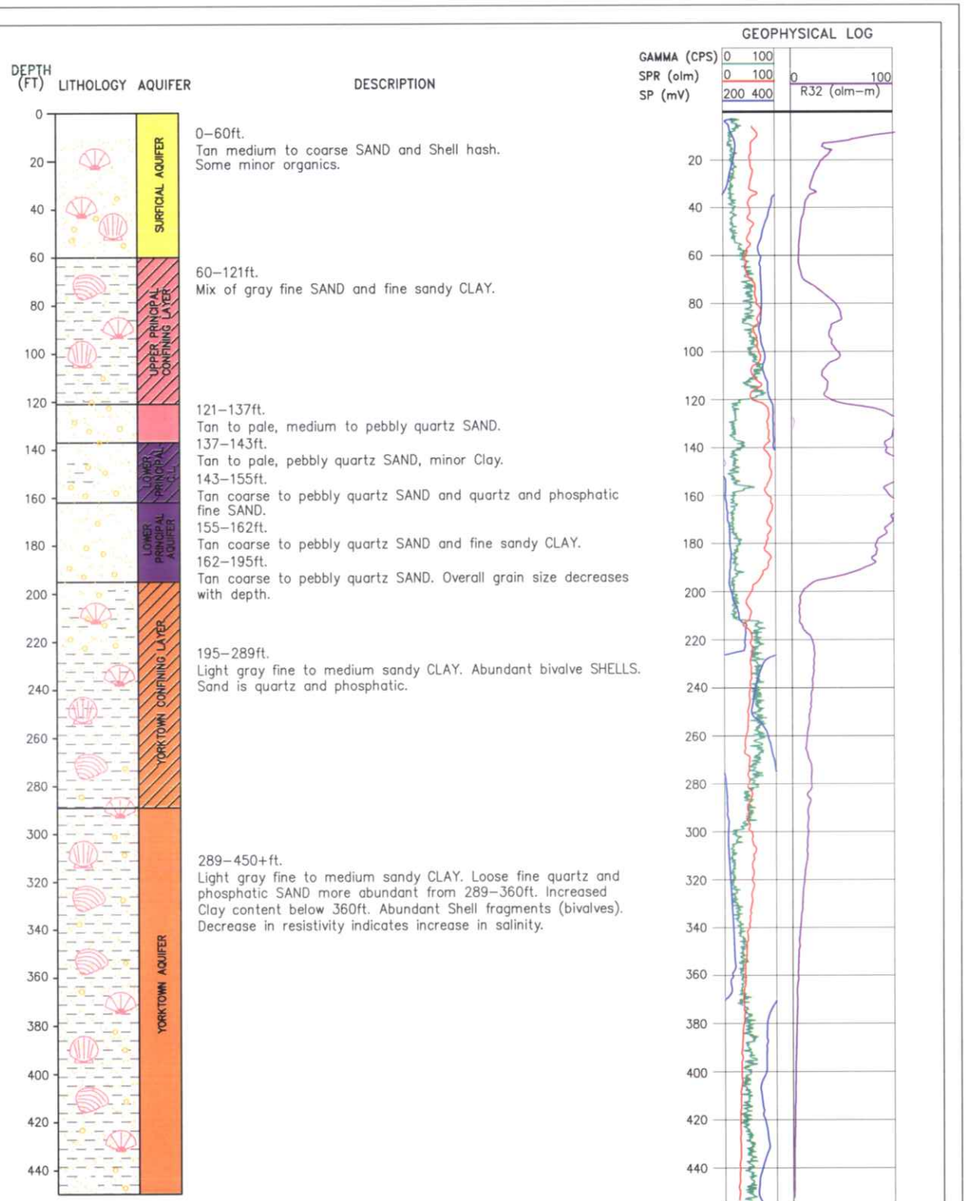
LOCATION OF YORKTOWN TEST WELL AND EXISTING PRODUCTION WELL SITES

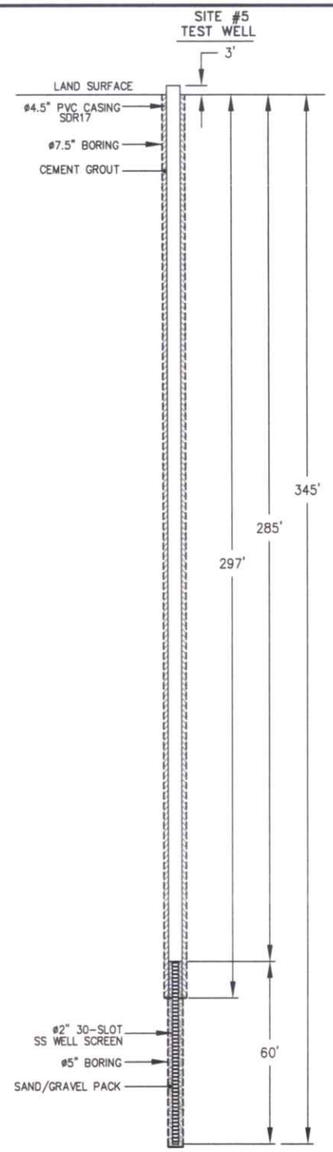


- YORKTOWN PILOT HOLE AT SKYCO PLANT
- YORKTOWN TEST WELL AT SKYCO SITE #5

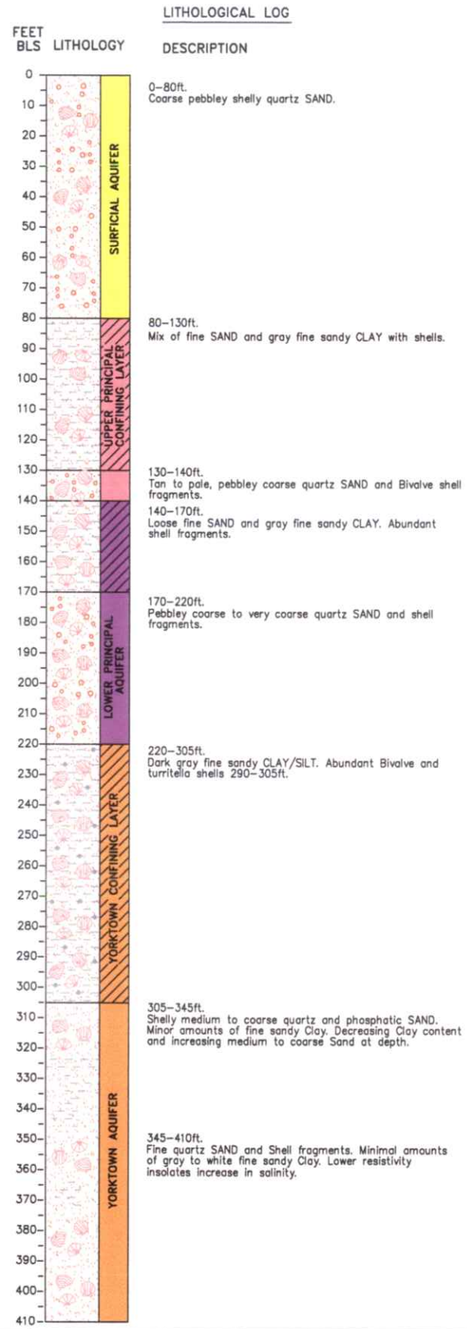
WANCHESE QUADRANGLE
NORTH CAROLINA - DATE COUNTY
7.5 MINUTE SERIES (TOPOGRAPHIC)
CONTOUR INTERVAL=5 FEET
PHOTOREVISED 1982

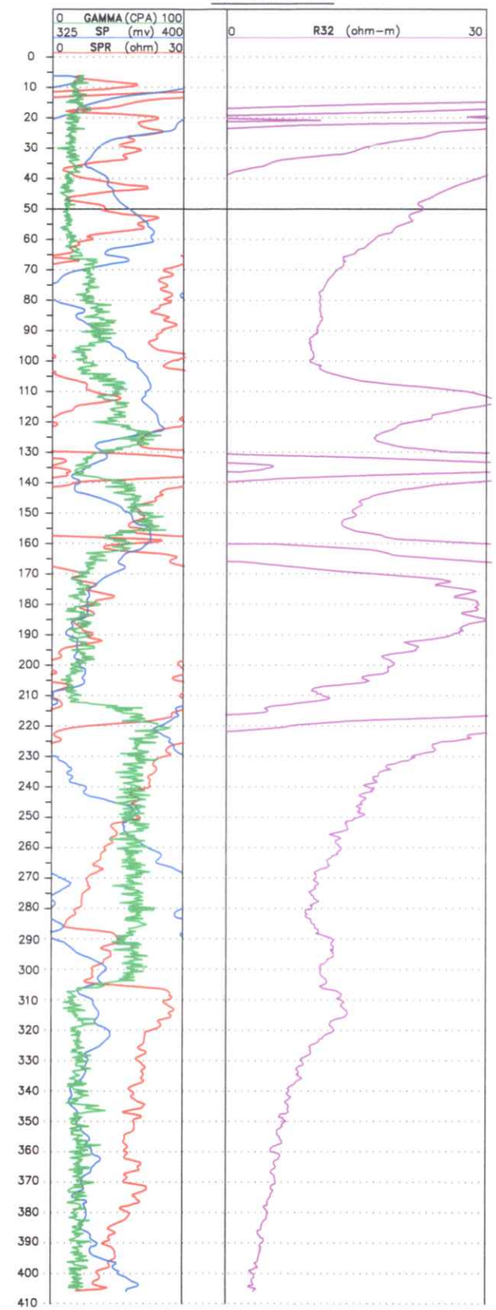
DARE COUNTY WATER ROANOKE ISLAND	FIGURE 1
GMA GROUNDWATER MANAGEMENT ASSOCIATES, INC. 4300 SAPPHIRE COURT, SUITE 100 GREENVILLE, NORTH CAROLINA 27834	DATE 1/23/2009 PROJECT 113501


DEPTH (FT)
LITHOLOGY
AQUIFER
DESCRIPTION
GEOPHYSICAL LOG
GAMMA (CPS) 0 100
SPR (olm) 0 100
SP (mV) 200 400
0 100
R32 (olm-m)
SURFICIAL AQUIFER
UPPER PRINCIPAL CONFINING LAYER
LOWER PRINCIPAL CLAY
LOWER PRINCIPAL AQUIFER
YORKTOWN CONFINING LAYER
YORKTOWN AQUIFER
0–60ft.
Tan medium to coarse SAND and Shell hash.
Some minor organics.
60–121ft.
Mix of gray fine SAND and fine sandy CLAY.
121–137ft.
Tan to pale, medium to pebbly quartz SAND.
137–143ft.
Tan to pale, pebbly quartz SAND, minor Clay.
143–155ft.
Tan coarse to pebbly quartz SAND and quartz and phosphatic fine SAND.
155–162ft.
Tan coarse to pebbly quartz SAND and fine sandy CLAY.
162–195ft.
Tan coarse to pebbly quartz SAND. Overall grain size decreases with depth.
195–289ft.
Light gray fine to medium sandy CLAY. Abundant bivalve SHELLS.
Sand is quartz and phosphatic.
289–450+ft.
Light gray fine to medium sandy CLAY. Loose fine quartz and phosphatic SAND more abundant from 289–360ft. Increased Clay content below 360ft. Abundant Shell fragments (bivalves).
Decrease in resistivity indicates increase in salinity.
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
LEGEND
COARSE SAND
SAND
SHELL
CLAY
UPPER PRINCIPAL AQUIFER
WELL COORDINATES
N35° 53.146'
W75° 39.636'
GMA
GROUNDWATER MANAGEMENT ASSOCIATES, INC.
File: DRAWINGS\103501 TWGEOLOG
LITHOLOGICAL AND GEOPHYSICAL LOG OF THE YORKTOWN PILOT HOLE AT THE SKYCO WATER TREATMENT PLANT
Date: 1/23/2009
Project No. 103501
DARE COUNTY WATER, ROANOKE ISLAND
Figure 2



WELL COORDINATES
N35° 51.632'
W75° 38.930'





CLAY
SAND
SILT
BIVALVES
PEBBLES
UPPER PRINCIPAL AQUIFER
LOWER PRINCIPAL CONFINING LAYER

PROJECT: 103501

LITHOLOGICAL AND GEOPHYSICAL LOGS OF YORKTOWN TEST WELL AT SKYCO #5

DARE COUNTY WATER, ROANOKE ISLAND

FIGURE 3
DATE 11/13/2008
VERTICAL SCALE 1"=50'

GMA
GROUNDWATER MANAGEMENT ASSOCIATES, INC.

APPENDIX I

WELL CONSTRUCTION RECORD AND GEOPHYSICAL LOGS OF YORKTOWN TEST WELL AND SKYCO WATER TREATMENT PLANT PILOT HOLE

YORKTOWN TW @ SKYLO WTP – NO TW CONSTRUCTED

– HOLE ABANDONED

MSI

COMPANY

WELL ID

FIELD

COUNTRY STATE

CO

WELL

FLD

CTY

STE

FILING No

LOCATION

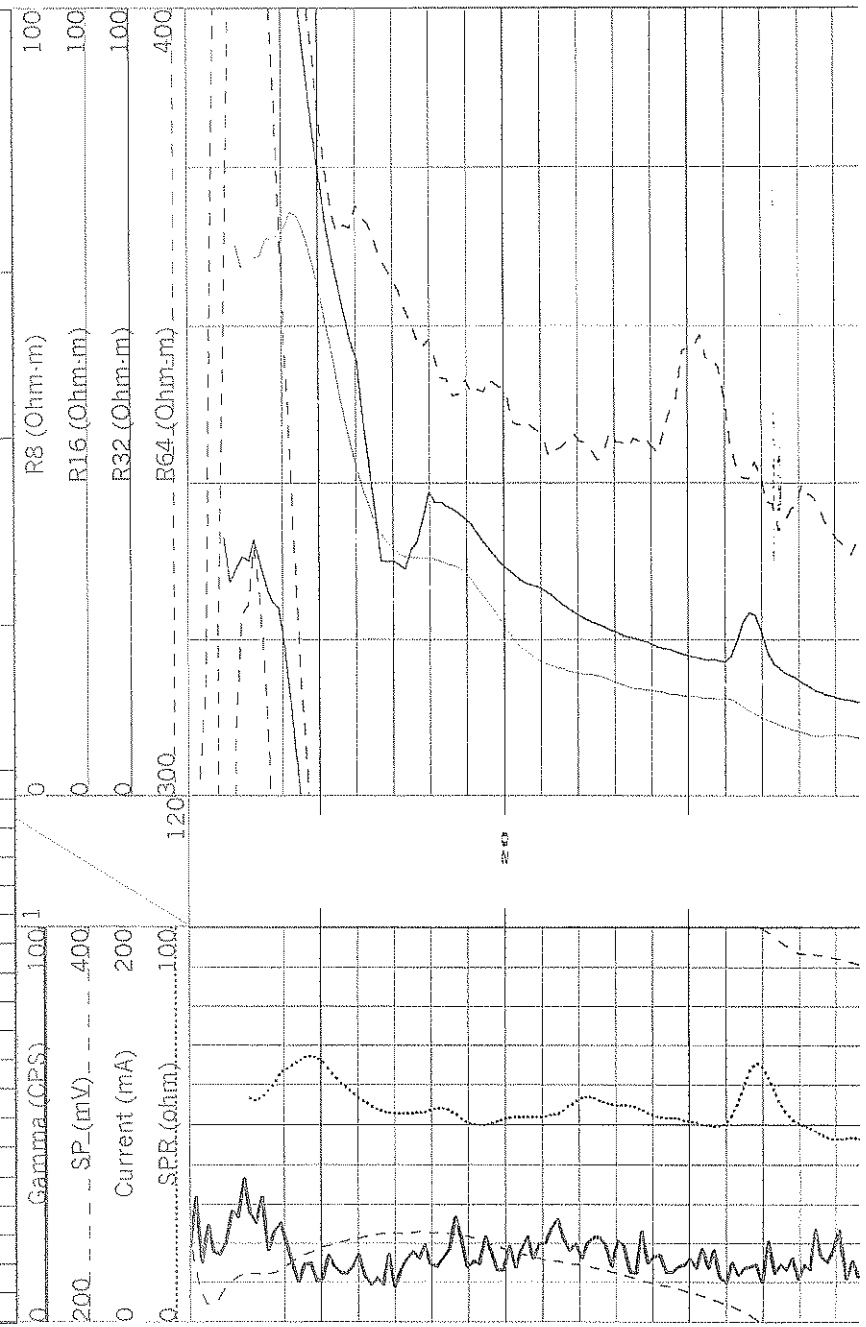
SEC TWP RGE

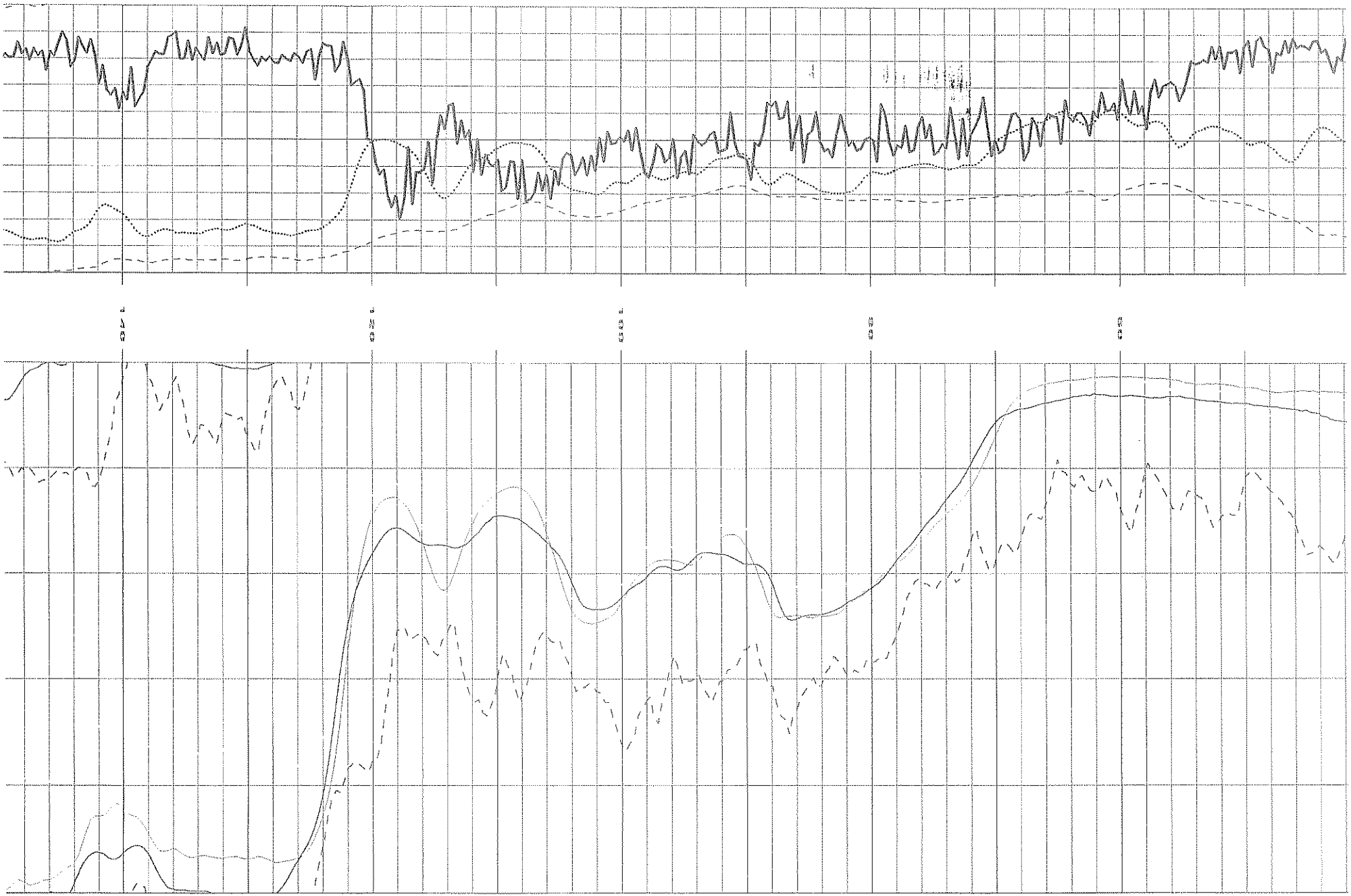
OTHER SERVICES

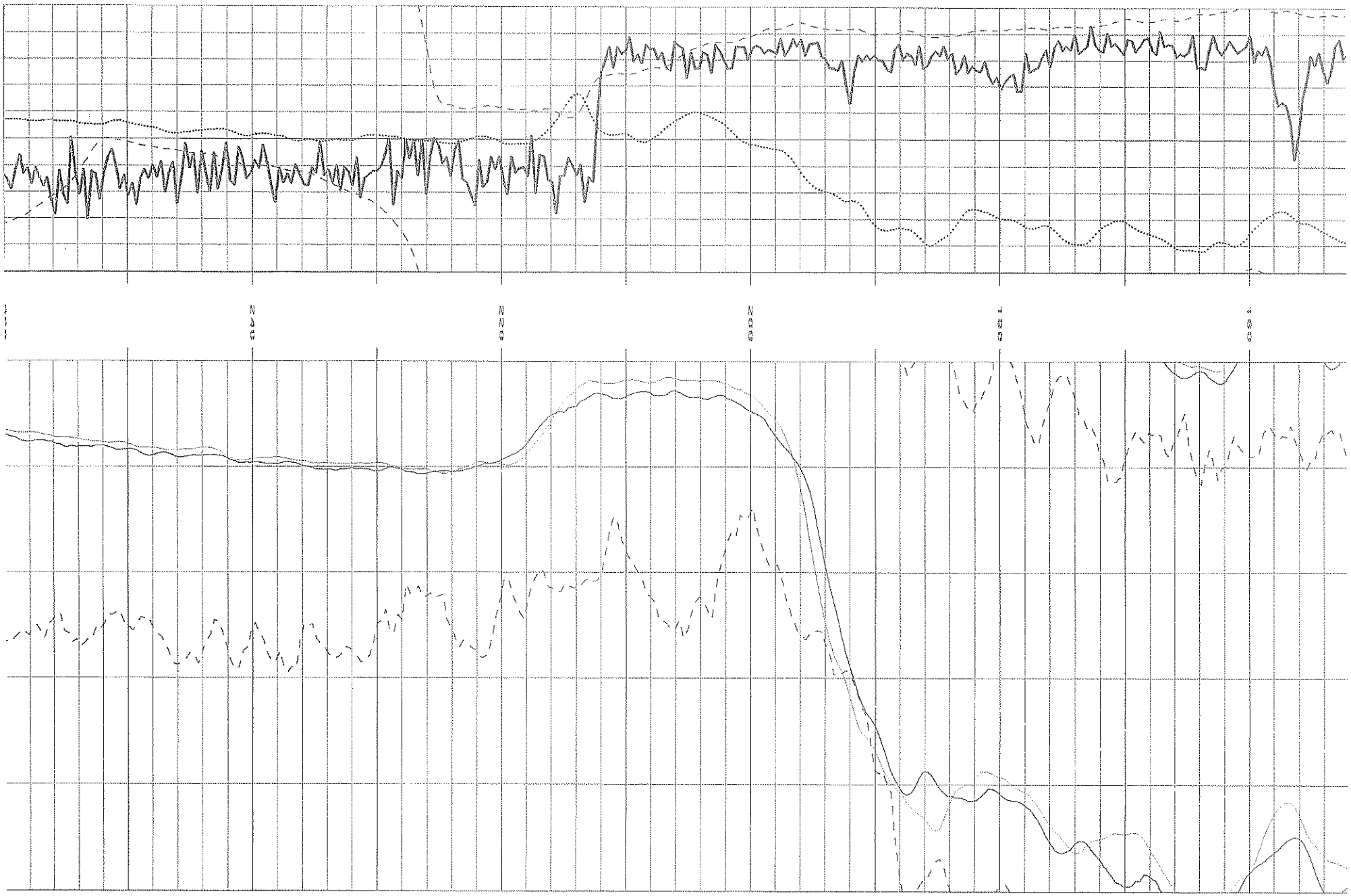
PERMANENT DATUM		ELEVATION	K.B.
LOG MEAS. FROM		ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM			G.L.

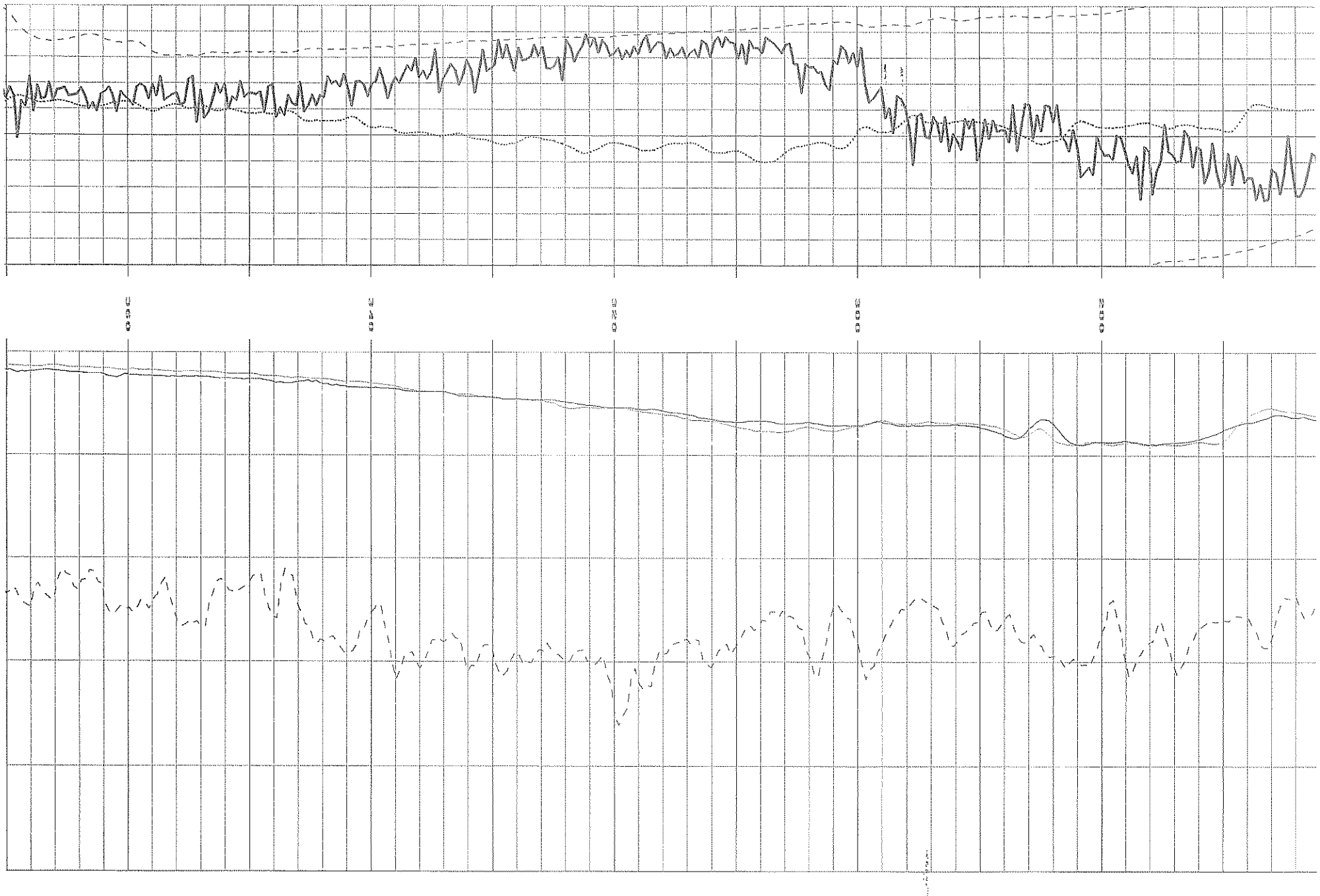
DATE		TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL			
TOP LOGGED INTERVAL			
OPERATING RIG TIME			
RECORDED BY			
WITNESSED BY			

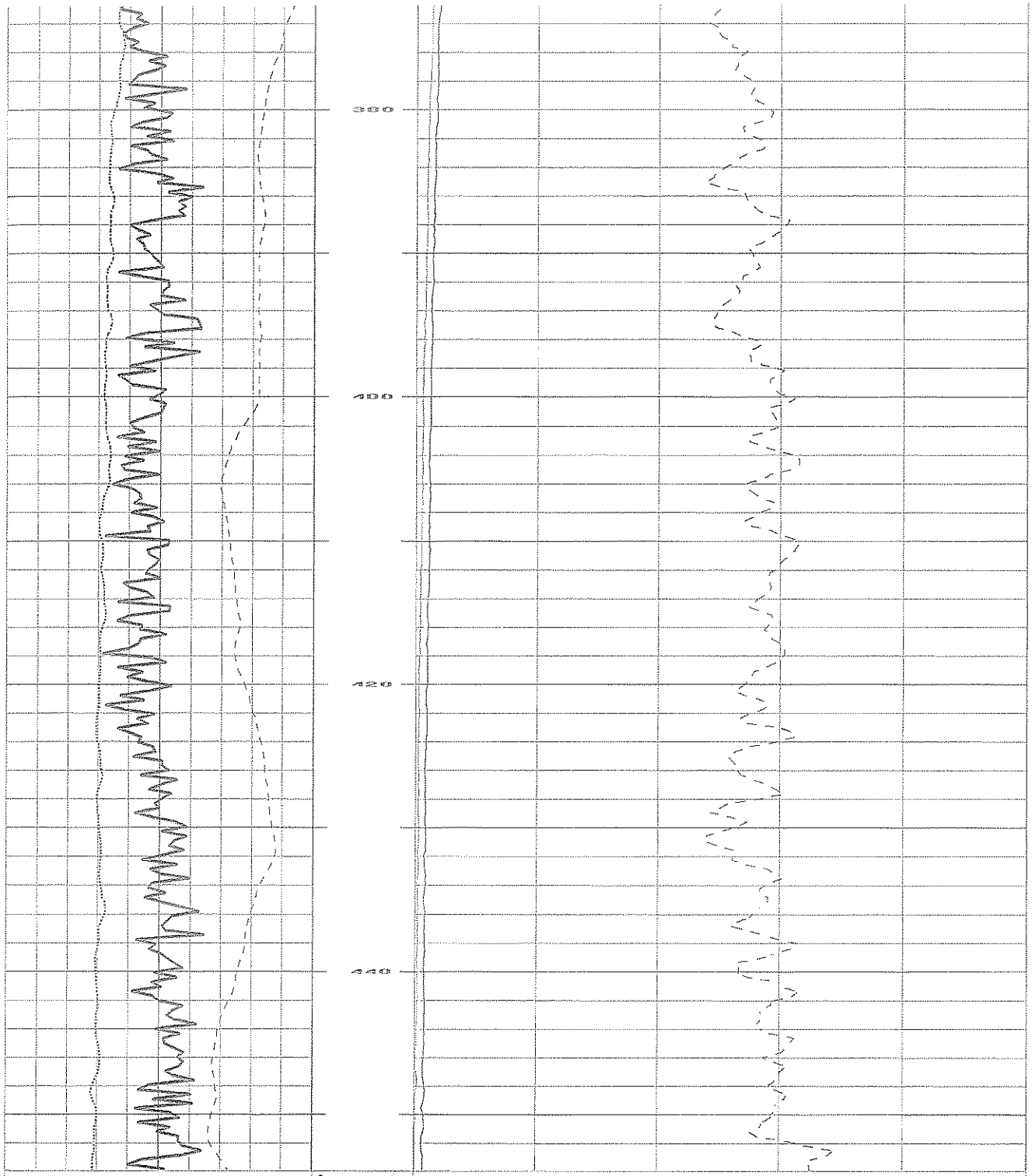
RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO











Date: Tuesday, September 23, 2008 Time: 12:33 File: C:\My Documents\SKYCO PLANT 9-08.rd

MSI

SKYCO #5 YORKTOWN TW SCREENED 245-305 BLS

COMPANY	
WELL ID	
FIELD	
COUNTRY	STATE
LOCATION	OTHER SERVICES
SEC	TWP	RGE

CO	
WELL	
FLD	
CTY	
STE	
FILING No	

PERMANENT DATUM	ELEVATION	K.B.
LOG MEAS. FROM	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM		G.L.

DATE	TYPE FLUID IN HOLE	
RUN No	SALINITY	
TYPE LOG	DENSITY	
DEPTH-DRILLER	LEVEL	
DEPTH-LOGGER	MAX REC. TEMP.	
BTM LOGGED INTERVAL		
TOP LOGGED INTERVAL		
OPERATING RIG TIME		
RECORDED BY		
WITNESSED BY		

RUN	BOREHOLE RECORD			CASING RECORD			
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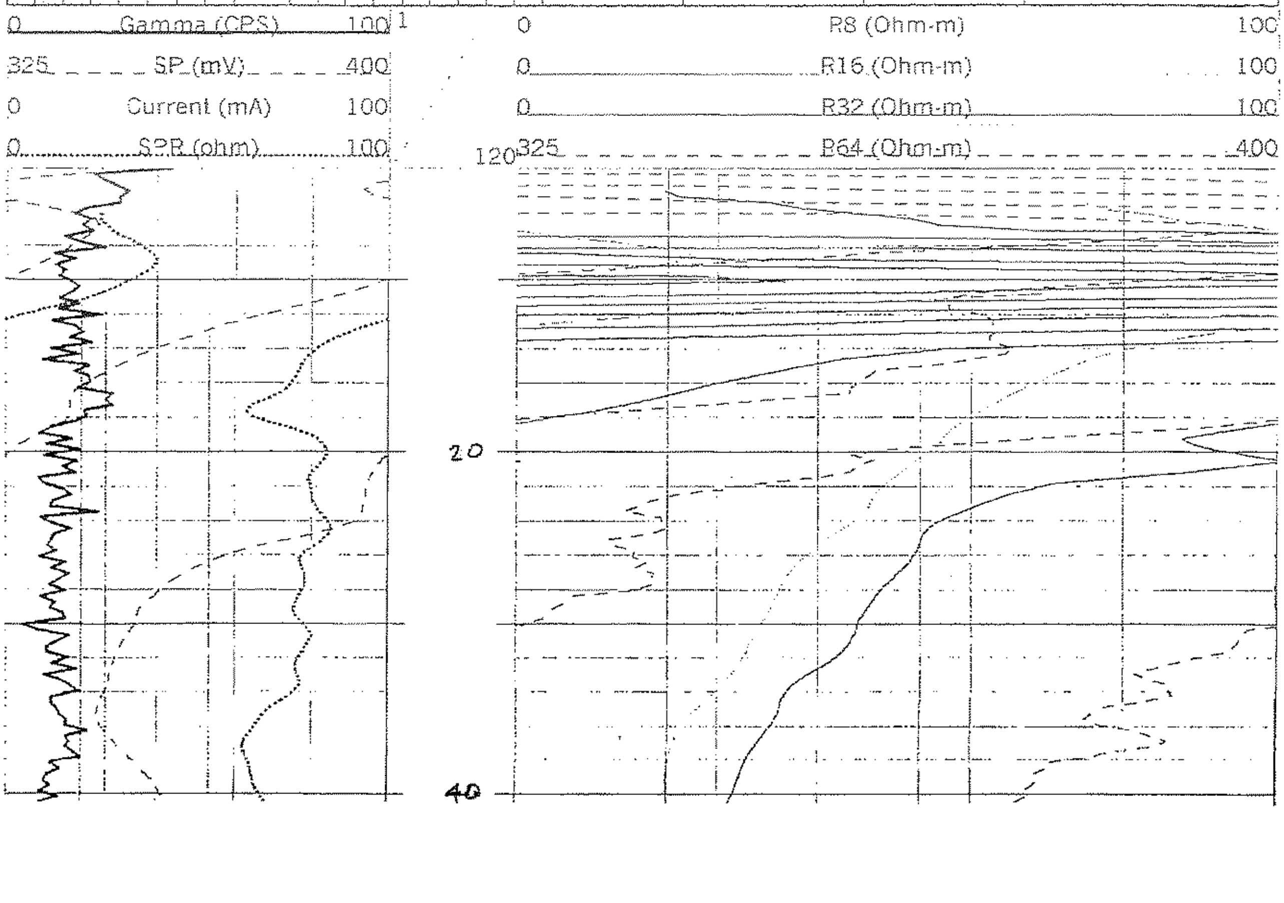

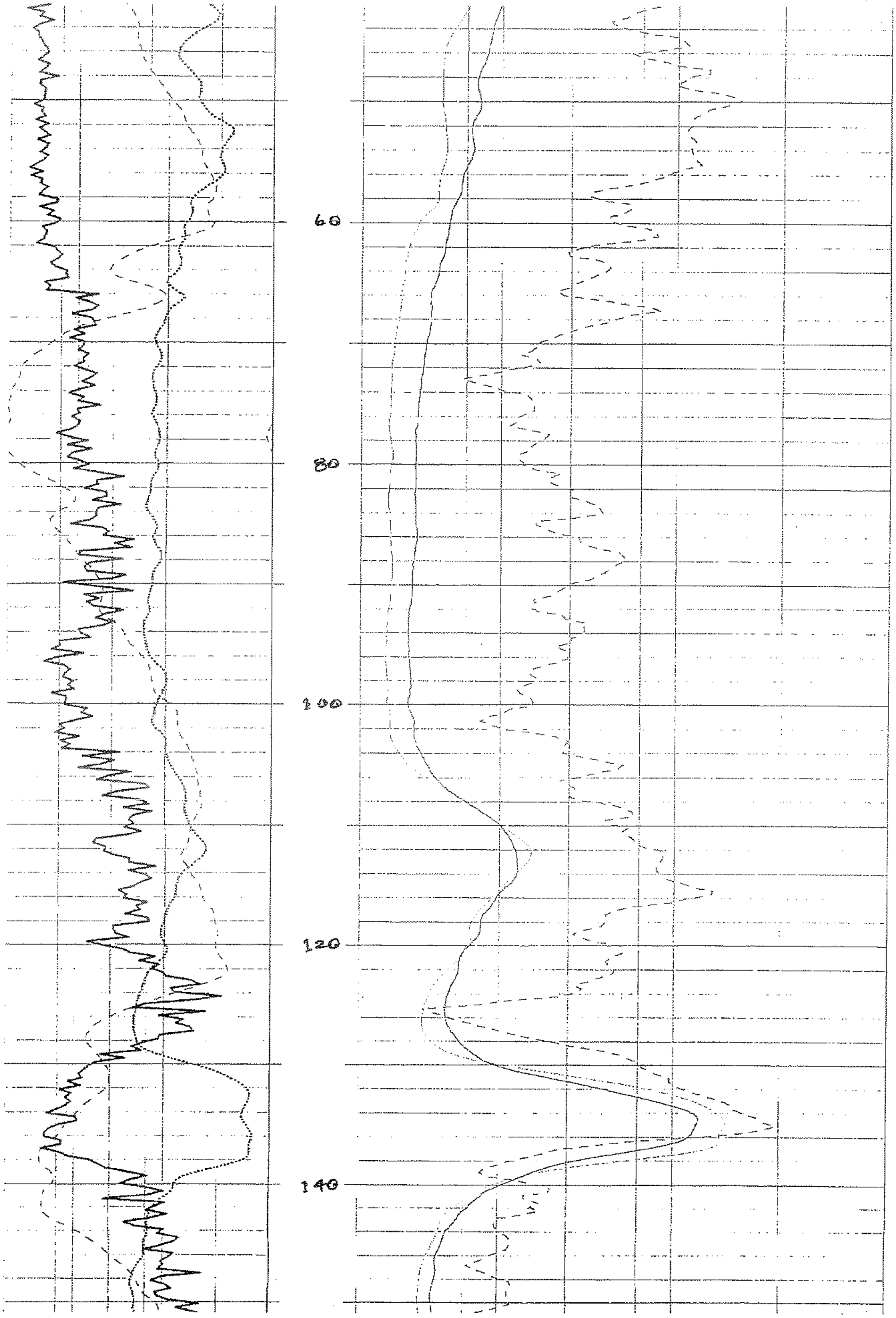
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80
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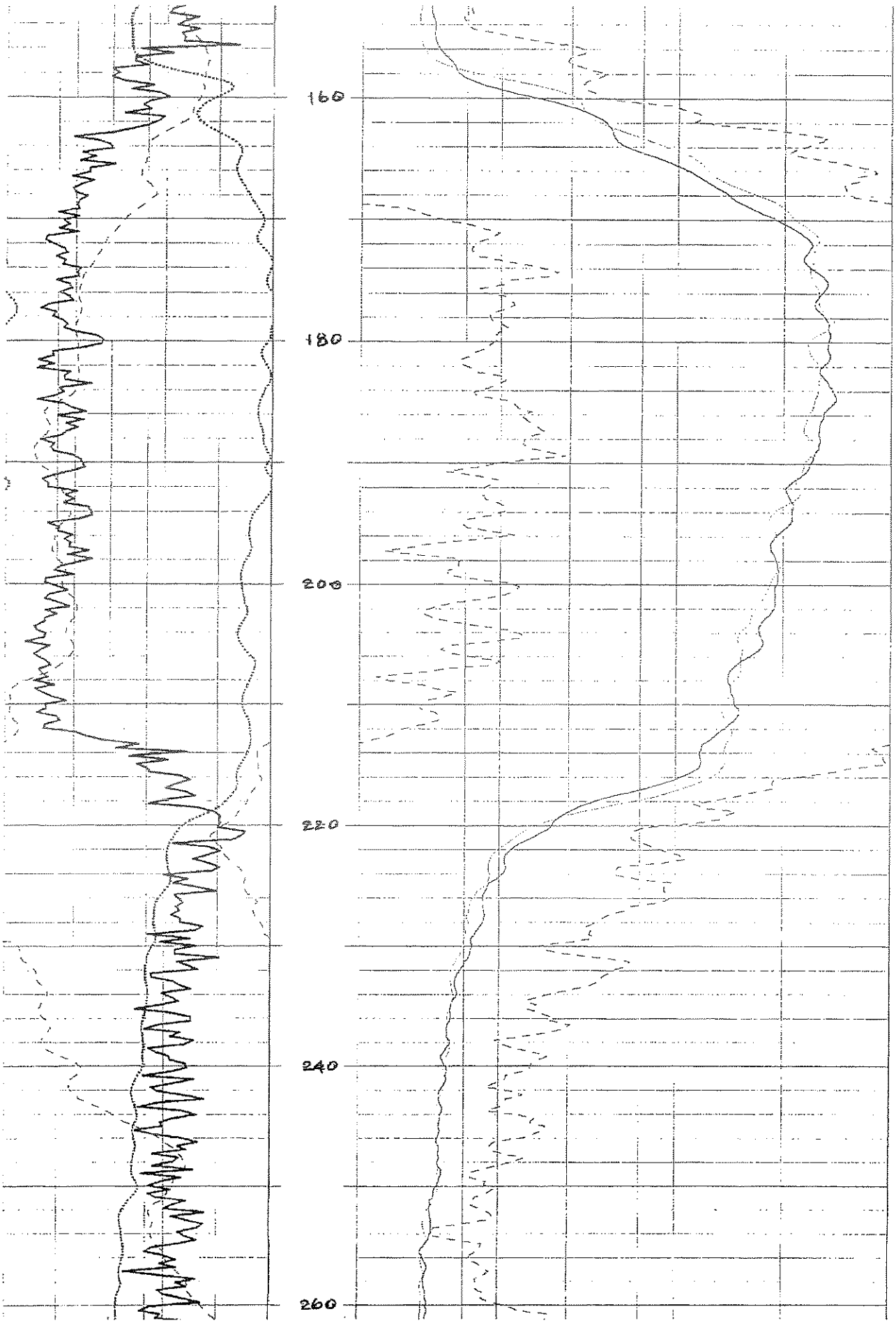
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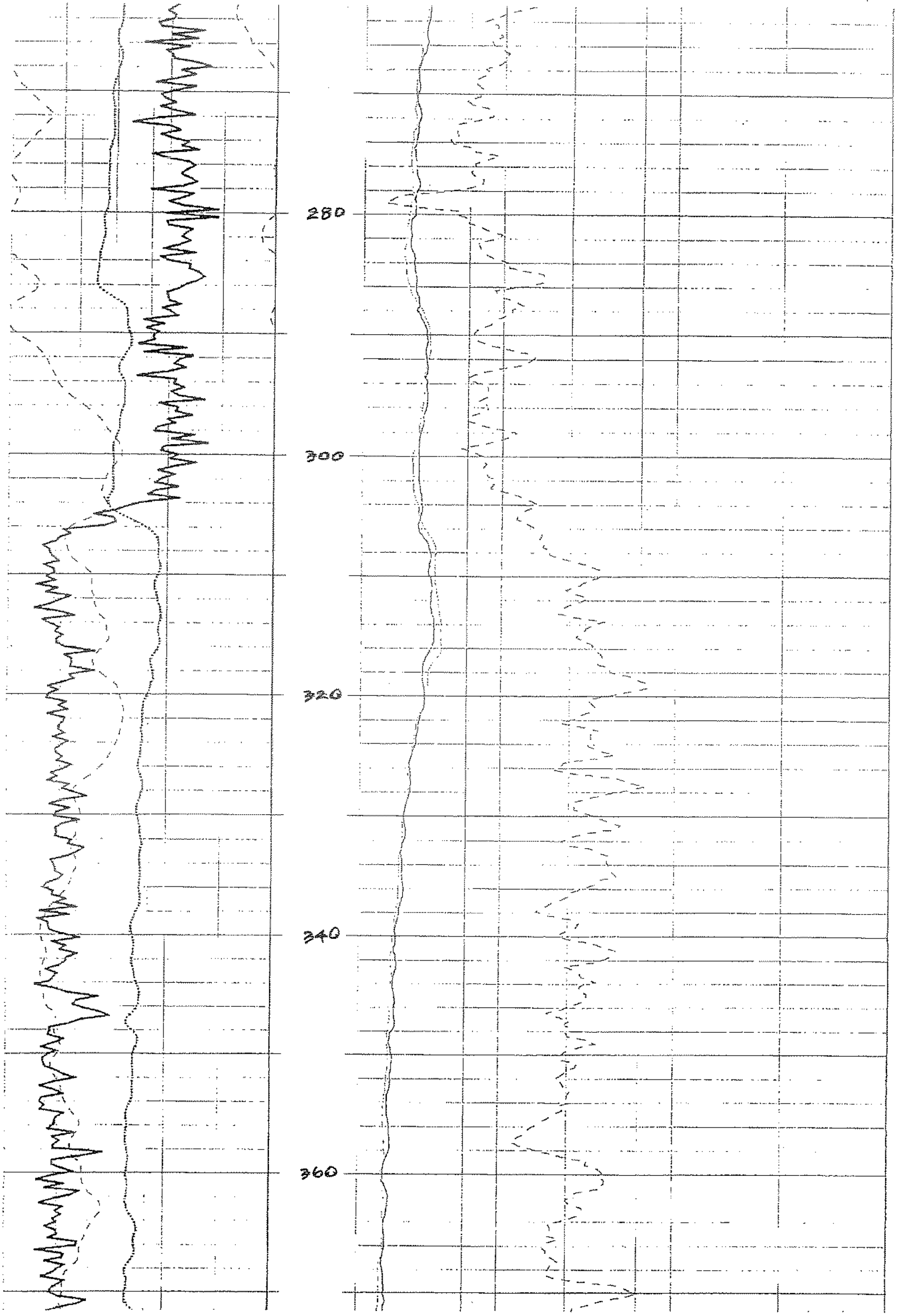
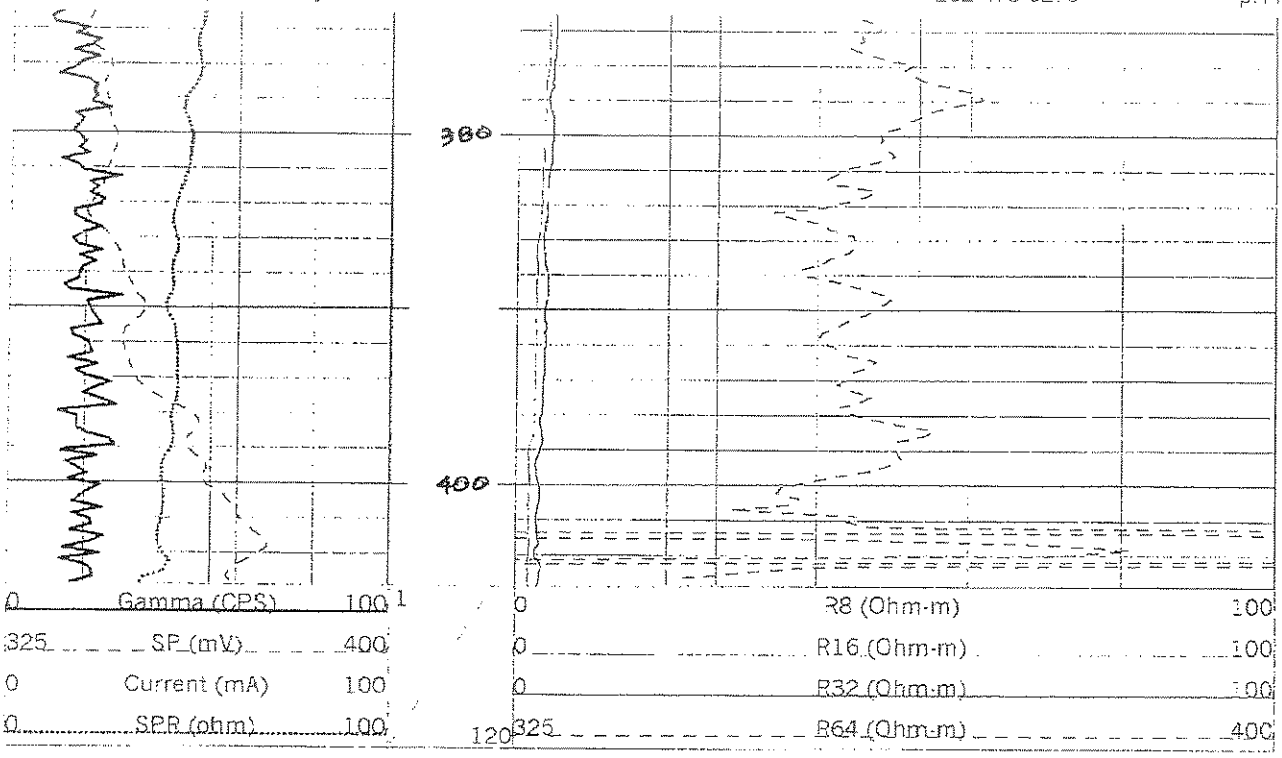


280
300
320
340
360



Date: Tuesday, October 07, 2008 Time: 18:15 File: C:\My Documents\skipper\SKYCO 5 TEST 08.rd

WELL CONSTRUCTION RECORD

Test well on Site #5

North Carolina-Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) *Sean Cropsey* CERTIFICATION# *2485*

WELL CONTRACTOR COMPANY NAME *SKIPPER'S WELL DRILLING & PUMP SERVICE, INC.* PHONE #(910) *371-2770*

STATE WELL CONSTRUCTION PERMIT #: (if applicable) ASSOCIATED WQ PERMIT # (if applicable)

1. WELL USE (Check Applicable bo Residential [ ] Municipal/Public [ ] Industrial [ ] Agricultural [ ]
Monitoring [X] Recovery [ ] Heat Pump Water Injection [ ] Other [ ] If Other, List Use:

2. WELL LOCATION:
Nearest town *Skyco* County *Dare*
(Street Name, Numbers, Community, subdivision, Lot No., Zip Code)

Topographic/Land setting
[ ] Ridge [ ] Slope [ ] Valley [ ] Flat
(check appropriate box)

3. OWNER *Dare County*
Address *P.O. Box 1000*
(Street or Route No.)
Manteo NC 27954
City or town State Zip Code
Area code-Phone Number

Latitude/longitude of well location
(degrees/minutes/second)

4. DATE DRILLED *10/28/08* *USE OF WELL* monitoring
5. TOTAL DEPTH *345*
6. DOES WELL REPLACE EXISTING WELL [ ] Yes [X] No
7. STATIC WATER LEVEL Below Top of Casing *12* Ft.
(Use "+" if above Top of Casing
8. TOP OF CASING *3* FT. ABOVE LAND SURFACE.
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): *90* METHOD OF TES *pump*
10. WATER ZONES (depth)
11. DISINFECTION: Type *70%HTH* Amount *cup*
12. CASING:

	Depth			Diameter	Wall Thickness Weight/ft.	Material
From	*+3*	To	*297* Ft.	*4.5*	*SDR17*	*pvc*
From		To	Ft.			
From		To	Ft.			

13. GROUT:

	Depth			Material	Method
From	*0*	To	*297* Ft.	*cement*	*pump*
From		To	Ft.		
From		To	Ft.		

14. SCREEN

	Depth			Diameter	Slot size		Material
From	*285*	To	*345* Ft.	*2"*	*30*	in	*stainless steel*
From		To	Ft.			in	
From		To	Ft.			in	

15. SAND/GRAVEL PACK:

	Depth			Size	Material
From	*285*	To	*345* Ft.	*#2*	*southern products*
From		To	Ft.		

Drilling log

Depth From	Depth To	Formation Description
0	10	sand
10	20	sand, wood, clay
20	30	clay, sand
30	70	sand, coarse gravel, shell
70	90	streaks of gray clay, sand, shells
90	100	gray clay, shells, sand
100	110	gray clay, shells
110	130	brown clay, shells
130	140	brown gray clay - harder, shells
140	160	gray clay
160	170	sand with some clay
170	180	clay, gravel
180	210	gravel, some shells.
210	220	sand,clay at 215
220	280	clay
280	290	clay, shells
290	300	clay, shells, some sand
300	310	shells, some sand
310	350	shells, some sand-hard
350	360	mud, some sand
360	400	mud

16. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAN 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No (919) 733-3221, within 30 days. GW-1 REV. 07/2001

APPENDIX II

AQUIFER TEST DATA AND ANALYSES

Pumping Test Monitoring Log Form						
Project Number & Location: 103501-Dare Co. (Roanoke Is.)						Well#: Yorktown TW @ Skyco #5
Date: 10/30/08		Start Time: 9:44am				Static Water Level: 12.79'
Latitude:			Longitude:			
hr., min., & sec.	minutes	Time	Water Level (ft)	Drawdown (ft)	Spec. Cap. (Q/s)	Comments
15sec	0.25		22.90	10.11	9.05	
30sec	0.5					
45sec	0.75		24.31	11.52	7.94	
1min	1					
1min 15sec	1.25					
1min 30sec	1.5					
1min 45sec	1.75		34.98	22.19	4.12	
2min	2		38.77	25.98	3.52	
2min 30sec	2.5		38.86	26.07	3.51	
3min	3		38.86	26.07	3.51	
3min 30sec	3.5		38.88	26.09	3.51	
4min	4		38.94	26.15	3.50	
4min 30sec	4.5		38.97	26.18	3.50	
5min	5		39.00	26.21	3.49	93 GPM
5min 30sec	5.5					
6min	6		39.07	26.28	3.48	
6min 30sec	6.5		39.08	26.29	3.48	
7min	7		39.10	26.31	3.48	
7min 30sec	7.5		39.11	26.32	3.48	
8min	8		39.11	26.32	3.48	
8min 30sec	8.5		39.12	26.33	3.48	
9min	9		39.14	26.35	3.47	
9min 30sec	9.5		39.16	26.37	3.47	
10min	10		39.16	26.37	3.47	
11min	11		39.18	26.39	3.47	
12min	12		39.20	26.41	3.46	
13min	13		39.21	26.42	3.46	
14min	14		39.23	26.44	3.46	
15min	15		39.25	26.46	3.46	
16min	16		39.28	26.49	3.45	
17min	17		39.29	26.50	3.45	
18min	18		39.31	26.52	3.45	
19min	19		39.32	26.53	3.45	
20min	20		39.33	26.54	3.45	
22min	22		39.40	26.61	3.44	Change Coupling on Discharge Line
24min	24		39.30	26.51	3.45	
26min	26		39.30	26.51	3.45	
28min	28		39.32	26.53	3.45	92-93 GPM
30min	30		39.33	26.54	3.45	
32min	32		39.34	26.55	3.45	
34min	34		39.35	26.56	3.45	
36min	36		39.36	26.57	3.44	
38min	38		39.38	26.59	3.44	
40min	40		39.39	26.60	3.44	
45min	45		39.42	26.63	3.44	92 GPM
50min	50		39.45	26.66	3.43	
55min	55		39.48	26.69	3.43	
1hr	60		39.49	26.70	3.43	
1hr 5min	65		39.51	26.72	3.42	
1hr 10min	70		39.53	26.74	3.42	
1hr 15min	75		39.54	26.75	3.42	
1hr 20min	80		39.56	26.77	3.42	
1hr 25min	85		39.58	26.79	3.42	
1hr 30min	90		39.60	26.81	3.41	
1hr 35min	95		39.61	26.82	3.41	
1hr 40min	100		39.61	26.82	3.41	91-92 GPM
1hr 50min	110		39.64	26.85	3.41	
2hr	120		39.66	26.87	3.41	

					39.69	Well#: Yorktown TW @ Skyco #5
Date: 10/30/08		Start Time: 9:44am				Static Water Level: 12.79'
hr., min., & sec.	minutes	Time	Water Level (ft)	Drawdown (ft)	Spec. Cap. (Q/s)	Comments
2hr 10min	130		39.69	26.90	3.40	
2hr 20min	140		39.70	26.91	3.40	
2hr 30min	150		39.72	26.93	3.40	
2hr 40min	160		39.73	26.94	3.40	
2hr 50min	170		39.75	26.96	3.39	
3hr 3min	183		39.76	26.97	3.39	
3hr 13min	193		39.78	26.99	3.39	
3hr 20min	200		39.80	27.01	3.39	92 GPM
3hr 40min	220		39.84	27.05	3.38	
4hr	240		39.86	27.07	3.38	
4hr 20min	260		39.88	27.09	3.38	
4hr 40min	280		39.93	27.14	3.37	
5hr	300		39.94	27.15	3.37	
5hr 30min	330		39.99	27.20	3.36	92 GPM
6hr	360		40.01	27.22	3.36	

Notes:

Distance from Pumping Well to Observation well = NA

GMA Project #: 103501-Dare Co. (Roanoke Is.)

Measuring Point Description: Top of Casing

MP Height above Land Surface: ~2.0'

Test Pump Information:

Type:	Berkley?	Make:	
Horsepower:	3hp	Capacity:	80 GPM @ TDH
Intake Depth:	75 ft.		

Well Pipe ID:

Target Q: 80 GPM

Flow Meter Description: Herseey Inline Flow Meter

	If Orifice Weir, Flow Rate Measuring Point Height:
	Totalizer Start: 60,158,353.5 gal.
	Totalizer End: 60,191,322 gal. (Avg. 91.5 GPM)

Field Chemistry Tests: @ 5hr 30min

Chloride =	1525 mg/L (titration) 1811 mg/L (test strip)
Iron =	0.05 mg/L (Hannah)
Hydrogen Sulfide =	0.0-0.1 mg/L (test kit)
pH =	7.74 @ 2hr. 8.34 @ 5.5hr.
Temperature =	
=	
=	

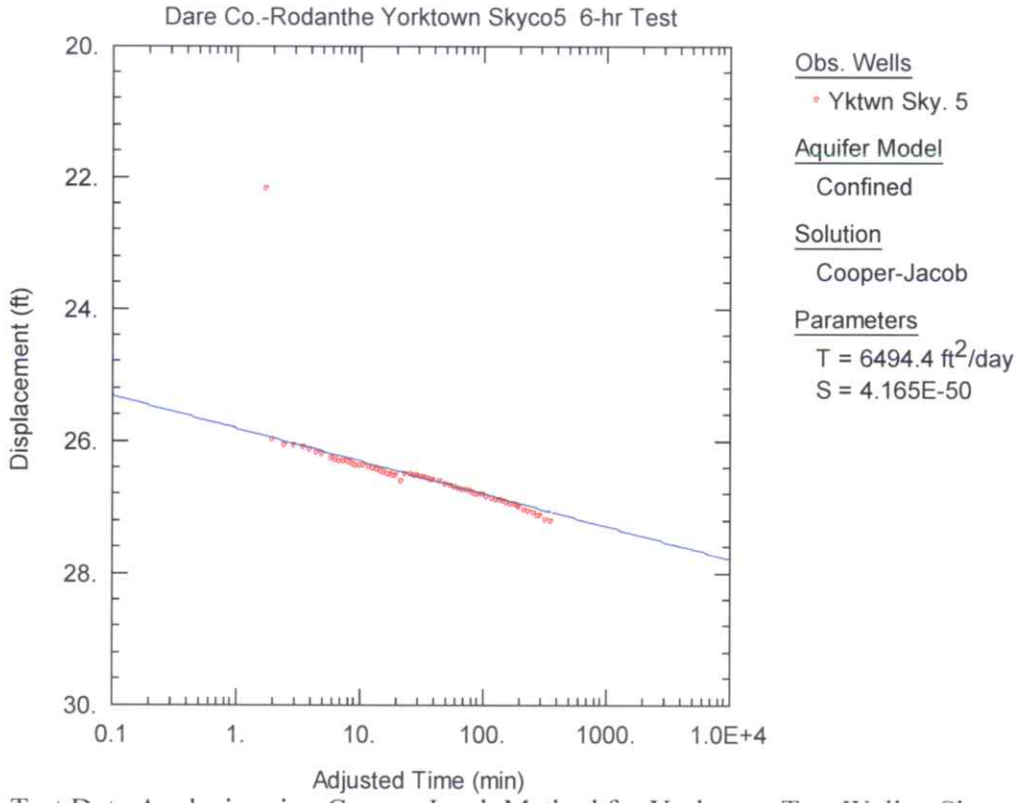
Samples Collected @: 5hr. 30min.

Samples Collected by: Sean w/ Skippers

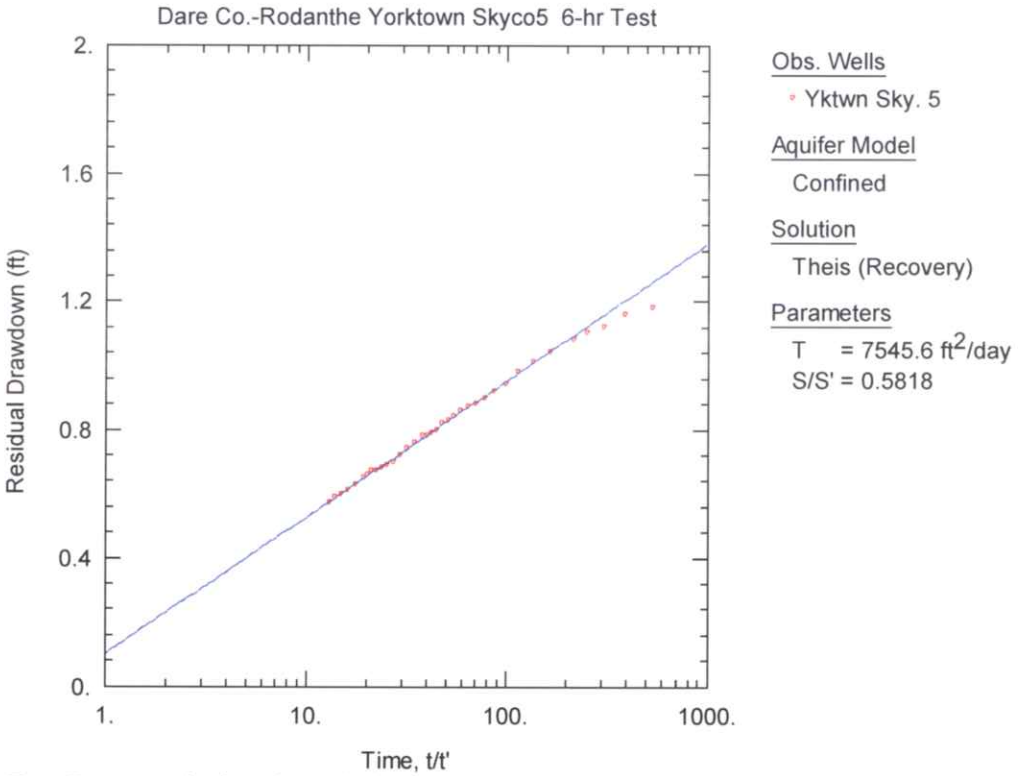
Pumping Equipment Contractor: Skippers

Person Recoring Data: Kyle Quick

Pumping Test Monitoring Log Form						
Project Number & Location: 103501-Dare Co. (Roanoke Is.)						Well#: Yorktown TW @ Skyco #5
Date: 10/30/08		Start Time: 9:44am				Static Water Level: 12.79'
Latitude:			Longitude:			
hr., min., & sec.	minutes	Time	Water Level (ft)	Drawdown (ft)	Spec. Cap. (Q/s)	Comments
15sec	0.25					Recovery
30sec	0.5		14.02	1.23		
45sec	0.75					
1min	1		13.97	1.18		
1min 15sec	1.25		13.95	1.16		
1min 30sec	1.5		13.91	1.12		
1min 45sec	1.75		13.89	1.10		
2min	2		13.87	1.08		
2min 30sec	2.5		13.83	1.04		
3min	3		13.80	1.01		
3min 30sec	3.5		13.77	0.98		
4min	4		13.73	0.94		
4min 30sec	4.5		13.71	0.92		
5min	5		13.69	0.90		
5min 30sec	5.5		13.67	0.88		
6min	6		13.66	0.87		
6min 30sec	6.5		13.65	0.86		
7min	7		13.63	0.84		
7min 30sec	7.5		13.62	0.83		
8min	8		13.61	0.82		
8min 30sec	8.5		13.59	0.80		
9min	9		13.58	0.79		
9min 30sec	9.5		13.57	0.78		
10min	10		13.57	0.78		
11min	11		13.55	0.76		
12min	12		13.53	0.74		
13min	13		13.51	0.72		
14min	14		13.49	0.70		
15min	15		13.48	0.69		
16min	16		13.47	0.68		
17min	17		13.46	0.67		
18min	18		13.46	0.67		
19min	19		13.45	0.66		
20min	20		13.44	0.65		
22min	22		13.42	0.63		
24min	24		13.40	0.61		
26min	26		13.39	0.60		
28min	28		13.38	0.59		
30min	30		13.36	0.57		
Notes:						
Distance from Pumping Well to Observation well = NA						
GMA Project #: 103501-Dare Co. (Roanoke Is.)						
Measuring Point Description: Top of Casing						
MP Height above Land Surface: ~2.0'						
Pumping Equipment Contractor: Skippers						
Person Recoring Data: Kyle Quick						



Aquifer Test Data Analysis using Cooper-Jacob Method for Yorktown Test Well at Skyco #5



Aquifer Test Data Analysis using Theis Recovery Method for Yorktown Test Well at Skyco #5

APPENDIX III

LABORATORY ANALYTICAL RESULTS

envirochem SM

ANALYTICAL & CONSULTING CHEMISTS

Environmental Chemists, Inc.

6602 Windmill Way • Wilmington, NC 28405
(910) 392-0223 (Lab) • (910) 392-4424 (Fax)

710 Bowsertown Road • Manteo, NC 27954
(252) 473-5702

NCDENR: DWQ CERTIFICATE #94, DLS CERTIFICATE #37729

SKIPPER'S WELL DRILLING

Index for Dare Co. Test Well # 5

Sample # 24159 Report 8-10204

Collected 10/30/08 @ 3:30 PM

envirochem
Analytical & Consulting Chemists

Environmental Chemists, Inc.
6602 Windmill Way • Wilmington, North Carolina 28405
(910) 392-0223 Phone • (910) 392-4424 Fax
EChemW@aol.com
NCDENR: DWQ Certificate #94, DLS Certificate #37729

NEW WELL INORGANIC CHEMICAL ANALYSIS

Note: All information must be supplied for plan review credit.

WATER SYSTEM ID #: * New Well * **County:** Dare

Name of Water System: Dare County Test Well # 5

Sample Type: X Source for Plan Review

Location Where Collected: N/A
(Note: Compliance sample MUST be collected at the entry point.)

Location Code: N/A

Collection Date 10/30/08 (MM/DD/YY)

Collection Time 03:30 PM (Specify AM or PM)

Collected By: Sean Cropsey (Please Print)

Mail Results to (water system representative):

SKIPPERS WELL DRILLING
107 Oakland Drive
Leland, NC 28451

Phone #: (910) 371-2770
Fax #: (910) 371-2787

*NOTE: Please complete portion above double line on Page 2.

LABORATORY ID #: 37729 ☐ SAMPLE UNSATISFACTORY ☐ RESAMPLE REQUIRED

CONTAM CODE	CONTAMINANT	METHOD CODE	REQUIRED REPORTING LIMIT (R.R.L.)		NOT DETECTED (i.e. < R.R.L.) (X)	QUANTIFIED RESULTS*		ALLOWABLE LIMIT
0100	Turbidity	SM2130 B	0.10	ntu	☐	0.6	NTU	N/A
1005	Arsenic	EPA 200.9	0.005	mg/L	X	.	mg/L	0.010 mg/L
-	Dissolved Arsenic	EPA 200.9	0.005	mg/L	X	.	mg/L	
1010	Barium	EPA 200.7	0.400	mg/L	X	.	mg/L	2.000 mg/L
1015	Cadmium	EPA 200.7	0.001	mg/L	X	.	mg/L	0.005 mg/L
1016	Calcium	EPA 200.7	0.001	mg/L	☐	11.8	mg/L	N/A
1017	Chloride	SM 4500 Cl-B	5.0	mg/L	☐	1512.	mg/L	250.0 mg/L
1020	Chromium	EPA 200.7	0.020	mg/L	X	.	mg/L	0.100 mg/L
1022	Copper	EPA 200.7	0.050	mg/L	X	.	mg/L	1.300 mg/L
1024	Cyanide	SM 4500 CN F	0.040	mg/L	X	.	mg/L	0.200 mg/L
1025	Fluoride	SM 4500 F B	0.100	mg/L	☐	0.5	mg/L	4.000 mg/L
1028	Iron	EPA 200.7	0.060	mg/L	☐	0.116	mg/L	0.300 mg/L
1030	Lead	EPA 200.9	0.003	mg/L	X	.	mg/L	0.015 mg/L
1031	Magnesium	EPA 200.7	1.0	mg/L	☐	32.4	mg/L	N/A
1032	Manganese	EPA 200.7	0.010	mg/L	X	.	mg/L	0.050 mg/L
1035	Mercury	EPA 245.1	0.0004	mg/L	X	.	mg/L	0.002 mg/L

*Note: Concentrations for Lead and Copper are action levels, not MCLs.

24159 8-10204

envirochem
Analytical & Consulting Chemists

Environmental Chemists, Inc.
6602 Windmill Way • Wilmington, North Carolina 28405
(910) 392-0223 Phone • (910) 392-4424 Fax
EChemW@aol.com
NCDENR: DWQ Certificate #94, DLS Certificate #37729

NEW WELL INORGANIC CHEMICAL ANALYSIS

(Continued)

Note: All information must be supplied for plan review credit.

WATER SYSTEM ID #: New Well **Collection Date** 10/30/08 (MM/DD/YY) **Collection Time** 03:30 PM (Specify AM or PM)

Location Code: Dare County Test Well #5

LABORATORY ID #: 37729

CONTAM CODE	CONTAMINANT	METHOD CODE	REQUIRED REPORTING LIMIT (R.R.L.)	NOT DETECTED (i.e. < R.R.L) (X)	QUANTIFIED RESULTS*	ALLOWABLE LIMIT
1036	Nickel	EPA 200.7	0.100 mg/L	X	mg/L	N/A
1040	Nitrate	SM 4500 NO_3-E	1.00 mg/L	X	mg/L	10.00 mg/L
1041	Nitrite	SM 4500 NO_2-B	0.10 mg/L	X	mg/L	1.00 mg/L
1045	Selenium	EPA 200.9	0.010 mg/L	X	mg/L	0.050 mg/L
1050	Silver	EPA 200.7	0.05 mg/L	X	mg/L	0.100 mg/L
1052	Sodium	EPA 200.7	1.0 mg/L	☐	1106. mg/L	N/A
1055	Sulfate	SM 426 C	15.0 mg/L	X	mg/L	250.0 mg/L
-	Silica	EPA 200.7	N/A	☐	17.9 mg/L	N/A
1068	Acidity	SM 2310 B	1.0 mg/L	X	mg/L	N/A
1074	Antimony	EPA 200.9	0.003 mg/L	X	mg/L	0.006 mg/L
1075	Beryllium	EPA 200.7	0.002 mg/L	X	mg/L	0.004 mg/L
1085	Thallium	EPA 200.9	0.001 mg/L	X	mg/L	0.002 mg/L
-	Strontium	EPA 200.7		☐	0.560 mg/L	N/A
1095	Zinc	EPA 200.7	1.0 mg/L	X	mg/L	5.0 mg/L
1905	Color	SM 2120 B	5 units	☐	45. Units	15 units
1915	Total Hardness	SM 2340 C	1.0 mg/L	☐	171. mg/L	N/A
1925	pH	SM 4500 H^+-B	N/A	N/A	7.73 Units	6.50 – 8.50 units
1927	Alkalinity	SM 2320 B	1.0 mg/L	☐	560. mg/L	N/A
1930	Total Dissolved Solids	SM 2540 C	10.0 mg/L	☐	2827. mg/L	500.0 mg/L

*Note: Concentrations for Lead and Copper are action levels, not MCLs.

	DATE:	TIME:
ANALYSES BEGUN:	10/31/08 (MM/DD/YY)	08:00 AM (Specify AM or PM)
ANALYSES COMPLETED:	12/18/08 (MM/DD/YY)	10:44 AM (Specify AM or PM)

Laboratory Log #: 24159 **Certified By:** Jim Pierce Jim Pierce (Print and sign name)

COMMENTS: **REPORT #** 8-10204

envirochem (SM)
ANALYTICAL & CONSULTING CHEMISTS

Environmental Chemists, Inc.

6602 Windmill Way • Wilmington, NC 28405
(910) 392-0223 (Lab) • (910) 392-4424 (Fax)
710 Bowsertown Road • Manteo, NC 27954
(252) 473-5702
NCDENR: DWQ CERTIFICATE #94, DLS CERTIFICATE #37729

Customer:

SKIPPERS WELL DRILLING
107 Oakland Drive
Leland, NC 28451

Date of Report: December 1, 2008

Purchase Order No.:

Report Number: 8-10204

REPORT OF ANALYSIS

Date Collected: 10/30/08

Sampled By: Sean Cropsey

Report To: Charlie Skipper

Project: Dare Co. Test Well # 5

I.D. # 24159

TRIHALOMETHANE FORMATION POTENTIAL – 7 DAY

Chlorine Residual after 7 day incubation = 1.1 ppm Cl_2 from a 50 ppm dose

THMFP Analysis

Chloroform mg/L	=	**0.0166**
Bromoform mg/L	=	**0.149**
Chlorodibromomethane mg/L	=	**0.0511**
Bromodichloromethane mg/L	=	**0.0309**

TFP mg/L = 0.248

4 hour Chlorine Demand = 39.2 ppm Cl_2

HALOACETIC ACID FORMATION POTENTIAL

HAAFP Analysis

Monochloroacetic Acid mg/L	=	**0.003**
Dichloroacetic Acid mg/L	=	**0.007**
Trichloroacetic Acid mg/L	=	**0.005**
Monobromoacetic Acid mg/L	=	**0.003**
Dibromoacetic Acid mg/L	=	**0.005**

TFP mg/L = 0.023

Comments:

Reviewed by Jim Pierce / Kay A

envirochem
Analytical & Consulting Chemists

Environmental Chemists, Inc.
6602 Windmill Way • Wilmington, North Carolina 28405
(910) 392-0223 Phone • (910) 392-4424 Fax EChemW@aol.com
NCDENR: DWQ Certificate #94, DLS Certificate #37729

VOLATILE ORGANIC CHEMICALS ANALYSIS (VOCs)

Note: All information must be supplied for compliance credit.

WATER SYSTEM ID #: _____ **County:** DARE COUNTY

Name of Water System: DARE COUNTY TEST WELL #5

Sample Type: ☐ Entry Point X Special/Non-compliance

Location Where Collected: NA
(Note: Compliance samples MUST be collected at the Entry Point)

Location Code: N/A

Collected By: Sean Cropsey
(Please Print)

Collection Date	Collection Time
10/30/08 (MM/DD/YY)	03:30 PM (Specify AM or PM)

Mail Results to (water system representative):

SKIPPERS WELL DRILLING
107 Oakland Drive
Leland, NC 28451

Phone #: (910) 371-2770
Fax #: ( )

*NOTE: Please complete portion above double line on Page 2.

LABORATORY ID #: 37729 ☐ SAMPLE UNSATISFACTORY ☐ RESAMPLE REQUIRED

CONTAM CODE	CONTAMINANT	METHOD CODE	REQUIRED REPORTING LIMIT (R.R.L.)	NOT DETECTED (i.e. < R.R.L.) (X)	QUANTIFIED RESULTS*		ALLOWABLE LIMIT
2030	p-Isopropyltoluene	502.2	0.0005 mg/L	X		mg/L	N/A
2210	Chloromethane	502.2	0.0005 mg/L	X		mg/L	N/A
2212	Dichlorodifluoromethane	502.2	0.0005 mg/L	X		mg/L	N/A
2214	Bromomethane	502.2	0.0005 mg/L	X		mg/L	N/A
2216	Chloroethane	502.2	0.0005 mg/L	X		mg/L	N/A
2218	Fluorotrichloromethane	502.2	0.0005 mg/L	X		mg/L	N/A
2246	Hexachlorobutadiene	502.2	0.0005 mg/L	X		mg/L	N/A
2248	Naphthalene	502.2	0.0005 mg/L	X		mg/L	N/A
2378	1,2,4-Trichlorobenzene	502.2	0.0005 mg/L	X		mg/L	0.07 mg/L
2380	Cis-1,2-Dichloroethylene	502.2	0.0005 mg/L	X		mg/L	0.07 mg/L
2408	Dibromomethane	502.2	0.0005 mg/L	X		mg/L	N/A
2410	1,1-Dichloropropene	502.2	0.0005 mg/L	X		mg/L	N/A
2412	1,3-Dichloropropane	502.2	0.0005 mg/L	X		mg/L	N/A
2413	1,3-Dichloropropene	502.2	0.0005 mg/L	X		mg/L	N/A
2414	1,2,3-Trichloropropane	502.2	0.0005 mg/L	X		mg/L	N/A
2416	2,2-Dichloropropane	502.2	0.0005 mg/L	X		mg/L	N/A
2418	1,2,4-Trimethylbenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2420	1,2,3-Trichlorobenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2422	n-Butylbenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2424	1,3,5-Trimethylbenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2426	Tert-Butylbenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2428	Sec-Butylbenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2430	Bromochloromethane	502.2	0.0005 mg/L	X		mg/L	N/A
2941	Chloroform	502.2	0.0005 mg/L	X		mg/L	N/A

*Note: If result exceeds allowable limit, the laboratory must fax analytical results to the State within 48 hours # 24159 8-10204

envirochem
Analytical & Consulting Chemists

Environmental Chemists, Inc.
6602 Windmill Way • Wilmington, North Carolina 28405
(910) 392-0223 Phone • (910) 392-4424 Fax EChemWil@aol.com
NCDENR: DWQ Certificate #94, DLS Certificate #37729

VOLATILE ORGANIC CHEMICALS ANALYSIS (VOCs)

Note: All information must be supplied for compliance credit.continued)

WATER SYSTEM ID #: TEST WELL # 5

Location Code: N/A

Collection Date	Collection Time
10/30/08 (MM/DD/YY)	03:30 PM (Specify AM or PM)

LABORATORY ID #: 37729

CONTAM CODE	CONTAMINANT	METHOD CODE	REQUIRED REPORTING LIMIT (R.R.L.)	NOT DETECTED ABOVE R.R.L. (X)	QUANTIFIED RESULTS*		ALLOWABLE LIMIT
2942	Bromoform	502.2	0.0005 mg/L	X		mg/L	N/A
2943	Bromodichloromethane	502.2	0.0005 mg/L	X		mg/L	N/A
2944	Chlorodibromomethane	502.2	0.0005 mg/L	X		mg/L	N/A
2955	Xylenes (Total)	502.2	0.0005 mg/L	X		mg/L	10.00 mg/L
2964	Dichloromethane	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2965	o-Chlorotoluene	502.2	0.0005 mg/L	X		mg/L	N/A
2966	p-Chlorotoluene	502.2	0.0005 mg/L	X		mg/L	N/A
2967	m-Dichlorobenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2968	o-Dichlorobenzene	502.2	0.0005 mg/L	X		mg/L	0.60 mg/L
2969	p-Dichlorobenzene	502.2	0.0005 mg/L	X		mg/L	0.075 mg/L
2976	Vinyl Chloride	502.2	0.0005 mg/L	X		mg/L	0.002 mg/L
2977	1,1,-Dichloroethylene	502.2	0.0005 mg/L	X		mg/L	0.007 mg/L
2978	1,1-Dichloroethane	502.2	0.0005 mg/L	X		mg/L	N/A
2979	Trans-1,2,-Dichloroethylene	502.2	0.0005 mg/L	X		mg/L	0.10 mg/L
2980	1,2-Dichloroethane	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2981	1,1,1-Trichloroethane	502.2	0.0005 mg/L	X		mg/L	0.20 mg/L
2982	Carbon Tetrachloride	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2983	1,2-Dichloropropane	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2984	Trichloroethylene	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2985	1,1,2-Trichloroethane	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2986	1,1,1,2-Tetrachloroethane	502.2	0.0005 mg/L	X		mg/L	N/A
2987	Tetrachloroethylene	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2988	1, 1,2,2-Tetrachloroethane	502.2	0.0005 mg/L	X		mg/L	N/A
2989	Chlorobenzene	502.2	0.0005 mg/L	X		mg/L	0.10 mg/L
2990	Benzene	502.2	0.0005 mg/L	X		mg/L	0.005 mg/L
2991	Toluene	502.2	0.0005 mg/L	X		mg/L	1.00 mg/L
2992	Ethylbenzene	502.2	0.0005 mg/L	X		mg/L	0.70 mg/L
2993	Bromobenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2994	Isopropylbenzene	502.2	0.0005 mg/L	X		mg/L	N/A
2996	Styrene	502.2	0.0005 mg/L	X		mg/L	0.10 mg/L
2998	n-Propylbenzene	502.2	0.0005 mg/L	X		mg/L	N/A

*Note: If result exceeds allowable limit, the laboratory must fax analytical results to the State within 48 hours

	DATE:	TIME:
ANALYSES BEGUN:	11/04/08	05:00 PM
ANALYSES COMPLETED:	11/14/08	10:30 AM

Laboratory Log #: 24159

Certified By: Jim Pierce Jim Pierce (Print and sign name)

COMMENTS:

REPORT # 8-10204

envirochem
Analytical & Consulting Chemists

Environmental Chemists, Inc.
6602 Windmill Way • Wilmington, North Carolina 28405
(910) 392-0223 Phone • (910) 392-4424 Fax EChemWiz@aol.com
NCDENR: DWO Certificate #94, DLS Certificate #37729

PESTICIDES AND SYNTHETIC ORGANIC CHEMICALS ANALYSIS (SOCs)

Note: All information must be supplied for compliance credit.

WATER SYSTEM ID #: _____ **County:** DARE COUNTY

Name of Water System: DARE COUNTY TEST WELL # 5

Sample Type: ☐ Entry Point X Special/Non-compliance

Location Where Collected: NA
(Note: Compliance sample MUST be collected at the Entry Point.)

Location Code: _____

Collection Date	Collection Time
10/30/08 (MM/DD/YY)	03:30 PM (Specify AM or PM)

Collected By: SEAN CROPSEY (Please Print)

Mail Results to (water system representative):

SKIPPERS WELL DRILLING
107 Oakland Drive
Leland, NC 28451

Phone #: (910) 371-2770
Fax #: ( ) _____

*NOTE: Please complete portion above double line on Page 2.

LABORATORY ID #: 37729 ☐ SAMPLE UNSATISFACTORY ☐ RESAMPLE REQUIRED

CONTAM CODE	CONTAMINANT	METHOD CODE	REQUIRED REPORTING LIMIT (R.R.L.)	NOT DETECTED (i.e. < R.R.L.) (X)	QUANTIFIED RESULTS*	ALLOWABLE LIMIT
2005	Endrin	508.1	0.00001 mg/L	X	___ mg/L	0.002 mg/L
2010	Lindane	508.1	0.00002 mg/L	X	___ mg/L	0.0002 mg/L
2015	Methoxychlor	508.1	0.0001 mg/L	X	___ mg/L	0.04 mg/L
2020	Toxaphene	508.1	0.001 mg/L	X	___ mg/L	0.003 mg/L
2021	Carbaryl	531.1	0.004 mg/L	X	___ mg/L	N/A
2022	Methomyl	531.1	0.004 mg/L	X	___ mg/L	N/A
2031	Dalapon	515.1	0.001 mg/L	X	___ mg/L	0.2 mg/L
2035	Di(2-ethylhexyl)adipate	525.2	0.0006 mg/L	X	___ mg/L	0.4 mg/L
2036	Oxamyl(vydate)	531.1	0.002 mg/L	X	___ mg/L	0.2 mg/L
2037	Simazine	508.1	0.00007 mg/L	X	___ mg/L	0.004 mg/L
2040	Picloram	515.1	0.0001 mg/L	X	___ mg/L	0.5 mg/L
2041	Dinoseb	515.1	0.0002 mg/L	X	___ mg/L	0.007 mg/L
2042	Hexachlorocyclopentadiene	508.1	0.0001 mg/L	X	___ mg/L	0.05 mg/L
2043	Aldicarb Sulfoxide	531.1	0.0005 mg/L	X	___ mg/L	N/A
2044	Aldicarb Sulfone	531.1	0.0008 mg/L	X	___ mg/L	N/A
2045	Metolachlor	508.1	0.0008 mg/L	X	___ mg/L	N/A
2046	Carbofuran	531.1	0.0009 mg/L	X	___ mg/L	0.04 mg/L
2047	Aldicarb	531.1	0.0005 mg/L	X	___ mg/L	N/A
2050	Atrazine	508.1	0.0001 mg/L	X	___ mg/L	0.003 mg/L
2051	Alachlor	508.1	0.0002 mg/L	X	___ mg/L	0.002 mg/L
2065	Heptachlor	508.1	0.00004 mg/L	X	___ mg/L	0.0004 mg/L

* Note: If result exceeds allowable limit, the laboratory must fax analytical results to the State within 48 hours.

24159 8-10204

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NCDENR: DWO Certificate #94, DLS Certificate #37729

PESTICIDES AND SYNTHETIC ORGANIC CHEMICALS ANALYSIS (SOCs)

(continued)

Note: All information must be supplied for compliance credit.

WATER SYSTEM ID #: TEST WELL # 5

Location Code: N/A

Collection Date	Collection Time
10/30/08 (MM/DD/YY)	03:30 PM (Specify AM or PM)

LABORATORY ID #: 37729

CONTAM CODE	CONTAMINANT	METHOD CODE	REQUIRED REPORTING LIMIT (R.R.L.)	NOT DETECTED ABOVE R.R.L. (X)	QUANTIFIED RESULTS*	ALLOWABLE LIMIT
2066	3-Hydroxycarbofuran	531.1	0.004 mg/L	X	___ mg/L	N/A
2067	Heptachlor Epoxide	508.1	0.00002 mg/L	X	___ mg/L	0.0002 mg/L
2070	Dieldrin	508.1	0.0002 mg/L	X	___ mg/L	N/A
2076	Butachlor	508.1	0.008 mg/L	X	___ mg/L	N/A
2077	Propachlor	508.1	0.006 mg/L	X	___ mg/L	N/A
2105	2,4-D	515.1	0.0001 mg/L	X	___ mg/L	0.07 mg/L
2110	2,4,5-TP (Silvex)	515.1	0.0002 mg/L	X	___ mg/L	0.05 mg/L
2274	Hexachlorobenzene	508.1	0.0001 mg/L	X	___ mg/L	0.001 mg/L
2298	Di(2-ethylhexyl)phthalate	525.2	0.00132 mg/L	X	___ mg/L	0.006 mg/L
2306	Benzo(a)pyrene	525.2	0.00002 mg/L	X	___ mg/L	0.0002 mg/L
2326	Pentachlorophenol	515.1	0.00004 mg/L	X	___ mg/L	0.001 mg/L
2356	Aldrin	508.1	0.0002 mg/L	X	___ mg/L	N/A
2383	PCB's	508.1	0.0001 mg/L	X	___ mg/L	0.0005 mg/L
2440	Dicamba	515.1	0.001 mg/L	X	___ mg/L	N/A
2595	Metribuzin	508.1	0.0008 mg/L	X	___ mg/L	N/A
2931	DBCP	504.1	0.00002 mg/L	X	___ mg/L	0.0002 mg/L
2946	Ethylene Dibromide (EDB)	504.1	0.00001 mg/L	X	___ mg/L	0.00005 mg/L
2959	Chlordane	508.1	0.0002 mg/L	X	___ mg/L	0.002 mg/L

*Note: If result exceeds allowable limit, the laboratory must fax analytical results to the State within 48 hours.

	DATE:	TIME:
ANALYSES BEGUN:	11/03/08 (MM/DD/YY)	08:00 AM (Specify AM or PM)
ANALYSES COMPLETED:	11/10/08 (MM/DD/YY)	02:30 PM (Specify AM or PM)

Laboratory Log #: 24159

Certified By: Jim Pierce Jim Pierce (Print and sign name)

COMMENTS:

REPORT # 8-10204

Florida Radiochemistry Services, Inc.

5456 Hoffner Ave., Suite 201 Orlando, FL 32812
Phone: (407) 382-7733 Fax: (407- 382-7744

Radiological Analysis

New Well

Note: ALL information must be supplied for compliance credit

WATER SYSTEM ID #: ___ ___-___ ___-___ ___ **County:** Dare County

Name of Water System: New Well 5-4-6

Sample Type: ☐ Single Sample - Entry Point ☐ Composite Sample - Entry Point ☒ Special/Non-compliance

Facility ID No. ___ ___ ___

Sample Point: ___ ___ ___

Mail Results to (system representative): " " "

Environmental Chemist
6602 Windmill Way
Wilmington, NC 28405

Telephone:

Fax #: (___) ___________

Responsible Person's email: ___________

Collection Data

Period	Date (MM/DD/YY)	Time (Specify AM or PM)		Collected By
Single or 1st Qtr	10/31/05	3:30 PM		Sea-Crips[illegible]
2nd Qtr	__/__/__	__:__ __M		
3rd Qtr	__/__/__	__:__ __M		
4th Qtr	__/__/__	__:__ __M		

LABORATORY ID #: 12709 ☐ SAMPLE UNSATISFACTORY ☐ RESAMPLE REQUIRED

	Contaminant Code	Contaminant	Method Code	Required Reporting Limit (R.R.L.)	NOT Detected (i.e. <R.R.L.) (X)	Quantified Results*	Counting Error	Allowable Limit
X	4002	Gross Alpha	EPA 900.0	3 pCi/L	☒	___ pCi/L	2.1	15 pCi/L
	4004	Radon		100 pCi/L	☐	___ pCi/L	___	N/A
X	4006	Uranium	EPA 908.0	0.67 pCi/L	☒	___ pCi/L	0.4 **	20.1 pCi/L
	4010	Combined Radium	N/A	N/A	N/A	___ pCi/L	___	5 pCi/L
X	4020	Radium 226	EPA 903.1	1 pCi/L	☒	___ pCi/L	0.2	3 pCi/L
X	4030	Radium 228	EPA Ra-05	1 pCi/L	☒	___ pCi/L	0.5	2 pCi/L
X	4100	Gross Beta	EPA 900.0	4 pCi/L	☐	28.8 pCi/L	3.1	50 pCi/L

*Note: If result exceeds allowable limit, the laboratory must fax analytical results to the State within 48 hours.
**Note: Not applicable if using ICP-MS

	Date:	Time:
Analyses Begun:	11/18/08 (MM/DD/YY)	07:30 AM (Specify AM or PM)
Analyses Completed:	11/26/08 (MM/DD/YY)	15:16 PM (Specify AM or PM)

Laboratory Log #: 2459 0811088-01 Certified by: Mike Naumann / [signature]

Comments: ___________

8-10204

Laboratory should mail results to:
Public Water Supply Section, Attn: Data Entry, 1634 Mail Service Center, Raleigh, NC 27699-1634
Fax: 919-715-6637

envirochem
Environmental Chemists, Inc.
6602 Windmill Way • Wilmington, North Carolina 28405
(910) 392-0223 Phone • (910) 392-4424 Fax
EChemW@aol.com
NCDENR: DWQ Certificate #94, DLS Certificate #37729

BACTERIOLOGICAL ANALYSIS

Note: All appropriate information must be supplied for compliance credit.

WATER SYSTEM NO. ___ ___ - ___ ___ - ___ ___ ___ **County:** Dare County

Name of Water System: Skyco **System Type:** Test Well and Well #5

Sample Type: ☐ Routine ☐ Repeat ☐ Special/Non-compliance

Location Where Collected (MUST be collected in distribution system, not the wellhouse): _____

Facility ID No. (Distribution): D01

Sample Point: ☐ Routine Original (RTOR) ☐ Repeat–Original Tap (RPOR) ☐ Repeat-Upstream (RPUP) ☐ Repeat-Downstream (RPDN)

Location Code: _____

Collected By: Sean Coopsey (Please Print)

Collection Date (MM/DD/YY)	Collection Time (Specify AM or PM)
10/30/08	3:30, PM

Mail Results to (water system representative):

Skipper's Well Drilling

Phone #: (910) 371-2770

Fax #: (____) _____

Responsible Person's email: _____

Also Complete For *REPEAT* Samples:

Previous Positive Laboratory Log # _____

Previous Positive Location Code: ___ ___ ___

Positive Collection Date: ___ ___ / ___ ___ / ___ ___

If Chlorinated:

Total Chlorine Residual: _____ mg/L
Free Chlorine Residual: _____ mg/L
Combined Chlorine Residual: _____ mg/L
(Combined Chlorine = Total Chlorine minus Free Chlorine)

LABORATORY ID# 37729 ☐ Repeat Samples Required from Client ☐ Resample Required from Client

CONTAMINANT	METHOD CODE	RESULTS		
		PRESENT [1,2]	ABSENT	INVALID CODE [3]:
Total Coliform	SM 9223 B		X	
Fecal/E. coli				
Heterotrophic P.C.		_____ cfu/mL (number)		

INVALID CODES:

1) Confluent Growth/No Coliform Growth Found
2) TNTC/No Coliform Growth Found
3) Turbid Culture/ No Coliform Growth Found
4) Over 30 Hours Old

Notes: [1] If Total Coliform bacteria is present, the laboratory must fax analytical results to the State within 48 hours. [2] If Fecal/E. coli bacteria is present, the laboratory must fax analytical results to the State on day test completed. [3] Invalid code #5 should be accompanied by an explanation in the comments below.

	DATE:	TIME:
ANALYSES BEGUN:	10/31/08 (MM/DD/YY)	2:55, PM (Specify AM or PM)
ANALYSES COMPLETED:	11/01/08 (MM/DD/YY)	2:55, PM (Specify AM or PM)

Laboratory Log #: 24159 *Certified By:* J. Brock / g. Brock (Print and sign name)

COMMENTS: New well KIT

2008

Laboratory should Mail Results to:
Public Water Supply Section, Attn: Data Entry, 1634 Mail Service Center, Raleigh, NC 27699-1634
Fax: 919.715.6637

S-10204

(Jay Holley)

envirochem
Analytical & Consulting Chemists

Environmental Chemists, Inc.
6602 Windmill Way, Wilmington, North Carolina 28405
910•392•0223 phone 910•392•4424 fax Email: EChem@esi.com
NCDENR: DWQ Certificate #94; DLS Certificate #37729 01-15-03

COLLECTION SHEET FOR DRINKING WATER

Water System ID#: ____ - ____ - ____ County: ____

Name of System: Dare County Test well at well #5

Results to: Skippers Well Drilling Phone #: 371-2770 8-10204

State Requirements - w/additions Fax #: ____

Email or Cell #: ____

( ) Chlorinated
Free ____
Total ____

Requested Test/Method	Collection Date	Collection Time	Sample Type	Location Code	Treat.	Location Where Collected	Lab ID	Report No.
( )Nitrate ( ) Nitrite				24159				
(X)Inorganics, Regular ( ) New Well (X)								
(X)Trihalomethanes (THM) THM F.P. (7day)								
(X)Voc by EPA 502.2 or ( ) EPA 524.2								
(X)SOC *Check appropriate methods listed below:*								
(X)EPA Method 504 (EDB + DBCP)								
( )EPA Method 507 (N&P Compounds)								
(X)EPA Method 508 (Chlorinated Pesticides)								
(X)EPA Method 515 (Chlorinated Herbicides)								
(X)EPA Method 525.1 (Organic Compounds)								
(X)EPA Method 531.1 (Carbamates)								
(X)Other Radiological/Bacteria								
(X)Other Metals								

*Sample Type: (E=Entry Point; D=Distribution; M=Maximum; S=Special/Non-Compliance)

Collected by: Sean Cropsey (Skippers well Drilling Date: 10/30/08 Time: 3:30 pm

Relinquished by:	Date/Time: 10/31/08	Received By:	Date/Time: 10/31/08 8:00
Delivered By: Sean Cropsey	Received by:		Date/Time:

Temperature When Sampled: ____ Initials: ____ Temperature When Received: ____ Initials: ____