E-1.9

DLWD

FINAL WELL REPORT

EXLOG

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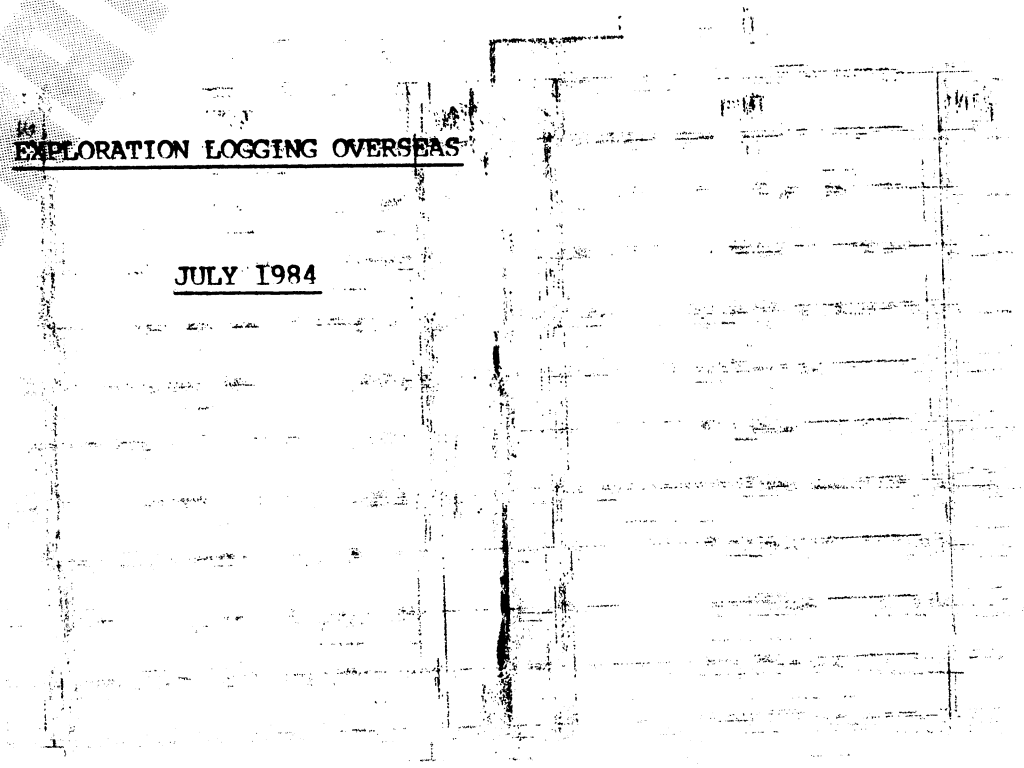


FINAL DLWD REPORT

STATOIL

WELL : 6406/3-1

NORWEGIAN NORTH SEA

7th MAY 1984 to 3rd JULY 1984

CONTENTS

WELL DATA SUMMARY

Operator:	Statoil
Well:	6406/3-1
Region:	Haltenbanken, Norwegian North Sea
Coordinates:	64 deg 44' 29.68" N 06 deg 49' 29.83" E
Spud Date:	27 April 1984
DLWD Start Date: End Date :	10 May 1984 3 July 1984
DLWD Start Depth: End Depth :	969m 4472m
RKB to Sea Level:	22m
Contractor:	Ross Drilling
Rig:	Ross Isle, Semi-submersible
Hole Size:	36" to 353m 26" to 962m 17-1/2" to 2177m 12-1/4" to 3775m 8-1/2" to 4498m
Casing Record:	30" at 352m 20" at 945m 13-3/8" at 2148m 9-5/8" at 3763m
Mud Type:	Seawater to 514m Gel/Seawater to 962m Gyp/Lignosulphonate to TD
DLWD Operators:	A. Higgins E. Doyle
Exlog Unit No.:	256

INTRODUCTION

In addition to Formation Evaluation and GEMDAS services Exlog provided a Downhole Logging While Drilling (DLWD) service in the 17 1/2", 12 1/4" and 8 1/2" hole section s of Statoil well 6406/3-1.

A total of 10 assemblies were used for 15 runs from 969m to 4472m. The tools provided information on gamma ray, formation resistivity, directional surveys, mud temperature and mud resistivity.

This report contains a summary of the DLWD logging runs together with plots of the gamma ray, formation resistivity and ROP. Also enclosed are data listings and plots of directional survey data recorded by the tool.

Interval Logged

No DLWD tools were run over the intervals 2177m to 2183m and 3775m to 3847m.

Directional Surveys

There were 98 good surveys taken by the tools, the first one being at a depth of 991m and the last at 4467m. These surveys were tied into the single shot results from 958m. Exlog uses the "Balanced Tangential" method of evaluating survey data. In determining the error in the wellbore position, if a "radius of uncertainty" is required rather than an "ellipse of uncertainty", the MAJOR AXIS data from the UNCERTAINTY RANGE column should be used. All azimuths have been corrected by 4 degrees West to allow for magnetic declination.

All surveys marked "D" in the survey listing were taken by the DLWD tool, and those marked as "S" by single shot surveys.

THE DLWD TOOL

The main component of the DLWD system is an instrumentation assembly housed in a special non-magnetic stainless steel drill collar. Including crossover subs the whole assembly is approximately 11m in length. The collars used on this well were 8" and 6.25" in diameter.

The assembly is placed in the drill string near the bit and is powered by the circulating drilling mud. The DLWD system is capable of measuring all of the following parameters :

1. Formation Resistivity - a 16" short normal tool. Stored/transmitted once each minute.
2. Gamma Ray - a scintillation counter provides data which is averaged downhole over one minute intervals. Stored/transmitted once each minute.
3. Directional Surveys - a solid state magnetometer/accelerometer array measures inclination, azimuth and tool face together with other parameters which enable the accuracy of the survey to be checked. Surveys may be taken whenever the mud pumps are restarted, for example after a connection. Operator-entered setpoints instruct the tool on whether to take a survey or not.
4. Mud Temperature - internal. Stored/transmitted sequentially.
5. Mud Resistivity - internal. Stored/transmitted sequentially.

The data is stored downhole in a Battery-backed Random Access Memory (BRAM) for later retrieval and transmitted to surface in real-time by means of a negative mud pulse telemetry system. This involves modulating the flow of mud through the drillstring by a valve and control mechanism mounted in the drill collar assembly near the bit. Valving mud from within the collar to the annulus creates negative pressure pulses inside the drillpipe which are transmitted to surface at a speed close to that of sound in mud. Since the transmission medium is the pressure field developed by the mud pumps data

cannot be transmitted when circulation stops.

Pulses are detected and decoded at the surface using equipment installed in Exlog's GEMDAS Xl units. The data is depth-correlated, merged with other parameters monitored, and stored for output as required. When the tool is returned to the surface the downhole memory (BRAM) is retrieved, cross-referenced and merged with real time data.

Field prints of all DLWD logs are provided at the wellsite to scales required by the client. Final masterlogs and data discs are presented at the end of each well.

LOG EVALUATION

17 1/2 INCH HOLE; 969m to 2177m

Two DLWD assemblies were run in this interval, both in BHAs which contained 95m of 9 1/2" drill collars and a stabilizer at 23m.

The first DLWD assembly was run from 969m, after the leak-off test. Apart from a period of 15 minutes, the tool pulsed data for the whole period of circulation. Only valid gamma ray data was transmitted throughout this run. At 1322m the formation resistivity sensor began to malfunction and erratic data was transmitted. This data has been retained on the final log because the general level and relative trend of the values were believed to be valid. From 1426m only offscale resistivity values were transmitted. The directional survey package failed at the last survey point at 1609m but prior to this 15 directional surveys were recorded. The mud temperature and mud resistivity sensors failed after 30.6 and 25.6 hours of circulation respectively. Total circulation time for this run was 33.3 hours and a lithology of claystone with minor sand and siltstone produced gamma ray values of 55 to 70 API and resistivities of 1.5 to 1.7 ohm-m. Possible Pliocene-Miocene boundary was at about 1480m.

This DLWD tool was laid out at the bit change at 1609m, and a new tool was run in the same BHA and transmitted data for 88.7 of 88.9 hours of circulation, with the pulser again stopping for a period of 18 minutes during the run. The formation resistivity and directional sensors operated throughout the run but towards the end of the run the gamma ray began to give occasional offscale values although only 2.5% of the data was lost because of this malfunction. The lithology was mainly claystone, with some siltstone from 1800m. Gamma ray showed a general decrease from 70-80 API to 40-50 API over the interval and formation resistivity decreased from around 1.2 to 0.35 ohm-m.

The drilling assembly was pulled at 2177m to run the 13 3/8" casing.

Despite the failures of some of the sensors the formation data for the 1208m of 17 1/2" hole was generally complete, the only big gap being 178m of formation resistivity data. Directional data for this hole section was complete, and it was unnecessary to run single shot surveys. A total of 29 directional surveys were recorded, at intervals of approximately 50m. Maximum hole angle was 1.3 deg although hole direction varied greatly.

The formation resistivity data compared favourably with that recorded by the wireline logging but no comparison could be made with the wireline gamma ray log as the wireline values were badly affected by the hole wash-outs and the high barite content in the 1.70 gm/cc mud.

The data retrieved from the downhole memory was complete for both runs and agreed closely with the transmitted data.

12 1/4 INCH HOLE; 2177m to 3775m

DLWD tools were run continuously from 2183m to 3775m, involving 5 runs using four assemblies. Of the 1598m of formation logged, 236m of resistivity data (14.8%) and 223m of gamma ray data (14%) were lost due to tool malfunctions.

The first run in this section of hole was from 2183m. After drilling 6m of new formation for the leak-off test, the tool was run in a normal rotary BHA. Apart from a period of 10 minutes the tool pulsed valid data throughout the run. Gamma ray in this predominantly claystone lithology was between 30 and 60 API with a peak of 133 API in a limestone at 2410m. Formation resistivity ranged from 0.5 to 2.7 ohm-m and again the peak was in the limestone.

The assembly was re-run from 2717m and transmitted valid data for 30.8 hours. It did not pulse for the first 1.5 hours of circulation and towards the end of the run there was only intermittent data transmission. The

lithology was again mainly claystone, with gamma ray of 45-55 API and resistivities of 1.1 to 2.0 ohm-m, showing a slight increase through the section.

The assembly was pulled at 2932m but the downhole memory was found to be corrupted and no data was recovered for the periods of non-pulsing. When the tool was returned to the service base the problems were traced to a faulty voltage regulator.

A new DLWD tool was picked up and run behind a three stage 9 1/2 inch Christensen turbine. The tool pulsed data for 50.1 hours out of a total circulation time of 94.7 hours. The pulses became weaker after 40 hours of circulation and then pulsing became sporadic. All sensors except the mud temperature provided valid data. Gamma ray values of 50-65 API and resistivities of 1.1-2.0 ohm-m were seen in the silty claystone lithology.

The assembly was pulled at 3262m for a bit change, the DLWD tool was laid out and the downhole memory accessed. Again this was found to be corrupted and only 25m of extra data were recovered.

The new assembly was again run behind a turbine and the pulser operated normally for the entire 141.5 hours of circulation. However, three of the sensors failed after 90.8 hours and the gammma ray failed after 94.5 hours. At 3739m this assembly was pulled to lay down the turbine. The tool memory was full after approximately 70 hours of circulation so no data other than that transmitted was recovered. The data obtained again showed little variation, with gamma ray values of 60-70 API and formation resistivities of 1-2 ohm-m in shaly or silty claystone with some thin marls.

A new tool was picked up for the final run in the 12 1/4" hole. Before drilling ahead the intention was to ream through a section from 3640m to 3740m in order to log the Kimmeridge for depth correlation but the pulser failed to function and the reaming was abandoned. After 1.5 hours of circulation the tool began to transmit data and operated normally until

the end of the run. After drilling to 3775m the section between 3637m and 3717m was reamed through and logged, hole was conditioned and the assembly was pulled in order to run wireline logs.
This was the last tool run in this section of hole and the 9 5/8 inch casing was set at 3769m.

The DLWD resistivity and gamma ray log values compared very closely with those recorded by the wireline logs.

A total of 33 directional surveys were recorded in this section of hole. The initial surveys from 2185m gave inclinations greater than 2.0 degrees indicating that the hole had begun to kick-off after drilling out the cement below the 13 3/8" casing. Values less than 1.5 deg were seen from 2324m onwards. A single shot survey taken at 3705m agreed closely with DLWD figures.

8 1/2"m HOLE : 3775m to 4498m

The 9 5/8" casing was set at 3769m, 8m of new formation were drilled and a 2.5 cu.m. kick taken at 3783m. Three cores were cut from 3783m to 3847m and wireline logs run over this interval before the first 6 1/4" DLWD tool was run with bit #18 on 22 June. High torque fluctuations made data decoding difficult but good data was being transmitted when the bit was pulled at 3857m. The tool was re-run but pulsed only sporadically and high torque caused pressure surges which made decoding impossible. The bit was pulled at 3862m to put a roller reamer in the BHA and the DLWD tool was laid down but internal memory could not be retrieved at the well-site.

DLWD run 10 logged the interval 3862m to 4043m with all main sensors operating. Formation resistivity ranged from 0.6 to 17 ohm-m and gamma ray from 27 to 100 API in a sandstone, with a thick coal between 3910m and 3932m and some silty claystone stringers and kaolinite.

A trip was made at 4043m to fish for a cone and the tool was then re-run with a junk sub added above the bit. Good data was transmitted during the 4 hours circulating and the bit pulled at 4051m.

The tool was fully tested at the surface prior to run 12 because of a possible fault in the formation resistivity circuitry but all sensors tested successfully and the same BHA was re-run. Gamma ray and directional surveys worked throughout the run, to 4121m, but the formation resistivity, despite having worked during the surface test, transmitted only off-scale values for the first 18.6 hours of the circulating time and then provided reasonable data for the last hour.

DLWD directional surveys showed that the hole angle had built up from 0.15 deg at 3858m to 5.15 deg at 4116m so a trip was made at 4121m to change from a stiff BHA to a pendulum-type. With the bottom stabiliser 10m above the DLWD tool there was some chance of serious damage to the tool so it was decided to re-run the same one in spite of the unreliability of the formation resistivity. In fact this sensor provided data for 9.3 of the 21.6 circulating hours although most of this data cannot be trusted. Three surveys taken during this run showed that the hole angle had dropped back to 4.9 deg, this same figure also obtained by a single shot survey at 4167m.

The assembly was tripped out at 4181m, a new DLWD tool picked up and a stiff BHA made up again. A surface test showed the tool to be fully operational and good data were obtained from all the main sensors for the whole of the pulsing time. The tool logged the section from 4160m to check the suspect resistivity of the previous run and values of 4-5 ohm-m were seen compared with less than 1 ohm-m previously.

The tool stopped transmitting for no apparent reason after 20.6 hours circulating, restarted 5.5 hours later and then stopped again after an attempt to take a survey at 4385m. The last survey taken on this run gave a deviation of 9.46 deg due north, at 4369m, having increased from 6 deg

at 4180m.

The tool was laid down at 4414m, the BHA changed back to a pendulum-type and a new tool picked up. The gamma ray sensor failed after 3.2 hours and formation resistivity after 3.7 hours although pulsing continued to the end of the run, through a sandstone and coal lithology. DLWD surveys showed that the hole angle was dropping from 9.2 deg to 7.3 deg whilst holding the northerly direction. When at the surface the electrode assembly of the tool was seen to be badly worn and one of the two resistivity electrodes was missing. It was intended to re-run the tool for directional survey information but after a full set of Bram was retrieved it was not possible to communicate with the tool electronics in order to set it up for the next run, presumably because of vibrational damage, so the tool was laid down. The tool used for the previous run had been dropped when it was being laid down and was unusable, therefore the last bit run in this section of hole was made without a DLWD tool in the BHA.

A total of 34 directional surveys were recorded during the drilling of the 8 1/2" hole section, showing a continual increase in hole angle throughout, whilst the direction swung around from west to north.

RUN SUMMARY AND PROBLEMS

1. Fifteen runs were made using ten assemblies.

2. DLWD gamma ray and formation resistivity data generally showed good correlation with conventional wireline logging.

3. Directional survey data was accurate.

4. In all cases data retrieved from the tools downhole memory (BRAM) was identical to that transmitted, except for runs 2,4,6 and 13 where the BRAM memory capacity was full.

5. No tools were run from 2177 to 2183m because this assembly was used to drill out the 13-3/8" casing shoe. Similarly no tools were run over the interval from 3775m to 3847m as this section was cored.

6. Complete data was pulsed on seven of the runs and overall 88% of the data was pulsed and decoded on surface. As a percentage of the logged interval 81% gamma ray, 74% formation resistivity and 82% directional survey data was obtained.

The following is a breakdown of individual tool failures:

Run 1 - Assembly 96

There were no pulses for 15 minutes soon after circulation commenced, thereafter the tool worked well but there was no data in BRAM for this period. Gamma ray data was good throughout the run but formation resistivity failed after 17.9 hours of circulating resulting in a loss of 178m of resistivity data. The cause of this was later found to be due to electrical shorting of the sensor. This was possibly caused by excessive vibration.

Run 4 - Assembly 99

An 18% loss of data was incurred during this run. Data transmission and decoding was good but the tool stopped pulsing several times towards the end of the run. It was not possible to fill these gaps in the data as the BRAM downhole memory was full before this section was logged. No reason was found for the intermittent pulsing towards the end of the run.

Run 5 - Assembly 97

During run 5 the tool pulsed for 50.1 hours out of 94.7 hours circulating. Pulsing became sporadic towards the end of the run. When the tool was returned to the service base the problem was found to be caused by a voltage regulator failure. Consequently BRAM was corrupted and it was not possible to fill these gaps with data from the downhole memory.

Run 6 - Assembly 100

During this run the tool pulsed continuously, however after 90.8 hours all instruments apart from gamma ray ceased to operate. Some 3.7 hours later the gamma ray module failed also. As the downhole memory was full it was not possible to retrieve any of the lost data. It was later found that a capacitor failure on the formation resistivity PCBA shorted out the 15 volt power supply. This led to a loss of all instrumentation.

Run 7 - Assembly 104

No pulses were seen for the first 90 minutes of circulation, thereafter the tool functioned without any further problems. The 90 minute section of non pulsed data was later filled using data from BRAM. After drilling to 3775m a short trip was made to 3630m. The well was then reamed from 3637m to 3717m in order to log the top of the Kimmeridge Formation.

Run 9 - Assembly 108

This tool pulsed very weakly while reaming to bottom, once on bottom the tool did not pulse at all. When the tool was returned to the service base it was found that a fuse had blown on the regulator which activates the pulser solenoid. A full set of data was retrieved from the tools downhole memory and used on the final log.

Runs 12 & 13 - Assembly 109

Full gamma ray and directional survey data was obtained on this run, however formation resistivity was offscale for all but the last hour of drilling. It was decided to re-run the same tool for run 13 where a pendulum assembly replaced a stiff assembly with the bottom stabiliser 10m above the DLWD tool. This tool was re-run despite the unreliable formation resistivity as this assembly configuration may have caused damage to the tool. In fact this sensor provided data for 9.3 of the 21.6 circulating hours although this was found to be unreliable. When the tool was returned to the service base a section of the formation resistivity sensor was found to be damaged and exhibiting mud invasion.

Run 14 - Assembly 111

This tool was used to ream from 4160m to 4181m to log part of the section missed on the previous run. Good data was pulsed and decoded apart from two periods of 5.5 and 4 hours duration respectively. Data for the first period was retrieved from BRAM but there was a gap in the tool's memory for the second of no pulsing. The latter suggests that the turbine mechanism of the down-hole power generation system was jammed after the pipe became stuck for 10 minutes prior to the second period of no pulsing.

Run 15 - Assembly 115

Formation resistivity and gamma ray worked for 3.7 and 3.2 hours respectively out of 21.2 circulating hours. When the tool was at surface the downhole memory was found to contain 3.7 and 3.2 hours respectively of resistivity and gamma ray data although there was a full set of survey data. When the tool was returned to the service base the photo multiplier tube on the gamma ray module was found to be faulty, and there was a faulty oscillator within part of the resistivity instrumentation.

No more DLWD tools were run on this well.

APPENDIX A: OPERATING HOURS TABLE

Run No	Assy No	Depth in	Depth out	HOURS down	HOURS circ	HOURS drill	HOURS FR	HOURS GR	HOURS DSP	HOURS MT	HOURS MR	HOURS pulse	HOURS BRAM	% OF CIRCULATING HOURS FR	% GR	% DSP	% MT	% MR	% pls	% BRM	
17-01	96	969	1609	43.4	33.3	29.2	17.9	33.1	25.6	30.6	25.6	33.1	33.1	54	99	77	92	77	99	99	
17-02	87	1609	2177	119.7	88.9	33.7	88.7	88.7	88.7	0	0	88.7	70.0	99	99	99	0	0	99	78	*
17-03	99	2183	2717	72.3	53.6	32.2	53.4	53.4	53.4	0	53.4	53.4	53.4	99	99	99	0	99	99	99	
17-04	99	2717	2932	58.2	37.7	28.4	30.8	30.8	30.8	0	0	30.8	20.0	82	82	82	0	0	82	53	*
17-05	97	2932	3262	109.0	94.7	85.2	50.1	50.1	50.1	0	50.1	50.1	60.0	53	53	53	0	53	53	63	
17-06	100	3262	3740	174.6	141.5	129.2	90.8	94.5	90.8	0	90.8	141.5	70.0	64	67	64	0	64	100	50	*
17-07	104	3740	3775	32.1	17.2	12.4	17.2	17.2	17.2	0	12.4	15.7	17.2	100	100	100	0	72	91	100	
17-08	108	3847	3857	15.0	5.9	4.6	5.9	5.9	5.9	5.9	5.9	5.9	5.9	100	100	100	100	100	100	100	
17-09	108	3857	3862	20.3	12.1	10.9	0.0	12.1	12.1	12.1	12.1	0.0	12.1	100	100	100	100	100	0	100	
17-10	109	3862	4043	54.0	46.1	43.7	46.1	46.1	46.1	0.0	46.1	46.1	46.1	100	100	100	0	100	100	100	
17-11	109	4043	4051	16.8	4.0	2.7	4.0	4.0	4.0	0.0	0.0	4.0	4.0	100	100	100	0	0	100	100	
17-12	109	4051	4121	28.0	19.6	17.9	1.0	19.5	19.6	0.0	19.6	19.6	19.6	5	99	100	0	100	100	100	
17-13	109	4121	4181	31.3	21.6	19.5	9.3	21.4	21.6	0.0	21.6	21.6	0.5	43	99	100	0	100	100	2	*
17-14	111	4181	4414	63.0	50.5	42.7	46.5	46.5	46.5	0.0	46.5	41.0	46.5	92	92	92	0	92	81	92	
17-15	115	4414	4472	31.8	21.2	18.6	3.7	3.2	21.2	18.8	21.2	21.2	21.2	17	15	100	89	100	100	100	
TOTALS FOR ALL RUNS				869.2	647.9	510.9	477.5	526.5	533.6	67.4	405.3	572.7	479.1	74	81	82	10	63	88	74	

* Downhole Memory full, capacity approx 70hrs.

DIRECTIONAL SURVEY LISTING FOR WELL INDEX # 1: STATOIL 6406/3-1

DLWD AND CONVENTIONAL SURVEY DATA

SURVEYS STARTED ON 1 MAY 84, AT DEPTH = 347 m FROM KB. LAST SURVEY # 103 AT MD = 4467.0 m

---DEPTHS ARE MEASURED RELATIVE TO KB AT 22 m ABOVE MEAN SEA LEVEL---

	READINGS					ANALYSIS (CONFIDENCE LEVEL = 99.0%)							
	SVY #	DEPTH	COURSE LENGTH	INCL. ANGLE	AZIMUTH ANGLE	DOGLEG deg/100m	VERTICAL DEPTH	--POSITION-- NORTH	EAST	---UNCERTAINTY RANGE--- VERT	MAJOR	MINOR	AXIS
S	1	347.0	0.0	.50	348.00	0.00	347.0	0	0	0.0	.2	.2	0
S	2	958.0	611.0	.50	51.00	.08	958.0	4	2	.1	2.4	1.8	39
D	3	991.0	33.0	1.30	175.00	4.94	991.0	4	2	.1	2.5	1.8	39
D	4	1018.0	27.0	.90	166.00	1.59	1018.0	3	2	.1	2.5	1.8	39
D	5	1047.0	29.0	.60	143.00	1.42	1047.0	3	2	.1	2.5	1.8	39
D	6	1077.0	30.0	.70	202.00	2.14	1077.0	3	2	.1	2.5	1.8	39
D	7	1105.0	28.0	.60	209.00	.37	1105.0	3	2	.1	2.5	1.8	39
D	8	1135.0	30.0	.40	220.00	.69	1135.0	2	2	.1	2.5	1.9	39
D	9	1182.0	47.0	.30	141.00	.94	1182.0	2	2	.1	2.5	1.9	39
D	10	1230.0	48.0	.10	323.00	.82	1230.0	2	2	.1	2.5	1.9	39
D	11	1278.0	48.0	.30	180.00	.38	1278.0	2	2	.1	2.5	1.9	39
D	12	1325.0	47.0	.20	31.00	1.01	1325.0	2	2	.1	2.5	1.9	39
D	13	1374.0	49.0	.40	329.00	.37	1374.0	2	2	.1	2.5	1.9	40
D	14	1421.0	47.0	.60	270.00	1.10	1421.0	2	1	.1	2.5	1.9	39
D	15	1468.0	47.0	.70	309.00	.93	1468.0	2	1	.1	2.5	1.9	39
D	16	1514.0	46.0	.70	287.00	.56	1513.9	3	0	.1	2.5	1.9	39
D	17	1561.0	47.0	.50	333.00	1.06	1560.9	3	-0	.1	2.5	1.9	40
D	18	1606.0	45.0	.90	53.00	2.10	1605.9	3	0	.1	2.5	1.9	40
D	19	1656.0	50.0	.70	46.00	.42	1655.9	4	1	.1	2.5	1.9	40
D	20	1704.0	48.0	1.30	346.00	2.34	1703.9	4	1	.1	2.5	1.9	40
D	21	1733.0	29.0	1.10	290.00	3.92	1732.9	5	0	.1	2.5	2.0	40
D	22	1760.0	27.0	1.10	222.00	4.55	1759.9	5	-0	.1	2.5	2.0	40
D	23	1808.0	48.0	.40	160.00	2.03	1807.9	4	-0	.1	2.5	2.0	40
D	24	1857.0	49.0	.50	274.00	1.54	1856.9	4	-0	.1	2.5	2.0	40
D	25	1904.0	47.0	.50	208.00	1.14	1903.9	4	-1	.1	2.5	2.0	40
D	26	1952.0	48.0	.40	61.00	1.79	1951.9	4	-1	.1	2.5	2.0	40
D	27	1999.0	47.0	.80	179.00	2.22	1998.9	4	-1	.1	2.5	2.0	40
D	28	2046.0	47.0	1.30	189.00	1.12	2045.9	3	-1	.1	2.6	2.0	40
D	29	2057.0	11.0	.50	12.00	16.35	2056.9	3	-1	.1	2.6	2.0	40
D	30	2114.0	57.0	1.20	205.00	2.96	2113.9	2	-1	.1	2.6	2.0	40
D	31	2161.0	47.0	.70	311.00	3.29	2160.9	2	-1	.1	2.6	2.0	40
D	32	2185.0	24.0	2.61	274.00	8.72	2184.9	2	-2	.1	2.6	2.0	40
D	33	2194.0	9.0	2.29	275.00	3.52	2193.9	2	-2	.1	2.6	2.0	40
D	34	2223.0	29.0	2.12	273.00	.59	2222.8	2	-3	.1	2.6	2.0	40
D	35	2280.0	57.0	2.02	275.00	.17	2279.8	3	-5	.1	2.6	2.0	40
D	36	2324.0	44.0	1.70	297.00	1.76	2323.8	3	-7	.1	2.6	2.0	39
D	37	2336.0	12.0	1.54	287.00	2.63	2335.8	3	-7	.1	2.6	2.0	39
D	38	2385.0	49.0	.75	236.00	2.48	2384.8	3	-8	.1	2.6	2.0	39
D	39	2432.0	47.0	1.10	276.00	1.51	2431.8	3	-9	.1	2.6	2.0	39
D	40	2479.0	47.0	.92	272.00	.38	2478.7	3	-10	.1	2.6	2.0	39
D	41	2528.0	49.0	.50	280.00	.86	2527.7	3	-10	.1	2.6	2.1	39
D	42	2575.0	47.0	.69	271.00	.41	2574.7	3	-11	.1	2.6	2.1	39
D	43	2622.0	47.0	.55	248.00	.58	2621.7	3	-11	.1	2.6	2.1	39
D	44	2670.0	48.0	.74	262.00	.49	2669.7	3	-12	.1	2.6	2.1	39
S	45	2704.0	34.0	.75	250.00	.40	2703.7	3	-12	.1	2.6	2.1	39

DIRECTIONAL SURVEY LISTING FOR WELL INDEX # 1: STATOIL 6406/3-1

DLWD AND CONVENTIONAL SURVEY DATA

SURVEYS STARTED ON 1 MAY 84, AT DEPTH = 347 m FROM KB. LAST SURVEY # 103 AT MD = 4467.0 m

---DEPTHS ARE MEASURED RELATIVE TO KB AT 22 m ABOVE MEAN SEA LEVEL---

	READINGS					ANALYSIS (CONFIDENCE LEVEL = 99.0%)							
	SVY #	DEPTH	COURSE LENGTH	INCL. ANGLE	AZIMUTH ANGLE	DOGLEG deg/100m	VERTICAL DEPTH	--POSITION-- NORTH	EAST	---UNCERTAINTY RANGE--- VERT	MAJOR	MINOR	AXIS
D	46	2713.0	9.0	.94	256.00	2.18	2712.7	3	-12	.1	2.6	2.1	39
D	47	2756.0	43.0	.89	254.00	0.00	2755.7	3	-13	.1	2.6	2.1	39
D	48	2804.0	48.0	.71	277.00	.74	2803.7	2	-14	.1	2.6	2.1	39
D	49	2851.0	47.0	.69	279.00	0.00	2850.7	3	-14	.1	2.6	2.1	39
D	50	2902.0	51.0	.26	268.00	.84	2901.7	3	-15	.1	2.6	2.1	39
D	51	2943.0	41.0	1.00	307.00	1.98	2942.7	3	-15	.1	2.7	2.1	39
D	52	2981.0	38.0	.35	347.00	2.01	2980.7	3	-15	.1	2.7	2.1	39
D	53	3000.0	19.0	.58	327.00	1.41	2999.7	3	-15	.1	2.7	2.1	39
D	54	3067.0	67.0	.36	17.00	.65	3066.7	4	-15	.1	2.7	2.1	40
D	55	3174.0	107.0	.70	86.00	.62	3173.7	4	-15	.1	2.7	2.2	40
D	56	3248.0	74.0	.90	163.00	1.36	3247.7	4	-14	.1	2.7	2.2	39
D	57	3306.0	58.0	.60	325.00	2.55	3305.7	3	-14	.1	2.7	2.2	39
D	58	3334.0	28.0	1.22	86.00	5.76	3333.7	4	-14	.1	2.7	2.2	39
D	59	3372.0	38.0	1.01	175.00	4.13	3371.7	3	-13	.1	2.7	2.2	39
D	60	3420.0	48.0	1.31	102.00	2.91	3419.7	3	-13	.1	2.7	2.2	39
D	61	3467.0	47.0	1.27	98.00	.13	3466.7	3	-12	.1	2.7	2.2	39
D	62	3516.0	49.0	1.17	45.00	2.22	3515.6	3	-11	.1	2.7	2.2	39
D	63	3565.0	49.0	1.42	85.00	1.86	3564.6	3	-10	.1	2.8	2.2	38
D	64	3653.0	88.0	.49	91.00	1.06	3652.6	3	-8	.1	2.8	2.2	38
D	65	3690.0	37.0	.45	80.00	.15	3689.6	3	-8	.1	2.8	2.2	38
S	66	3705.0	15.0	.50	102.00	1.13	3704.6	3	-8	.1	2.8	2.2	38
D	67	3716.0	11.0	.45	60.00	3.04	3715.6	3	-8	.1	2.8	2.2	38
D	68	3769.0	53.0	.30	129.00	.82	3768.6	3	-8	.1	2.8	2.3	38
D	69	3852.0	83.0	.43	101.70	.24	3851.6	3	-7	.1	2.8	2.3	37
D	70	3858.0	6.0	.15	21.80	6.99	3857.6	3	-7	.1	2.8	2.3	37
D	71	3867.0	9.0	.24	205.00	0.00	3866.6	3	-7	.1	2.8	2.3	37
D	72	3897.0	30.0	.22	138.00	0.00	3896.6	3	-7	.1	2.8	2.3	37
D	73	3917.0	20.0	.39	174.00	.77	3916.6	3	-7	.1	2.8	2.3	37
D	74	3945.0	28.0	.94	278.00	3.93	3944.6	3	-7	.1	2.8	2.3	37
D	75	3973.0	28.0	1.52	293.00	2.33	3972.6	3	-8	.1	2.8	2.3	37
D	76	4002.0	29.0	2.27	308.00	3.07	4001.6	4	-9	.1	2.8	2.3	37
D	77	4011.0	9.0	2.37	318.00	4.56	4010.6	4	-9	.1	2.8	2.3	37
D	78	4030.0	19.0	2.63	318.00	1.32	4029.6	4	-10	.1	2.8	2.3	37
D	79	4038.0	8.0	2.44	315.00	2.80	4037.6	5	-10	.1	2.8	2.3	37
D	80	4068.0	30.0	3.75	319.00	4.42	4067.5	6	-11	.1	2.8	2.3	37
D	81	4097.0	29.0	4.40	323.00	2.44	4096.4	7	-12	.1	2.8	2.3	37
D	82	4116.0	19.0	5.15	321.00	4.03	4115.4	9	-13	.1	2.8	2.3	37
D	83	4125.0	9.0	4.76	316.00	6.43	4124.3	9	-14	.1	2.8	2.3	37
D	84	4143.0	18.0	4.93	318.00	1.28	4142.3	10	-15	.1	2.8	2.3	37
D	85	4153.0	10.0	4.90	322.00	3.38	4152.2	11	-15	.1	2.8	2.3	37
S	86	4167.0	14.0	4.90	325.00	1.79	4166.2	12	-16	.1	2.8	2.3	37
D	87	4180.0	13.0	6.02	336.00	11.75	4179.1	13	-17	.1	2.8	2.3	37
D	88	4189.0	9.0	6.01	336.00	0.00	4188.1	14	-17	.1	2.8	2.3	37
D	89	4199.0	10.0	7.70	349.00	22.83*	4198.0	15	-17	.1	2.8	2.3	37
D	90	4208.0	9.0	7.40	344.00	8.01	4206.9	16	-18	.1	2.8	2.3	37

DIRECTIONAL SURVEY LISTING FOR WELL INDEX # 1: STATOIL 6406/3-1

DLWD AND CONVENTIONAL SURVEY DATA

SURVEYS STARTED ON 1 MAY 84, AT DEPTH = 347 m FROM KB. LAST SURVEY # 103 AT MD = 4467.0 m

---DEPTHS ARE MEASURED RELATIVE TO KB AT 22 m ABOVE MEAN SEA LEVEL---

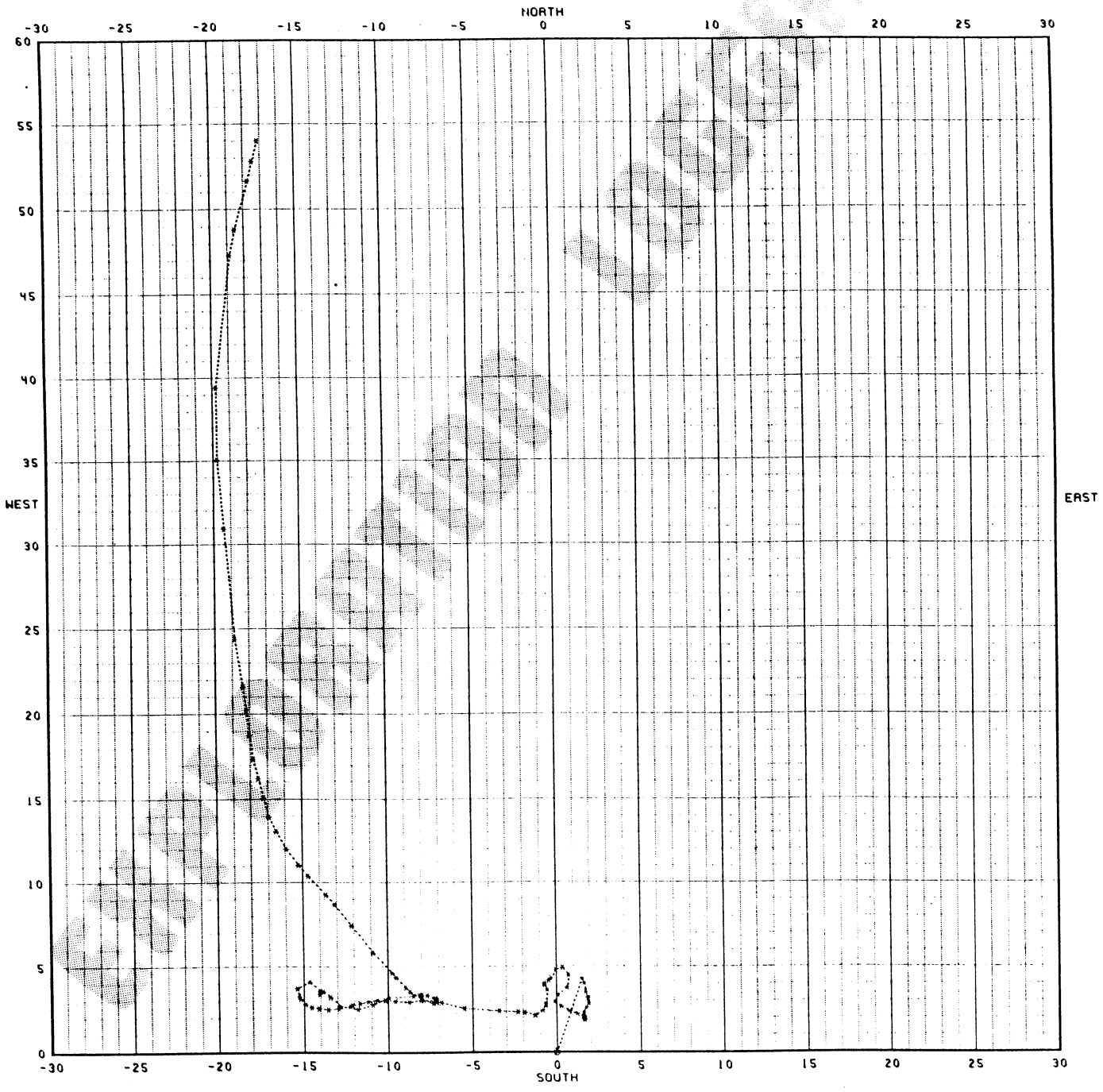
	READINGS				ANALYSIS (CONFIDENCE LEVEL = 99.0%)							
	SVY #	DEPTH	COURSE LENGTH	INCL. ANGLE	AZIMUTH ANGLE	DOGLEG deg/100m	VERTICAL DEPTH	--POSITION-- NORTH	EAST	---UNCERTAINTY RANGE--- VERT	MAJOR	MINOR	AXIS
D	91	4217.0	9.0	7.64	347.00	5.08	4215.8	17	-18	.1	2.8	2.3	37
D	92	4227.0	10.0	8.49	354.00	12.96	4225.7	19	-18	.1	2.8	2.3	37
D	93	4237.0	10.0	8.69	355.00	2.45	4235.6	20	-18	.1	2.8	2.3	37
D	94	4246.5	9.5	7.72	347.00	15.74	4245.0	22	-18	.1	2.8	2.3	37
D	95	4267.0	20.5	8.31	355.00	6.14	4265.3	24	-19	.1	2.8	2.3	37
D	96	4312.5	45.5	8.28	355.00	0.00	4310.4	31	-19	.1	2.8	2.3	37
D	97	4341.0	28.5	8.49	355.00	.72	4338.6	35	-20	.1	2.8	2.3	37
D	98	4369.0	28.0	9.46	4.20	6.17	4366.2	39	-20	.1	2.8	2.3	36
D	99	4418.0	49.0	9.20	9.00	1.67	4414.6	47	-19	.1	2.8	2.3	36
D	100	4428.0	10.0	8.80	16.00	11.64	4424.4	49	-19	.1	2.8	2.3	36
D	101	4448.0	20.0	7.91	15.30	4.47	4444.2	52	-18	.1	2.8	2.3	36
S	102	4457.0	9.0	7.25	14.00	7.56	4453.1	53	-17	.1	2.8	2.3	36
D	103	4467.0	10.0	7.20	14.00	0.00	4463.1	54	-17	.1	2.8	2.3	36

PLAN VIEW PLOT FOR WELL INDEX # 1: STATOIL 6406/3-1

SURVEYS STARTED ON 1 MAY 84 AT DEPTH = 347 M FROM KB. LAST SURVEY # 103 AT MD = 4467 M
DLWD AND CONVENTIONAL SURVEY DATA

--DEPTHS ARE MEASURED RELATIVE TO KB AT 22 M ABOVE MEAN SEA LEVEL--

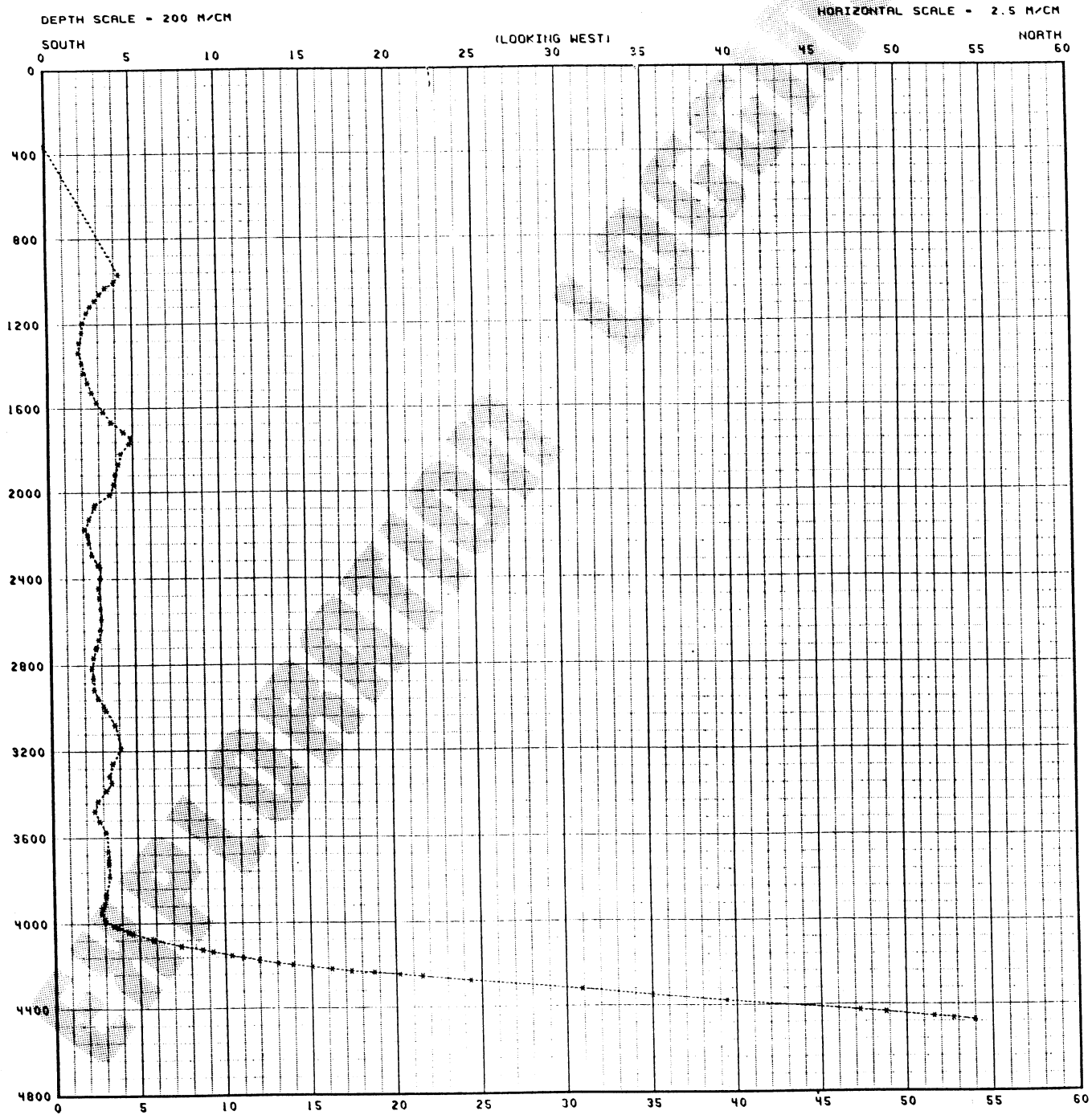
PLOT SCALE = 2.5 M/CM



ELEVATION VIEW PLOT FOR WELL INDEX # 1: STATOIL 6406/3-1

SURVEYS STARTED ON 1 MAY 84 AT DEPTH = 347 M FROM KB. LAST SURVEY # 103 AT MD = 4467 M
DLWD AND CONVENTIONAL SURVEY DATA

--DEPTHS ARE MEASURED RELATIVE TO KB AT 22 M ABOVE MEAN SEA LEVEL--



ELEVATION VIEW PLOT FOR WELL INDEX # 1: STATOIL 6406/3-1

SURVEYS STARTED ON 1 MAY 84 AT DEPTH = 347 M FROM KB. LAST SURVEY # 103 AT MD = 4467 M
DLWD AND CONVENTIONAL SURVEY DATA

--DEPTHS ARE MEASURED RELATIVE TO KB AT 22 M ABOVE MEAN SEA LEVEL--

DEPTH SCALE = 200 M/CM

HORIZONTAL SCALE = 1.0 M/CM