



Copyright © 2003 by Epoch Well Services, Inc.

Houston, TX
(281) 784-5500
Bakersfield, CA
(661) 328-1595
New Iberia, LA
(337) 364-2322
Anchorage, AK
(907) 561-2465

Geothermal Formation Log

COMPANY Coso Operating Co.

WELL BLM North 33A-7

FIELD Coso Geothermal

REGION Coso Mountains

COORDINATES

ELEVATION

COUNTY, STATE Inyo, California

API INDEX NA

SPUD DATE 12/20/2009

CONTRACTOR Kenai Drilling, U.S.A

CO. REP.

RIG/TYPE Kenai #6/Rotary Triple

LOGGING UNIT ML039

GEOLOGISTS Matt Uddenberg

Josiah Failing

ADD. PERSONS Marquel Mosebay

Rosalba Queirolo

CO. GEOLOGIST Mike Krahmer

LOG INTERVAL

DEPTHS: 100' **TO** 11,574'

DATES: 12/20/2009 **TO** 3/25/2010

SCALE: 2" = 100'

CASING DATA

20" **AT** 807'

13 3/8" **AT** 4041'

9 5/8" **AT** 7024'

7" **AT**

HOLE SIZE

26" **TO** 817'

17 1/2" **TO** 4061'

12 1/4" **TO** 7030'

8 1/2" **TO** 11,574'

MUD TYPES

SPUD/GEL **TO** 817'

GEL/Bentonite **TO** 11,574'

ABBREVIATIONS

NB NEWBIT

RRB RERUN BIT

CB CORE BIT

WOB WEIGHT ON BIT

RPM ROTARY REV/MIN

PP PUMP PRESSURE

SPM STROKES/MIN

PR POOR RETURNS

LAT LOGGED AFTER TRIP

LC LOST CIRCULATION

CO CIRCULATE OUT

NR NO RETURNS

TG TRIP GAS

WG WIPER GAS

CG CONNECTION GAS

	ALTERED ZONE		DIORITE		PYRITE
	ANDESITE		DOLOSTONE		PYROCLASTICS
	ANHYDRITE		FELSIC SILIC DIKE		QUARTZ DIORITE
	BASALT		GABBRO		QUARTZ LATITE
	BRECCIA		GLASSY TUFF		QUARTZ MONZONITE
	CALCAREOUS TUFF		GRANITE		RECRYSTALLIZED CALCITE
	CALCILUTITE		GRANITE WASH		RHYOLITE
	CARBONATES		GRANODIORITE		SAND
	CARBONACEOUS MAT		GYPSUM		SANDSTONE
	CARBONACEOUS SH		HALITE		SANDSTONE-TUFFACEOUS
	CEMENT CONTAM.		HORNBL-QTZ-DIO		SERPENTINE
	CRYSTALLINE TUFF		INTRUSIVES		SHALE
	CHERT - UNDIFF		LIMESTONE		SHALE TUFFACEOUS
	CLAY		LITHIC TUFF		SHELL FRAGMENTS
	CLAY-MUDSTONE		MARL - CALC		SILTSTONE
	CLYST-TUFFACEOUS		METAMORPHICS		SILTST-TUFFACEOUS
	COAL		OBSIDIAN		TUFF
	CONGLOMERATE		PORCELANITE		VOLCANICLASTICS SEDS
	DACITE		PORCELANEOUS CLYST		VOLCANICS

MINERAL PERCENTAGE

< 1% 1-3% 4-6% 7-9% > 10%



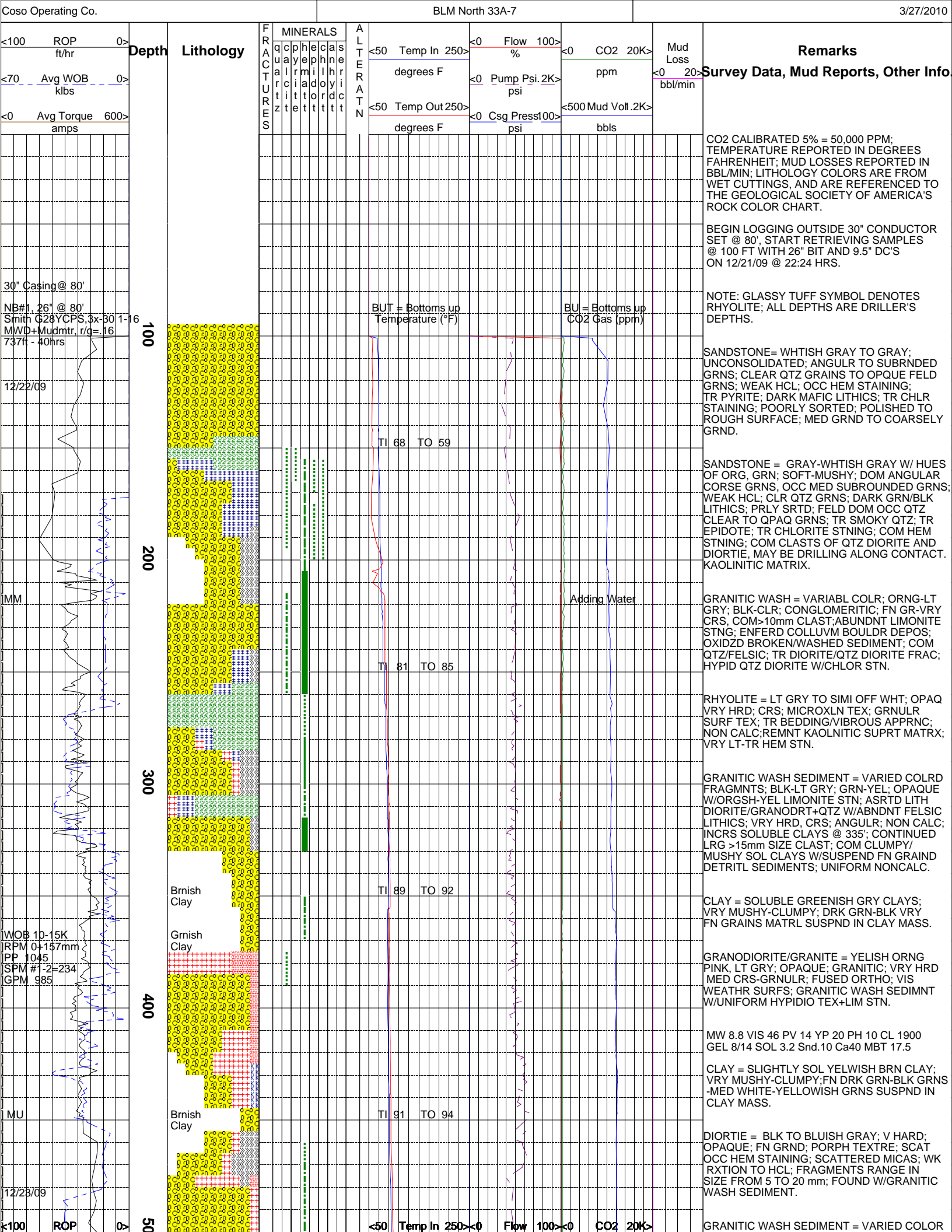
ALTERATION TYPES

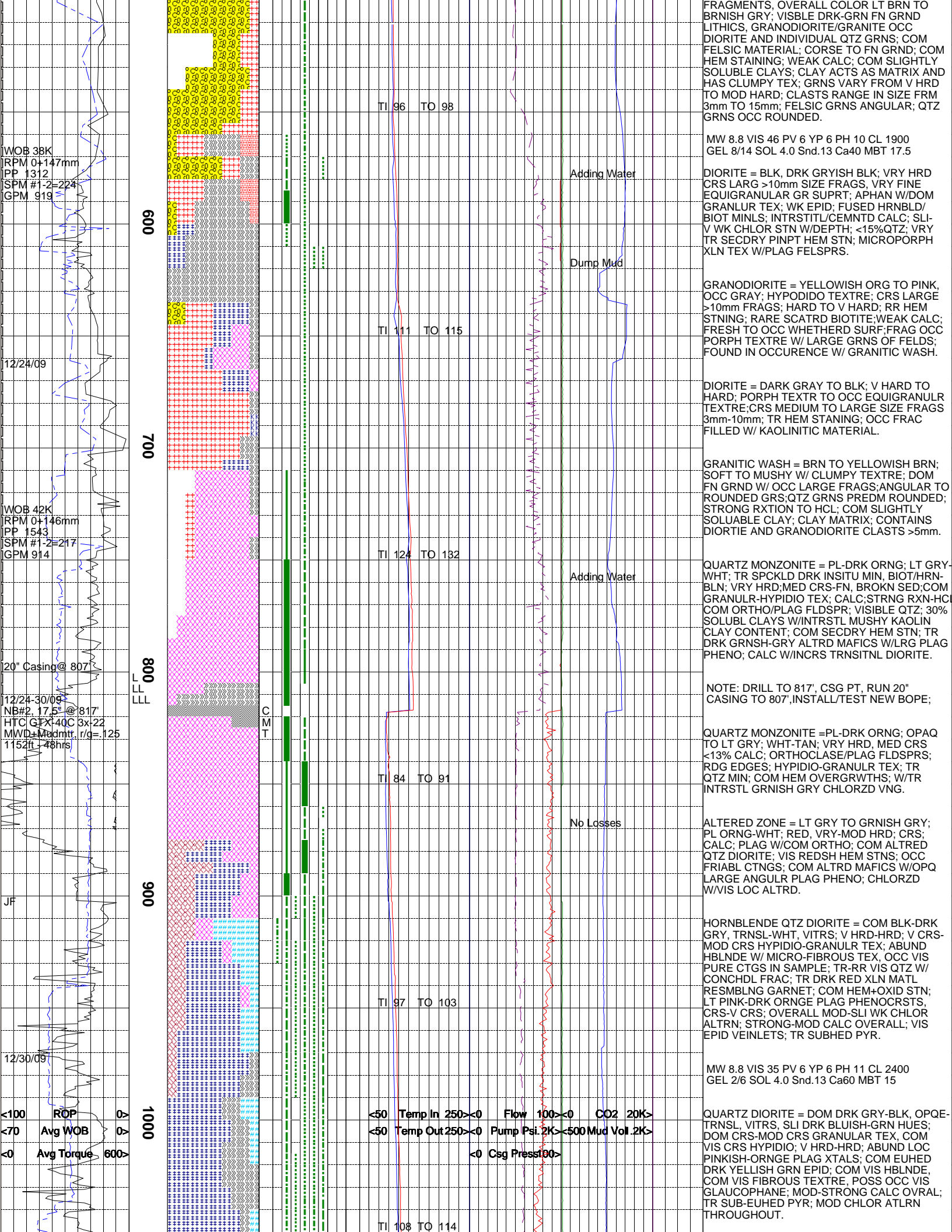
	SERICITIZATION		BIOTITIC
	SILICIFICATION		CHLORITIC
			KAOLINITIC

ALTERATION INTENSITY

WEAK MODERATE STRONG







WOB 38K
RPM 0+147mm
PP 1312
SPM #1-2=224
GPM 919

12/24/09

WOB 42K
RPM 0+146mm
PP 1543
SPM #1-2=217
GPM 914

20" Casing @ 807'

12/24-30/09
NB#2, 17.5" @ 817'
HTC GTX-40C 3x-22
MWD+Mudmtr, r/g=.125
1152ft - 48hrs

JF

12/30/09

<100 ROP
<70 Avg WOB
<0 Avg Torque

600

700

800
LLF
LLL

900

1000

TI 96 TO 98

TI 111 TO 115

TI 124 TO 132

TI 84 TO 91

TI 97 TO 103

TI 108 TO 114

Adding Water

Dump Mud

Adding Water

No Losses

FRAGMENTS, OVERALL COLOR LT BRN TO BRNISH GRY; VISIBLE DRK-GRN FN GRND LITHICS, GRANODIORITE/GRANITE OCC DIORITE AND INDIVIDUAL QTZ GRNS; COM FELSIC MATERIAL; CORSE TO FN GRND; COM HEM STAINING; WEAK CALC; COM SLIGHTLY SOLUBLE CLAYS; CLAY ACTS AS MATRIX AND HAS CLUMPY TEX; GRNS VARY FROM V HRD TO MOD HARD; CLASTS RANGE IN SIZE FRM 3mm TO 15mm; FELSIC GRNS ANGULAR; QTZ GRNS OCC ROUNDED.

MW 8.8 VIS 46 PV 6 YP 6 PH 10 CL 1900
GEL 8/14 SOL 4.0 Snd.13 Ca40 MBT 17.5

DIORITE = BLK, DRK GRYISH BLK; VRY HRD CRS LARG >10mm SIZE FRAGS, VRY FINE EQUIGRANULAR GR SUPRT; APHAN W/DOM GRANLUR TEX; WK EPID; FUSED HRNBLED/BIOT MINLS; INTRSTITL/CEMNTD CALC; SLI-V WK CHLOR STN W/DEPTH; <15%QTZ; VRY TR SECDRY PINPT HEM STN; MICROPORPH XLN TEX W/PLAG FELSPRS.

GRANODIORITE = YELLOWISH ORG TO PINK, OCC GRAY; HYPODIDO TEXTRE; CRS LARGE >10mm FRAGS; HARD TO V HARD; RR HEM STNING; RARE SCATRD BIOTITE/WEAK CALC; FRESH TO OCC WHETHERD SURF;FRAG OCC PORPH TEXTRE W/ LARGE GRNS OF FELDS; FOUND IN OCCURENCE W/ GRANITIC WASH.

DIORITE = DARK GRAY TO BLK; V HARD TO HARD; PORPH TEXTR TO OCC EQUIGRANULR TEXTRE;CRS MEDIUM TO LARGE SIZE FRAGS 3mm-10mm; TR HEM STAINING; OCC FRAC FILLED W/ KAOLINITIC MATERIAL.

GRANITIC WASH = BRN TO YELLOWISH BRN; SOFT TO MUSHY W/ CLUMPY TEXTRE; DOM FN GRND W/ OCC LARGE FRAGS;ANGULAR TO ROUNDED GRs;QTZ GRNS PREDM ROUNDED; STRONG RXTION TO HCL; COM SLIGHTLY SOLUBLE CLAY; CLAY MATRIX; CONTAINS DIORTIE AND GRANODIORITE CLASTS >5mm.

QUARTZ MONZONITE = PL-DRK ORNG; LT GRY-WHT; TR SPCKLD DRK INSITU MIN, BIOT/HRN-BLN; VRY HRD;MED CRS-FN, BROKN SED;COM GRANULR-HYPIDIO TEX; CALC;STRNG RXN-HCL;COM ORTHO/PLAG FLDSPR; VISIBLE QTZ; 30% SOLUBL CLAYS W/INTRSTL MUSHY KAOLIN CLAY CONTENT; COM SECDRY HEM STN; TR DRK GRNSH-GRY ALTRD MAFICS W/LRG PLAG PHENO; CALC W/INCRS TRNSITNL DIORITE.

NOTE: DRILL TO 817', CSG PT, RUN 20" CASING TO 807',INSTALL/TEST NEW BOPE;

QUARTZ MONZONITE =PL-DRK ORNG; OPAQ TO LT GRY; WHT-TAN; VRY HRD, MED CRS <13% CALC; ORTHOCLASE/PLAG FLDSPRS; RDG EDGES; HYPIDIO-GRANULR TEX; TR QTZ MIN; COM HEM OVERGRWTHS; W/TR INTRSTL GRNISH GRY CHLORZD VNG.

ALTERED ZONE = LT GRY TO GRNISH GRY; PL ORNG-WHT; RED, VRY-MOD HRD; CRS; CALC; PLAG W/COM ORTHO; COM ALTRD QTZ DIORITE; VIS REDSH HEM STNS; OCC FRIABL CTNGS; COM ALTRD MAFICS W/OPQ LARGE ANGULR PLAG PHENO; CHLORZD W/VIS LOC ALTRD.

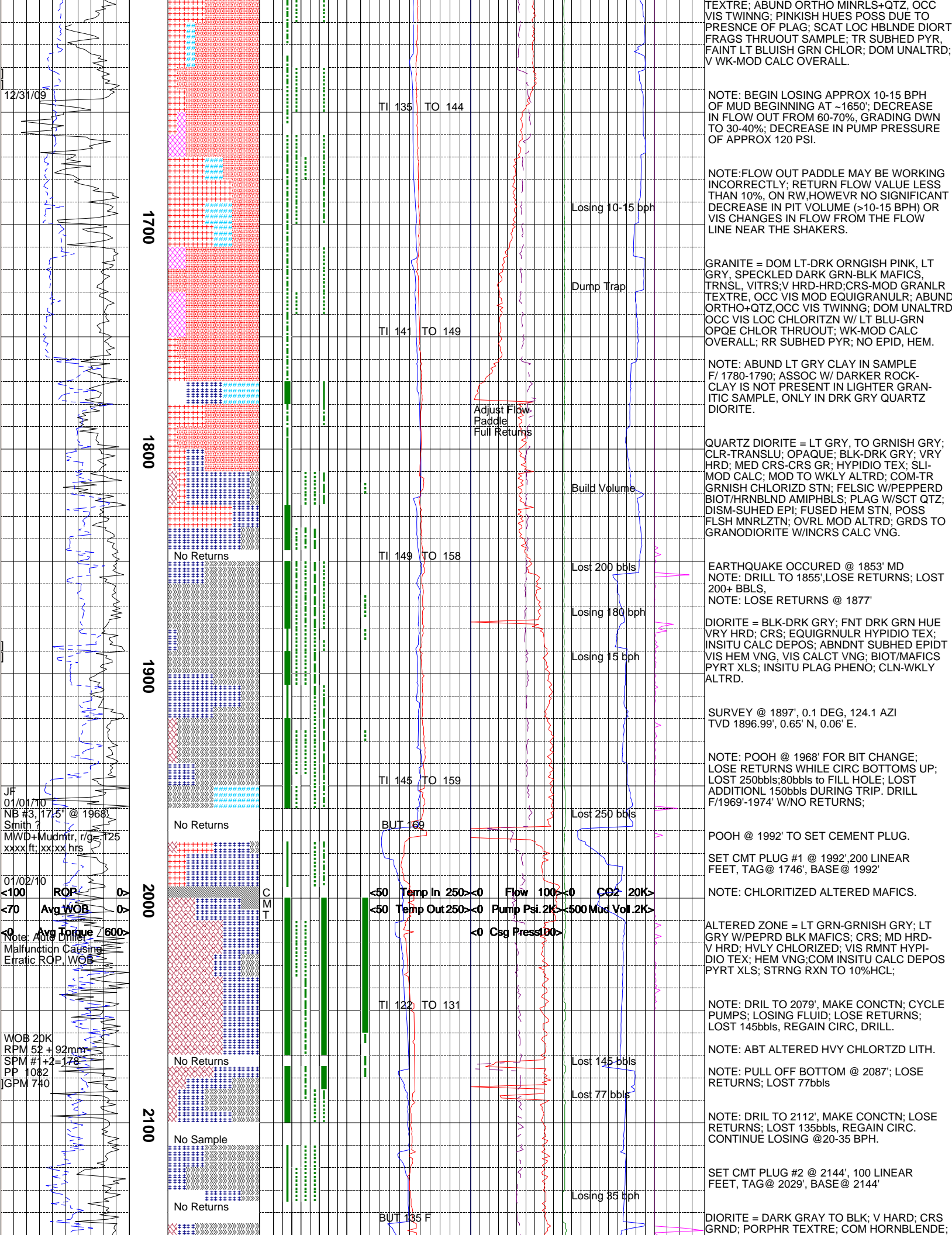
HORNBLende QTZ DIORITE = COM BLK-DRK GRY, TRNSL-WHT, VITRS; V HRD-HRD; V CRS-MOD CRS HYPIDIO-GRANULR TEX; ABUND HBLNDE W/ MICRO-FIBROUS TEX, OCC VIS PURE CTGS IN SAMPLE; TR-RR VIS QTZ W/ CONCHDL FRAC; TR DRK RED XLN MATL RESMBLNG GARNET; COM HEM+OXID STN; LT PINK-DRK ORNGE PLAG PHENOCRSTS, CRS-V CRS; OVERALL MOD-SLI WK CHLOR ALTRN; STRONG-MOD CALC OVRALL; VIS EPID VEINLETS; TR SUBHED PYR.

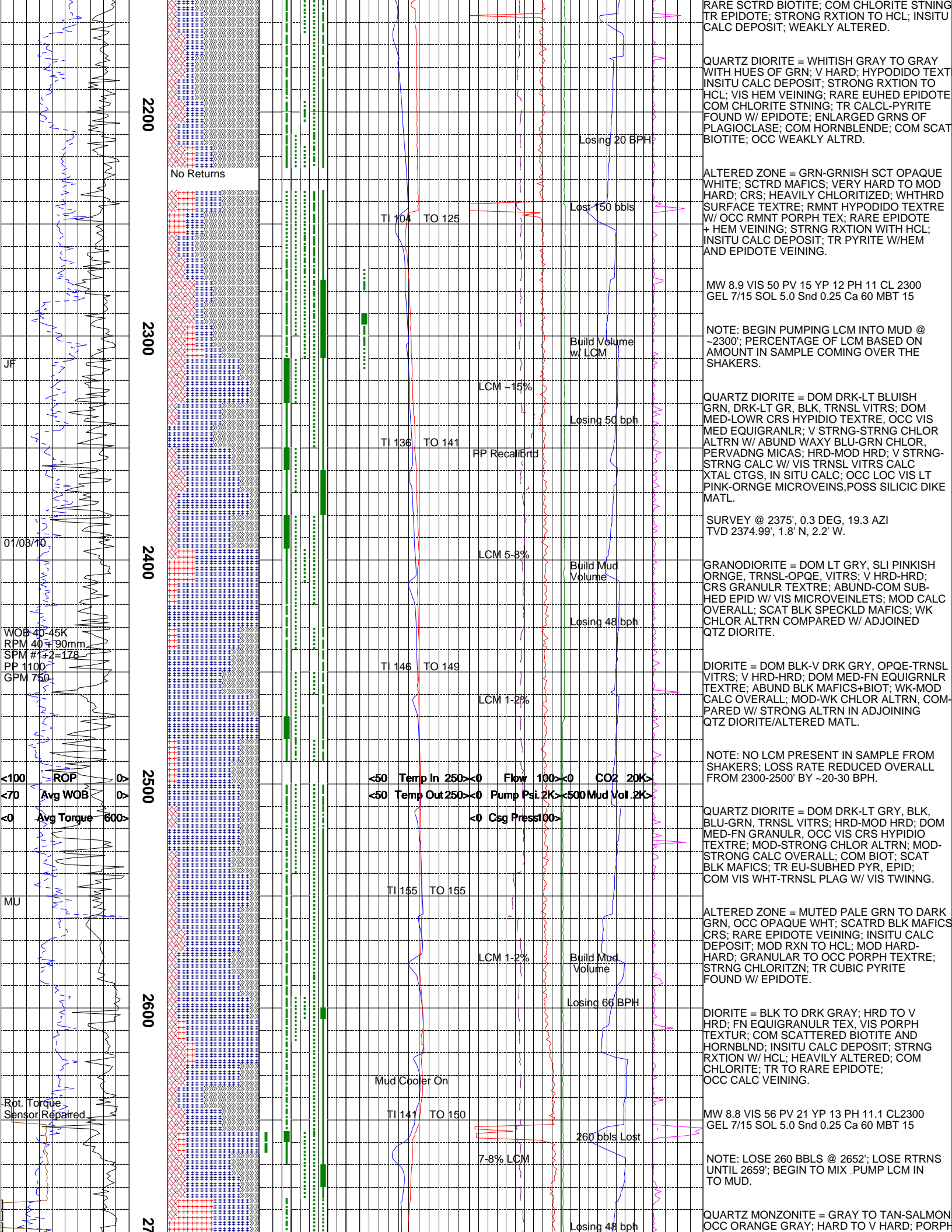
MW 8.8 VIS 35 PV 6 YP 6 PH 11 CL 2400
GEL 2/6 SOL 4.0 Snd.13 Ca60 MBT 15

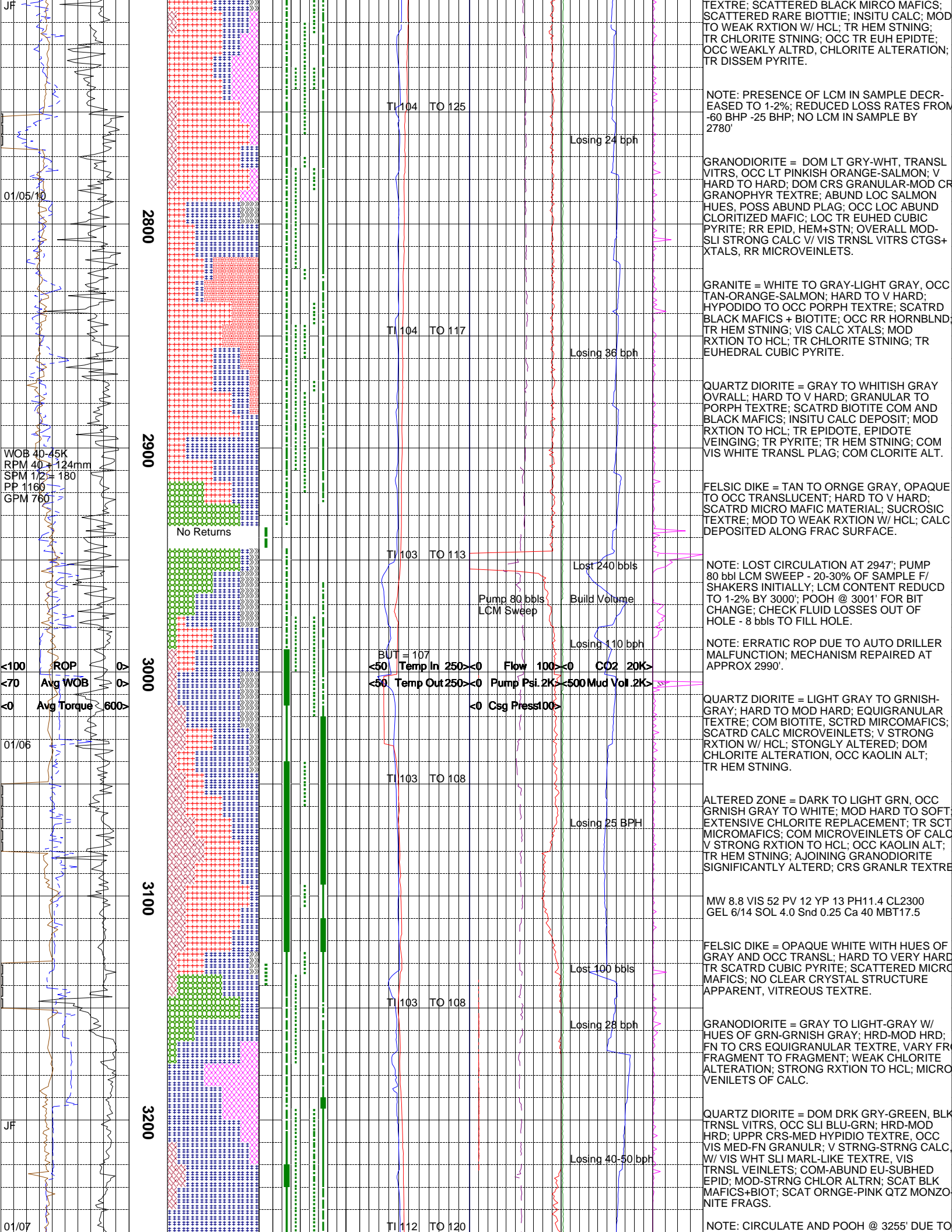
QUARTZ DIORITE = DOM DRK GRY-BLK, OPQE-TRNSL, VITRS, SLI DRK BLUISH-GRN HUES; DOM CRS-MOD CRS GRANULR TEX, COM VIS CRS HYPIDIO; V HRD-HRD; ABUND LOC PINKISH-ORNGE PLAG XTALS; COM EUHED DRK YELLISH GRN EPID; COM VIS HBLNDE, COM VIS FIBROUS TEXTRE, POSS OCC VIS GLAUCOPHANE; MOD-STRONG CALC OVRLL; TR SUB-EUHED PYR; MOD CHLOR ATLRN THROUGHOUT.

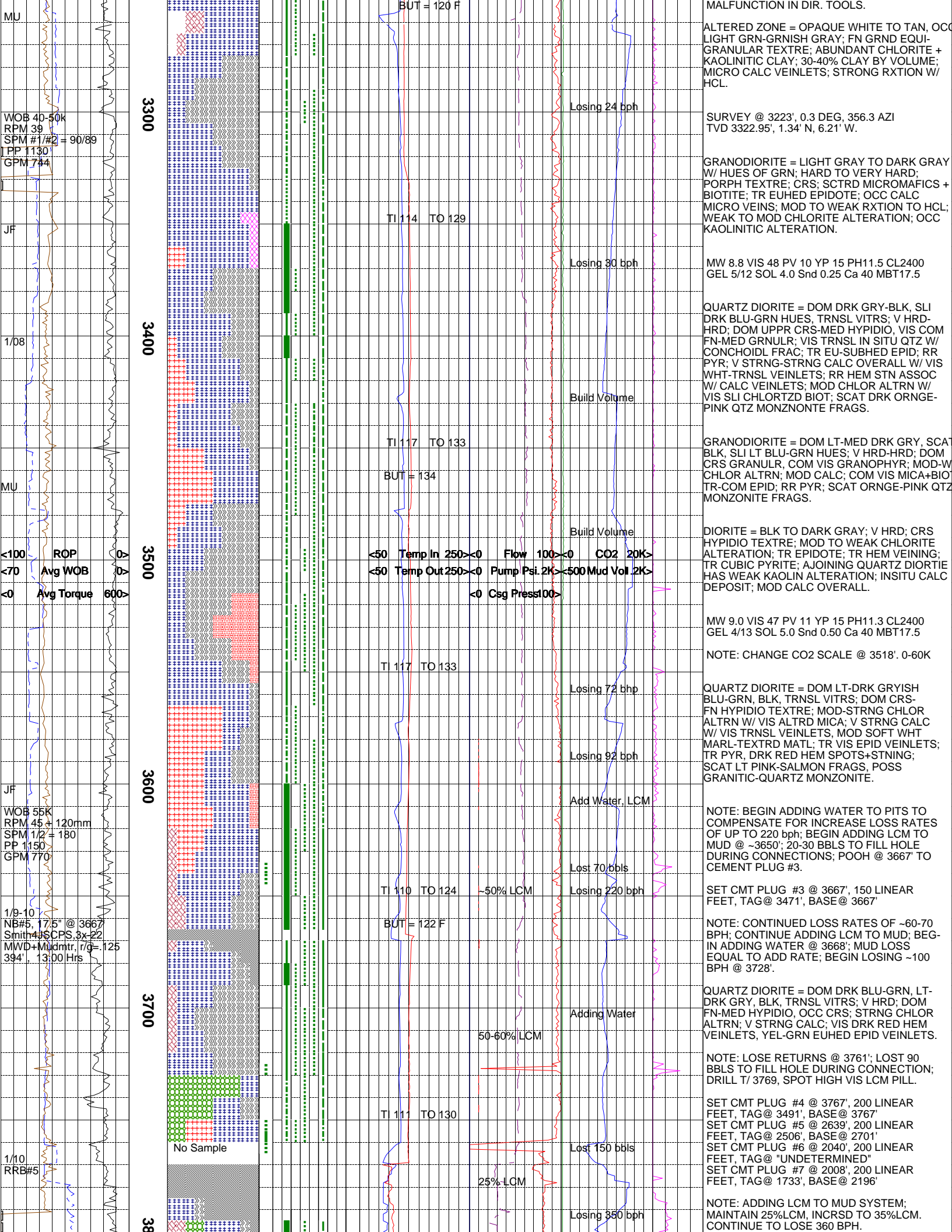
<50 Temp In 250><0 Flow 100><0 CO2 20K>
<50 Temp Out 250><0 Pump Psi 2K><500 Mud Vol 2K>
<0 Csg Press100>

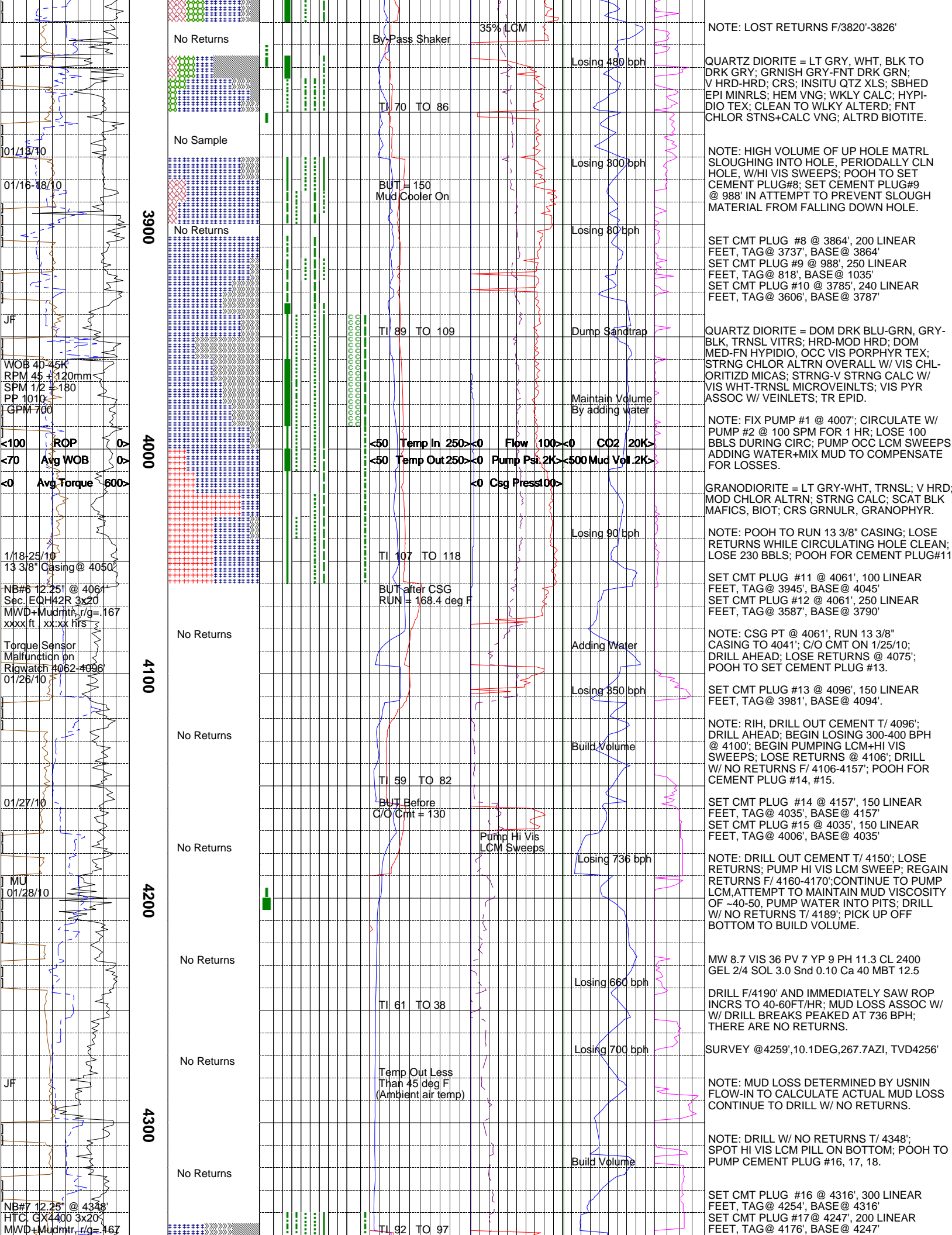
Depth (ft)	Wellbore (WOB)	Pressure (PP)	Rate of Penetration (ROP)	Flow (Flow)	Temperature (Temp)	Pressure (Psg)	Volume (Vol)	Notes
1100	WOB 35.45 RPM 40 + 91mm PP 1200 SPM #1-2=176 GPM 730							NOTE: LOC ABUND SOLUBLE CLAY VISABL IN SAMPLE @ 1070'; GRY-LT REDSH BRWN; OVERALL NON CALC; POSS KAOLINITC OR RHYOLITIC DIKE MAT'L; LOCAL DRK ORNGE-REDDISH HUE, POSS HEM STAINING.
1200								NOTE = CLY CONTENT IN SAMPLE MUCH LESS PREVALENT; CTGS OVER SHAKERS NO LONGER CLUMPED; SAMPLE DOM GRAVEL-LIKE CONSTNCY.
1300								
1400								
1500								
1600	WOB 42K PP 1096 RPM 35 + 84mm SPM #1-2=163 GPM 673							

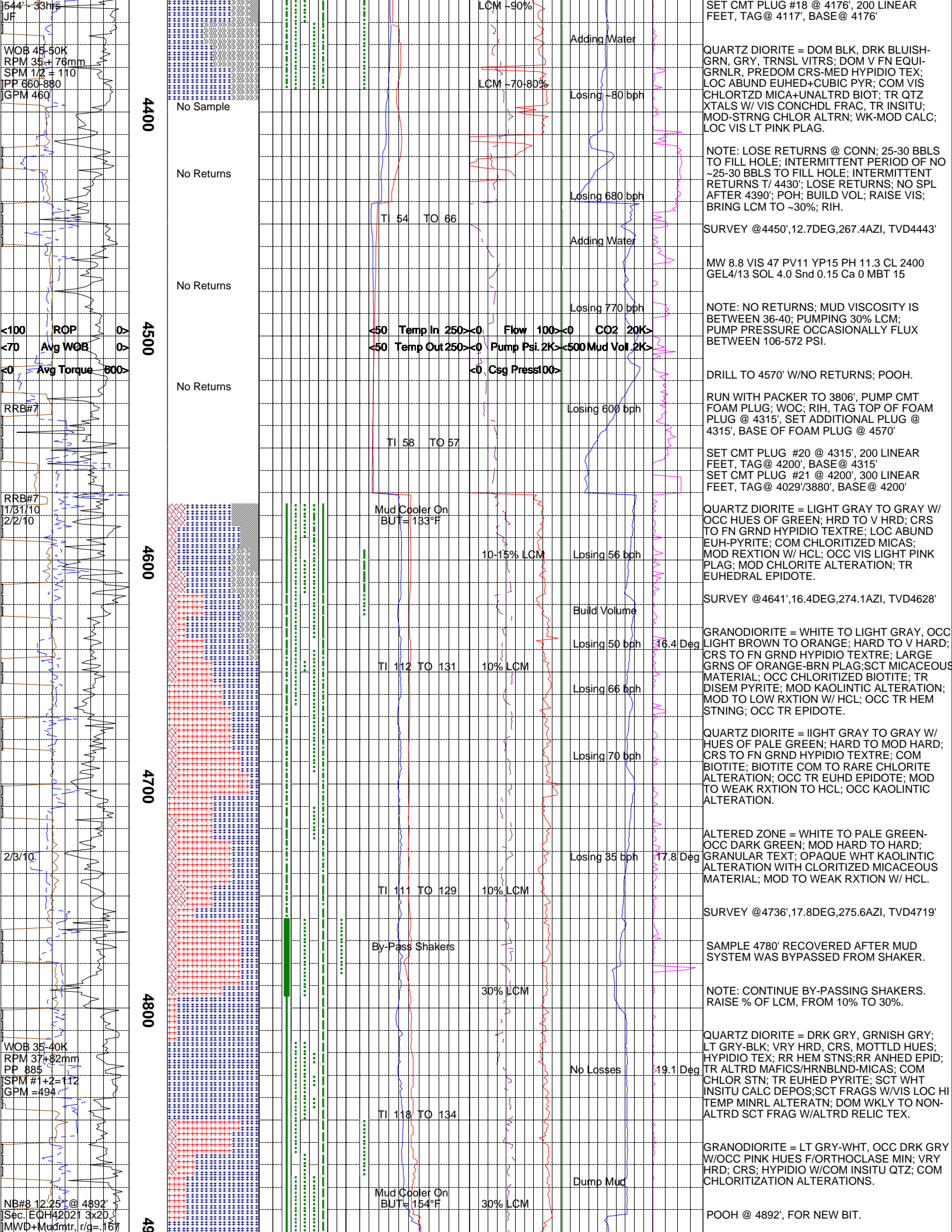


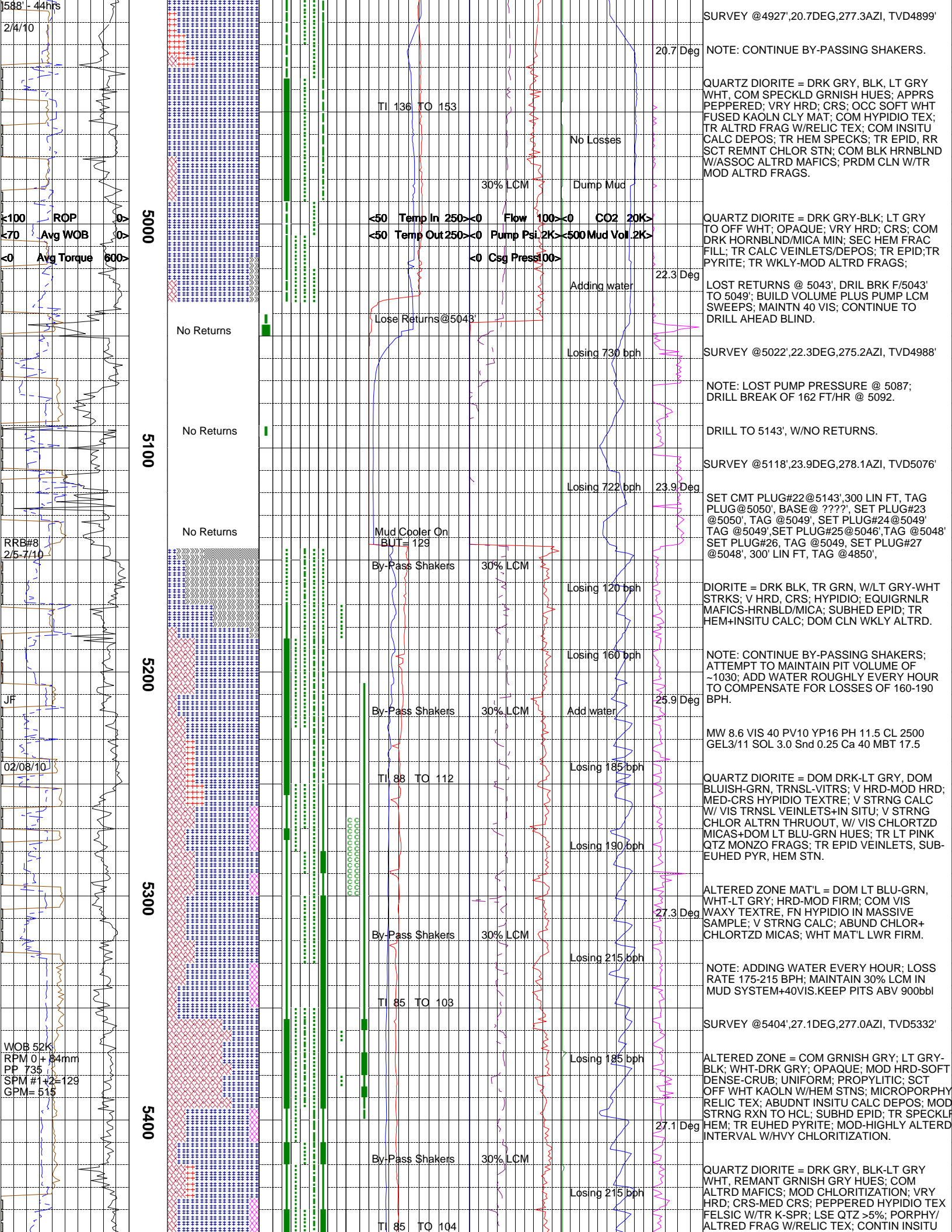












2/9-11/10
NB#9 12.25' @ 5483'
Sec. EQH42D2R 3x20
MVD+Mudmtr. r/g=167
562 ft; 39.00 hrs

02/12/2010

RRB#9

JF

<100 ROP
<70 Avg WOB
<0 Avg Torque

5500
5600
5700
5800
5900
60

Tool Temp at shoe= 104°C
Mud Cooler On BUT= 153°F

<50 Temp In 250><0 Flow 100><0 CQZ 20K>
<50 Temp Out 250><0 Pump Psi 2K><500 Mud Vol 2K>
<0 Csg Press 100>

TI 131 TO 156
TI 139 TO 158
TI 132 TO 155
TI 129 TO 153
TI 121 TO 149

Losing 200 bph
No Losses
Dump Sandtrap
Losing 10 bph
Build Volume
No Losses
Dump Sandtrap
Losing 180 bph
Adding Water Build Volume

50-60% LCM

CALC DEPOS; CLN-WKLY ALTRD FRGS.

FELSIC DIKE = WHT, CLR, OPQUE; TR ORNG INFERD SPL-5480', V HRD; MILKY MICROXLN APPRNC; TR EPID/PYR;TR EV D QTZ MONZONT.

POOH @ 5483',FOR CEMENT PLUGS/NEW BIT.

SET CMT PLUG#28@5483',300 LIN FT, TAG PLUG@5295', BASE@ 5483', SET PLUG#29 @5295', 300' LIN FT, TAG @5055'.

QUARTZ DIORITE = LT GRY, CLR, DRK BLK TO DRK GRY; GRNISH GRY-WHT; VRY HRD TO BRIL; OCC SOFT; ALTRD KAOLN W/COM ALTERED CHLORTZD FRAGS; VARIED-UNIFRM LITH; MINR PROPYLITIC/RELIC TEX; W/COM CLN HYPIDIO TEX; EUHD EPID; TR PYRITE; OCC FNT HEM STRKS; CONTND INSITU CALC DEPOS; SCT FELSCIS; >10%QTZ; COM HRNBLD MICA/FSPR; MOD-WKLY ALTRD FRAGS.

SURVEY @5594',27.6DEG,273.6AZI, TVD5501'

MW 8.9 VIS 40 PV10 YP16 PH 11.2 CL 2600 GEL4/11 SOL 5.0 Snd 0.25 Ca 40 MBT 17.5

QUARTZ DIORITE = DOM DRK GRY-BLK, TRNSL VITRS, OCC SLI BLUISH-GRN HUES; MED-CRS HYPIDIO TEXTRE; ABUND BIOT+MICA; WK-MOD CALC OVERALL; V WK-WK CHLOR ALTRN, SLI VIS CHLORTZN; ABUND LOC EUHD EPID, COM VIS VEINLETS; OCC DRK GRY CLAY-LIKE CONSTNCY IN SAMPLE; TR LOC SUBHED PYR, HEM STN.

NOTE: CONTINUE DRILLING WITH FULL RETURNS AND LOSS RATE OF 5-15 BPH; NO LCM IN MUD SYSTEM; MIXING AND BUILDING VOLUME W/O ADDING H2O; DUMP SANDTRAP EVERY OTHER CONNECTION.

FELSIC DIKE = DOM LT PINK-TRNSL PINK, SCAT DRK GRN MICRO-SPECKS; MICRO-XTALLNE TEXTRE; ABUND DRK GRN MAFICS; WK CALC OVERALL; SURROUNDING QTZ DIORITE MOD CHLOR ALTRN.

GRANODIORITE = DOM DRK-LT GRY, OCC SLI BLUISH-GRN HUES, BLK, TRNSL VITRS; DOM GRANOPHYR, OCC VIS MED-CRS HYPIDIO TEXTRE; V HRD-HRD; SCAT BLK MAFICS; SCAT LT PINKISH FRAGS, POSS QTZ MONZO OR PLAG; WK-MOD CALC OVERALL; WK CHLOR ALTRN.

QUARTZ MONZONITE = DOM LT-BRITE PINK, OCC VITRS-TRNSL, OPQE; V HRD-HRD; DOM MED-CRS HYPIDIO/GRANLR TEXTRE; VIS PYR GROWTH IN QTZ, POSS INDICATVE OF HYDROTHERML VEINING; STRNG-MOD CALC; TR SPOTY HEM STNS; COM YEL-GRN MINRL, POSS EPID; ABUND PINK PLAG THRUOUT; MOD-STRNG CHLOR ALTRN IN SURR QTZ DIORITE.

DRILL TO 5864', POOH TO SHOE FOR RIG REPAIRS IN SCR HOUSE.

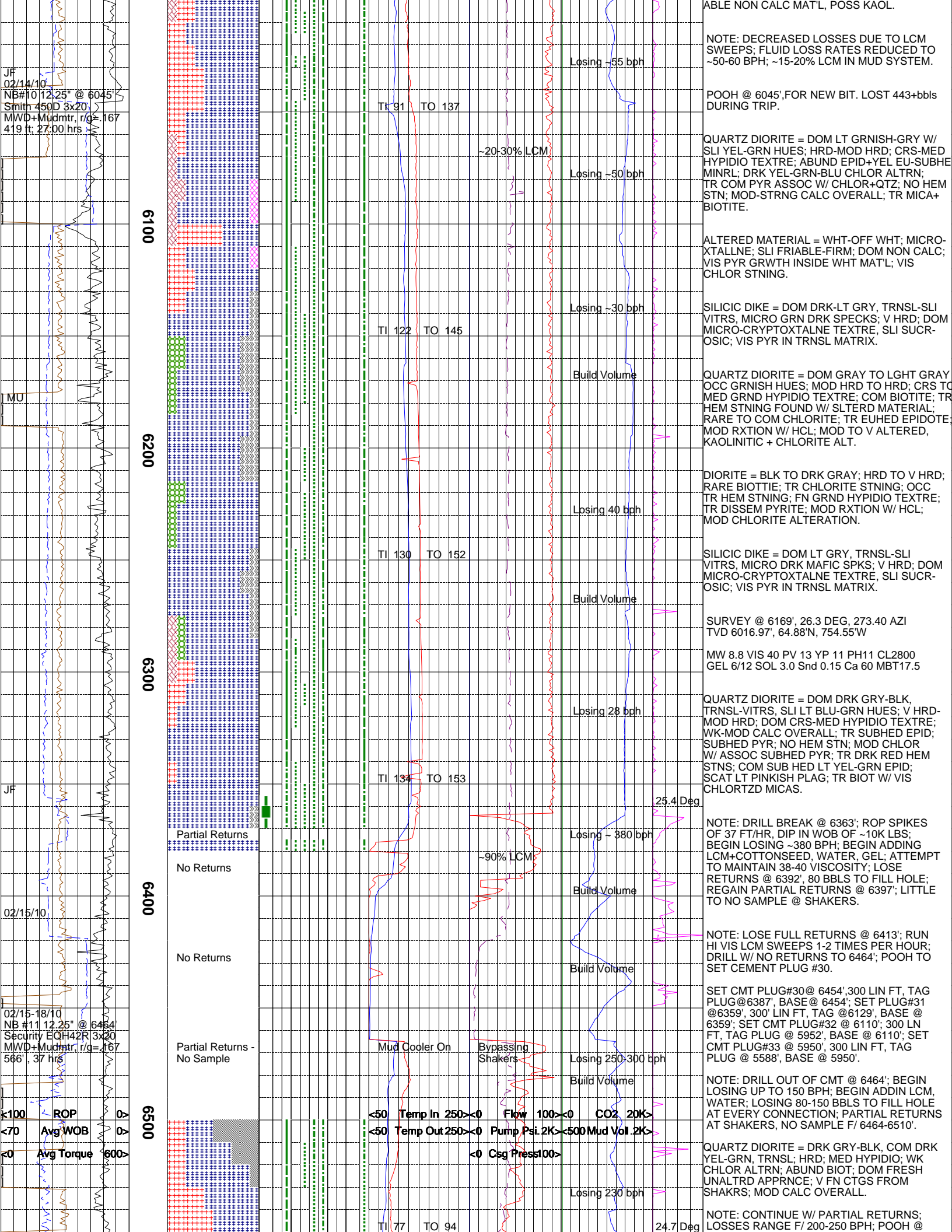
FELSIC DIKE = LT GRY-OPAQUE; VRY HRD; FNT INSITU BLK SPECS/MAFICS; PROPHY; COM CHLOR QTZ DIORITE FRAGS.

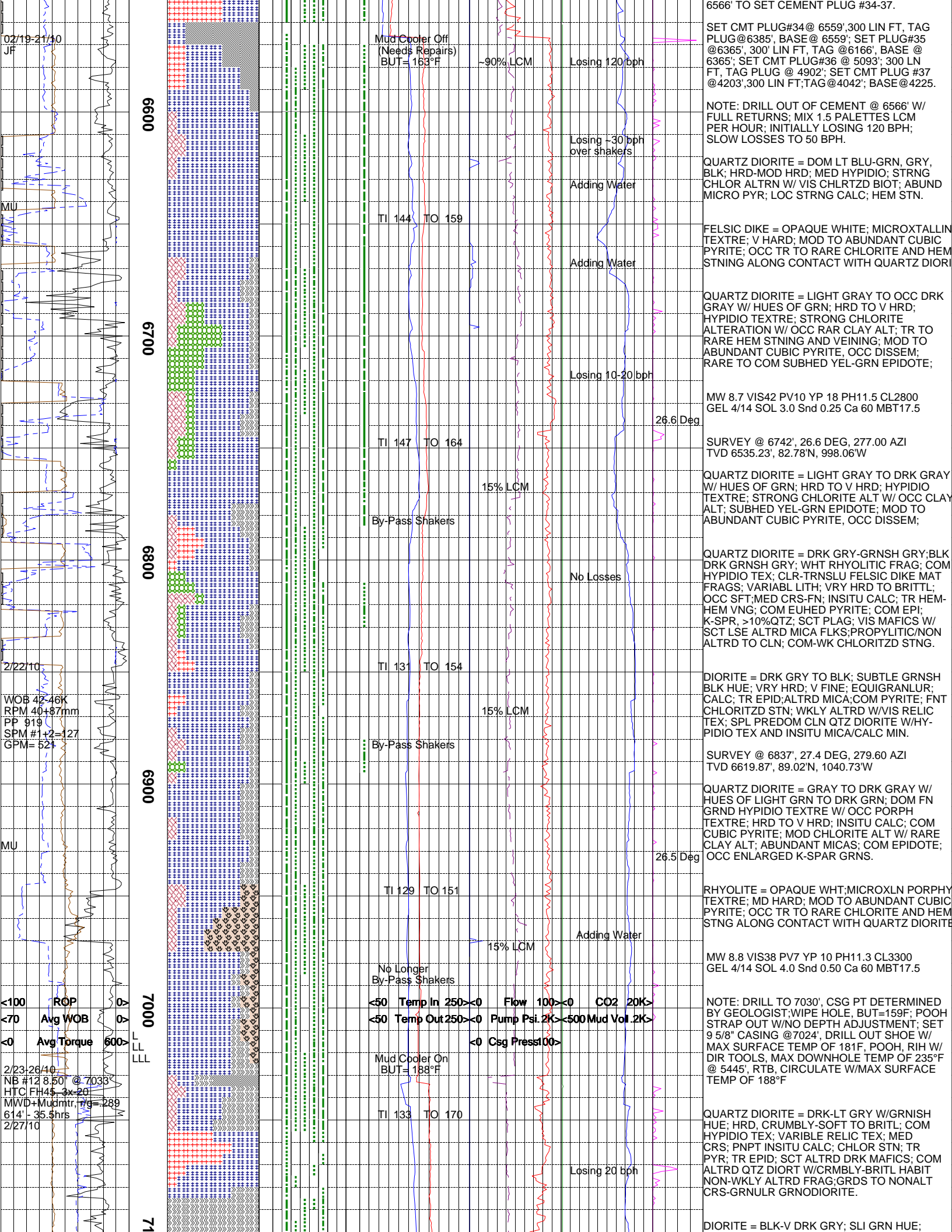
SURVEY @ 5881', 25.9 DEG, 275.00 AZI TVD 5758.05', 55.87'N, 628.78'W

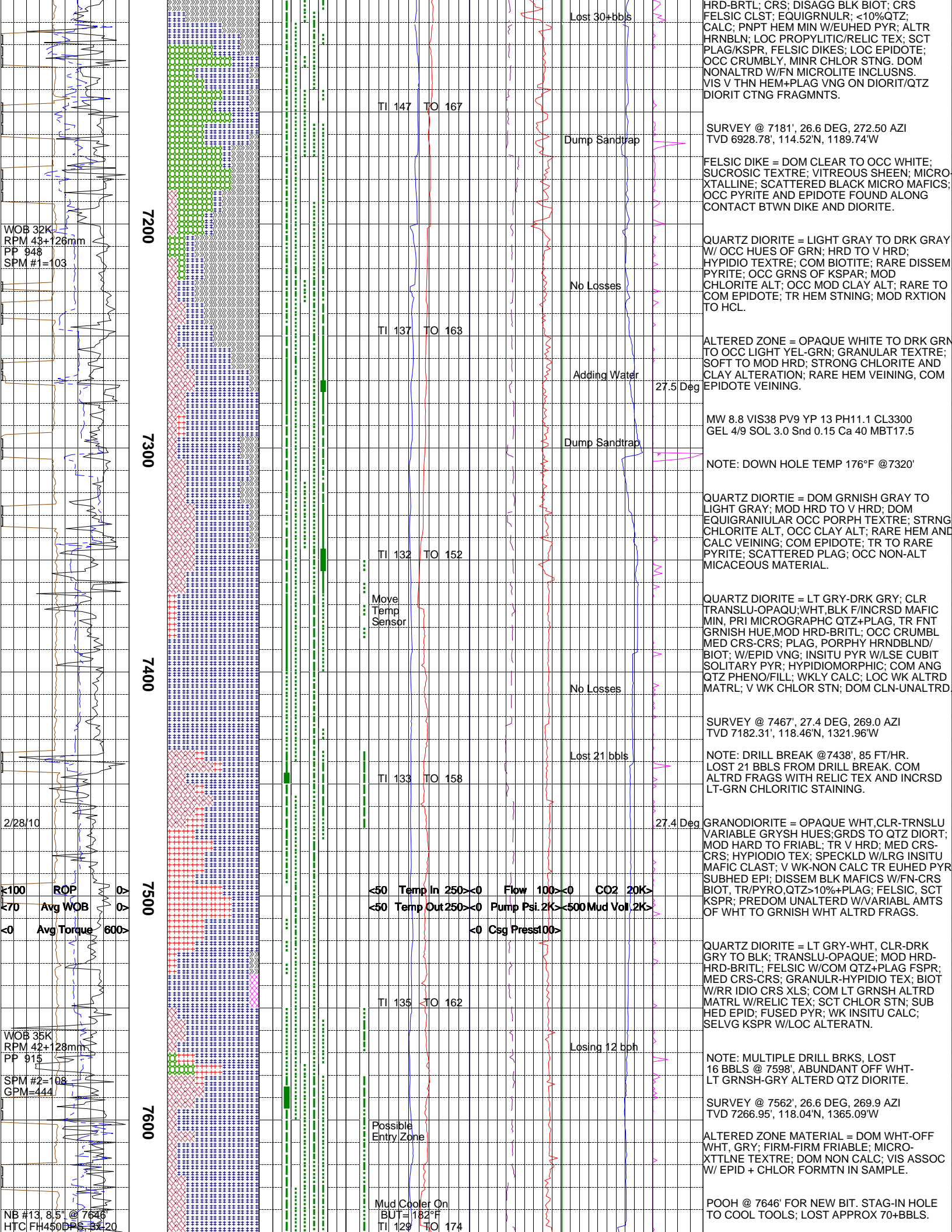
QTZ DIORITE = DOM DRK GRY-BLK, TRNSL VITRS; HRD-MOD HRD; CRS-MED HYPIDIO; COM VIS SUBHED PYR CLUSTRS ASSOC W/ MOD CHLOR ALTRN+QTZ; MOD-STRNG CALC; TR SUB-EUHED YEL-GRN EPID, RD HEM STN.

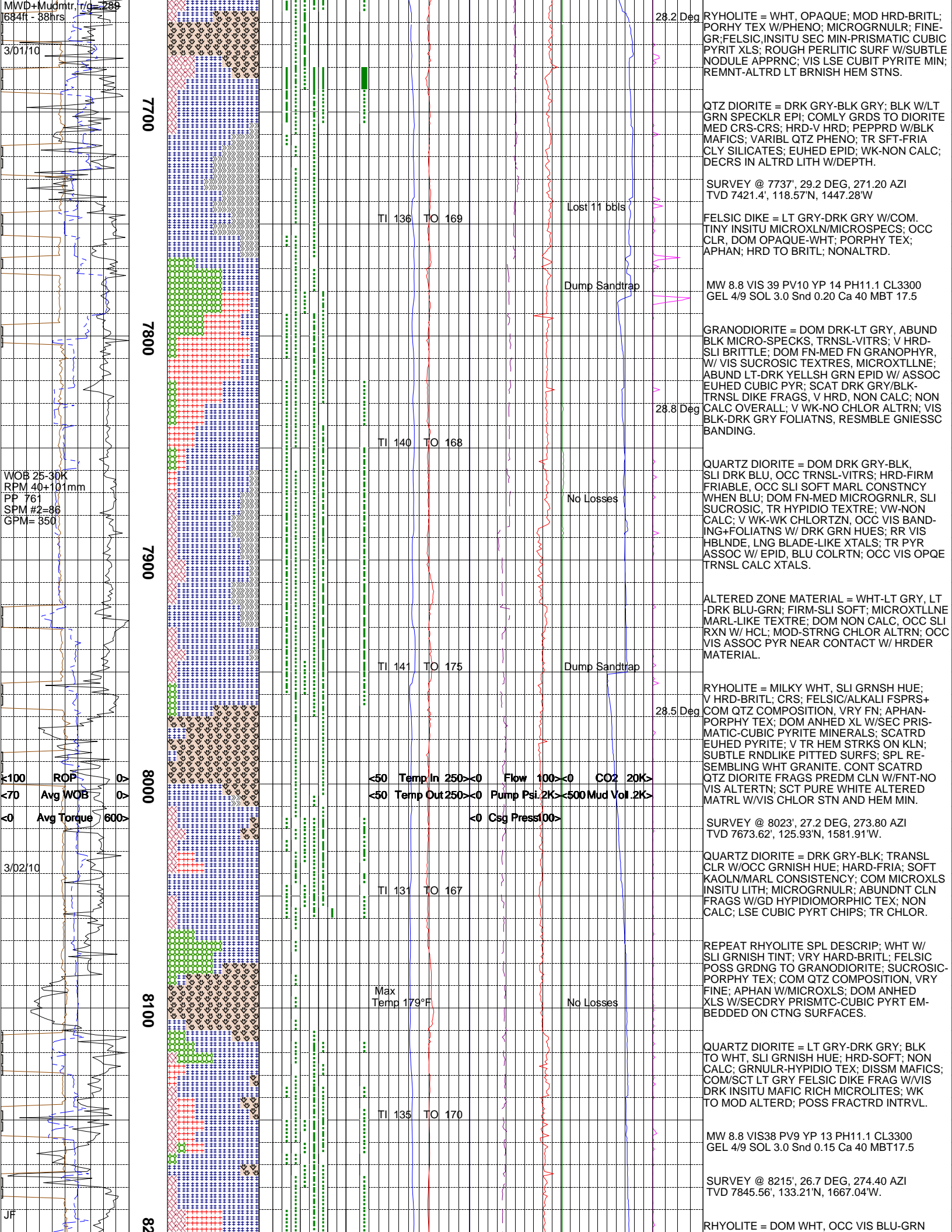
NOTE: DRILL BREAK @ 5933'; ROP OF 43 FT/HR; BEGIN LOSING FLUID AT ~180 BPH; BEGIN ADDING WATER TO PITTS; RUN LCM SWEEPS EVERY 2 HOURS.

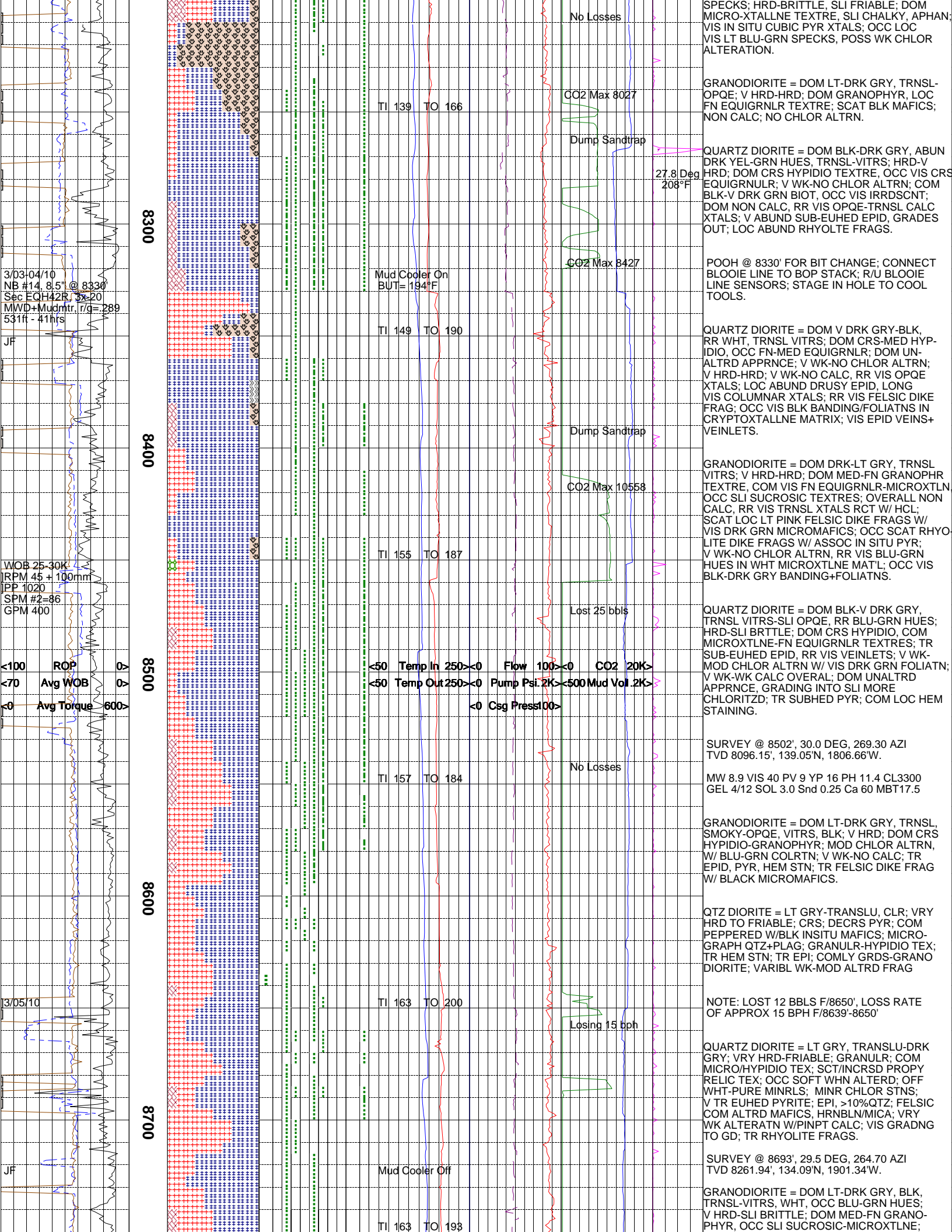
QUARTZ DIORITE = DOM DRK BLUISH GRN, BLK, TRNSL VITRS; MOD HRD-HRD; DOM CRS HYPIDIO TEXTRE; VIS DRK RED HEM SPTS+STN BTWN BIOT CLVGE PLANES; TR PYR THRUOUT, OFT ASSOC W/ CHLORTZD MAFICS; STRNG CALC; STRNG CHLOR ALTRN OVERALL; SCAT QTZ MONZONTE FRAGS; LOC COM PINK PLAG; SCAT WHT, SLI FRI-

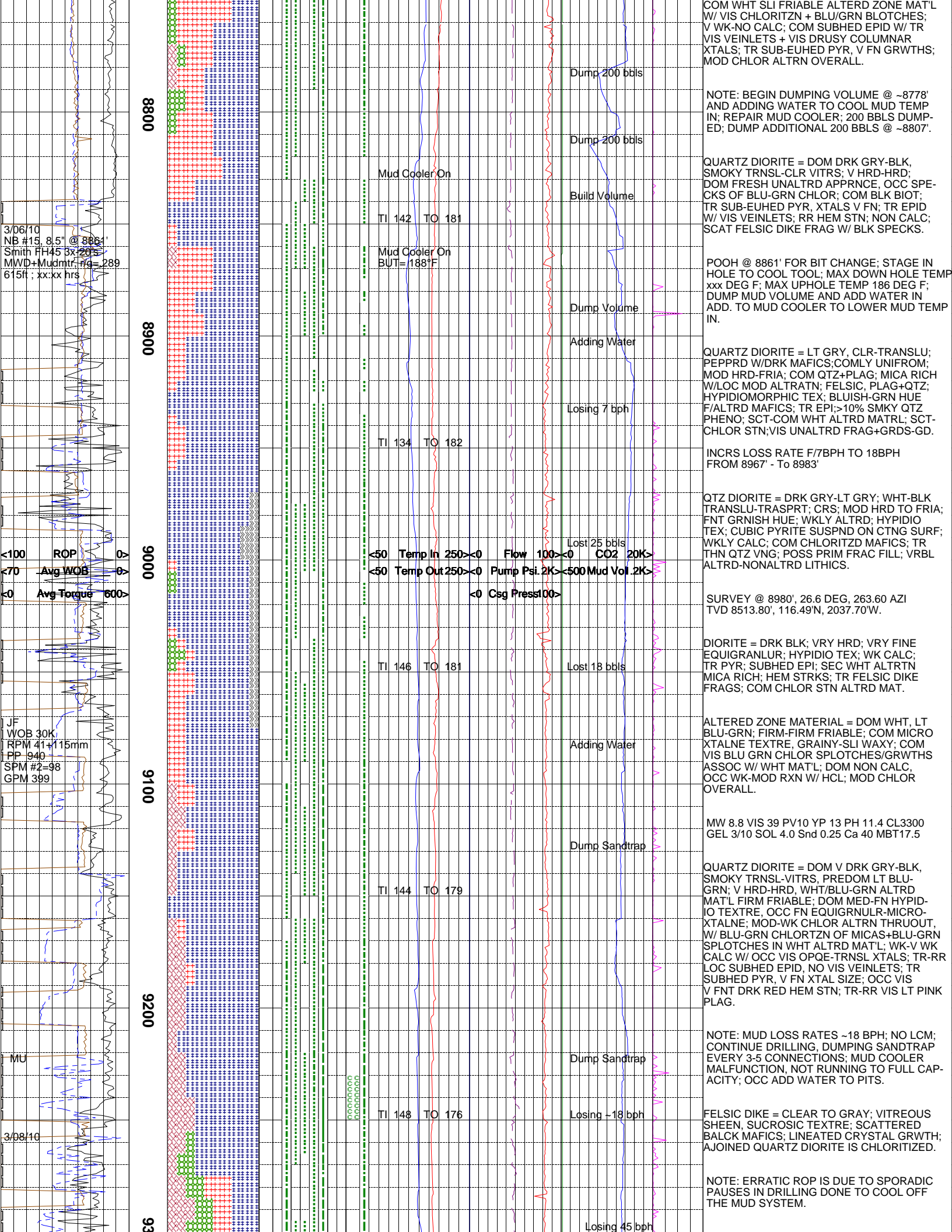


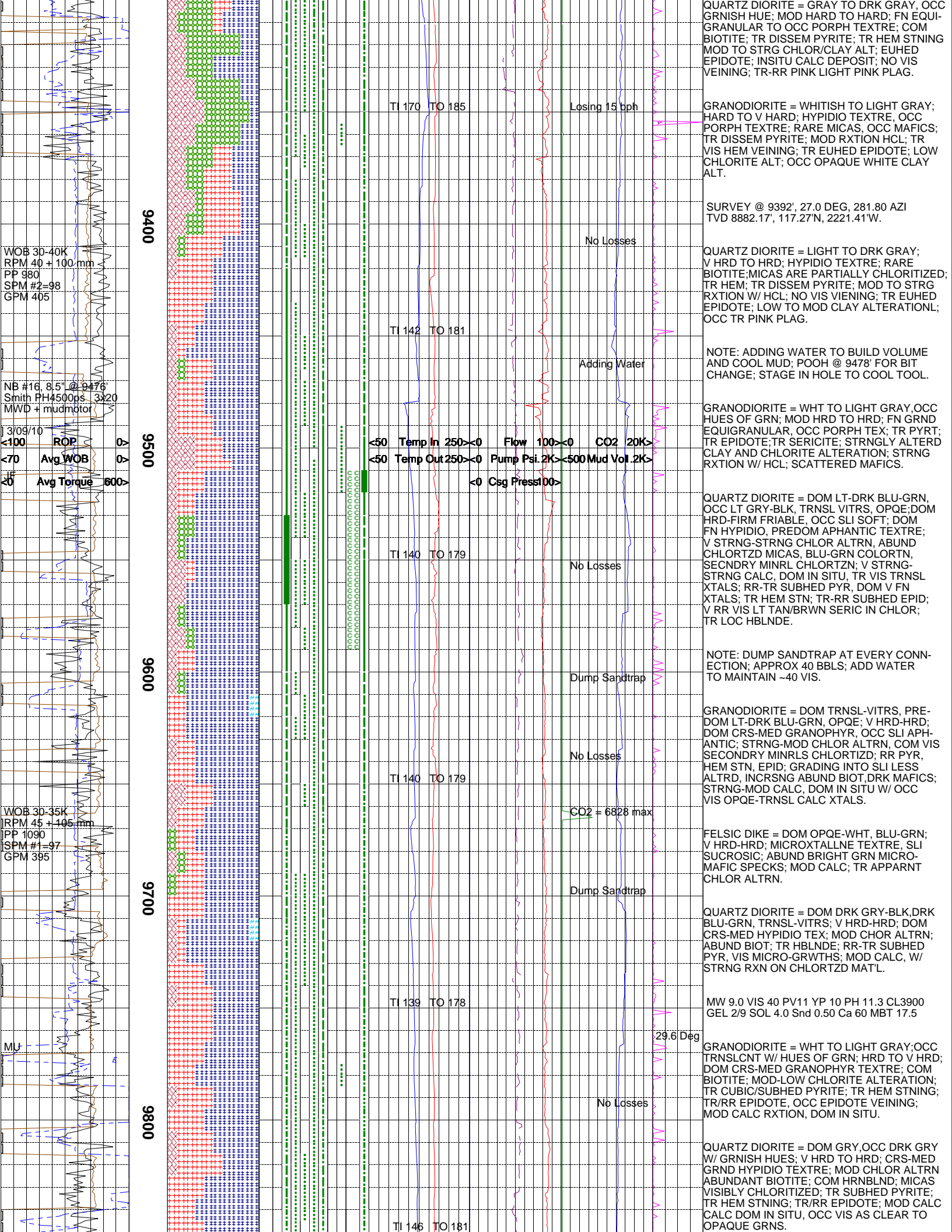


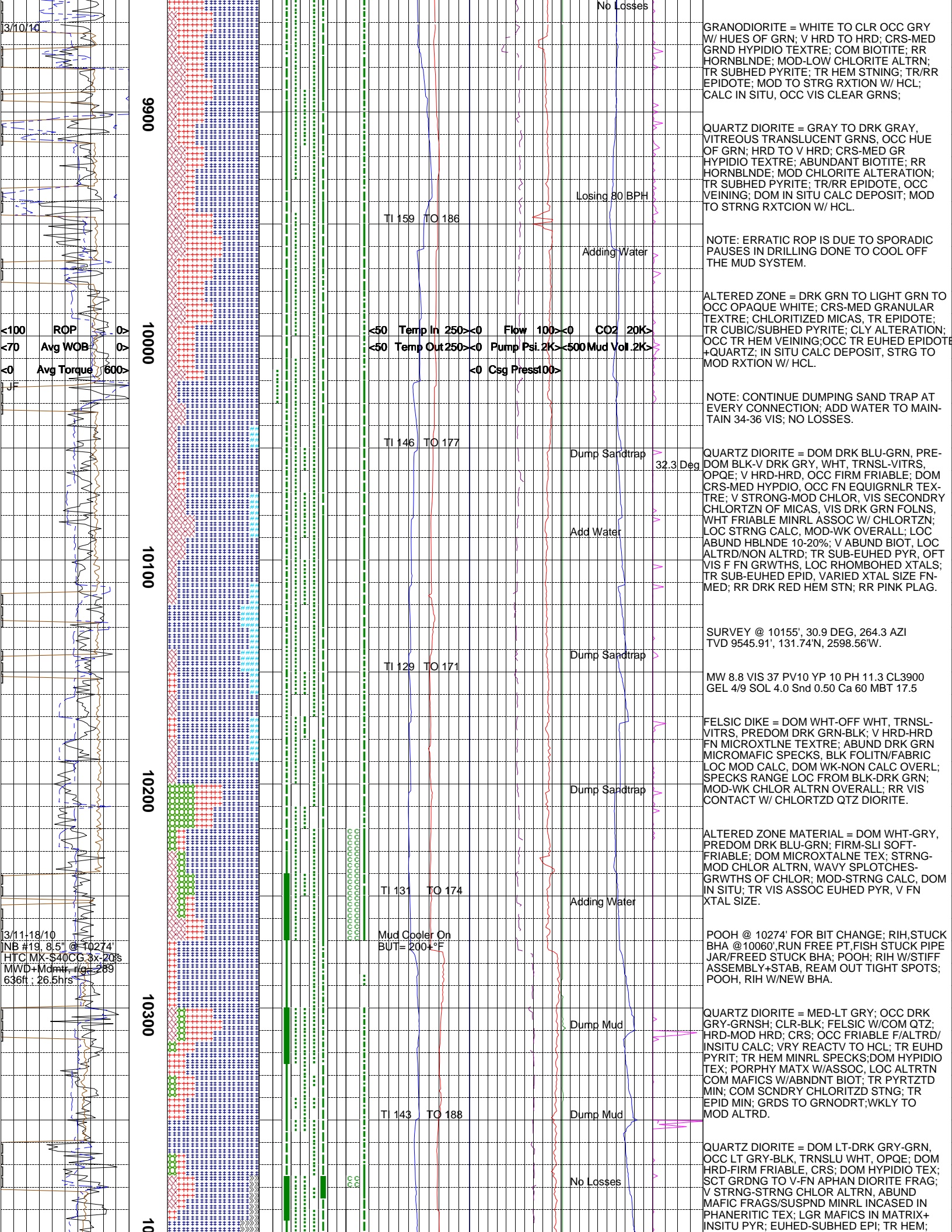












ROB 30-35K
RPM 37+120mm
PP 1359
SPM #2=108
GPM=439

<100 ROP
<70 Avg WOB
<0 Avg Torque

3/20/21/10
NB #20, 8.5" @ 10010
HTC MX-540 3x-205
MWD+Mamtr, rig=289
138ft : 8.2hrs

10500

10600

10700

10800

10900

TI 148 TO 191

<50 Temp In 250><0 Flow 100><0 CQ2 20K>
<50 Temp Out 250><0 Pump Psi 2K><500 Mud Vol 2K>
<0 Csg Press 100>

TI 139 TO 185

TI 141 TO 184

TI 142 TO 185

TI 138 TO 180

Mud Cooler On
BUT= 197°F

TI 141 TO 189

Dump Mud

Dump Mud

Dump Mud

Dump Mud

Dump Mud

Dump Mud

Dump Mud

Dump Mud

Dump Mud

No Losses

Dump Mud

25.4 Deg

FELSIC ABUNDNT PLAG/COM QTZ; BIOT;
COM INTRSTITL CALC MATRL; SCT OFF WHT
FRIABLE/CRUMBLY MATRL; MOD TO MOD
STRNG ALTRATN W/CONTIND CHLORITIZD
SECONDARY MINERLIZATION.

GRANODIORITE = OPAQUE WHT,CLR-TRNSLU
VARIABLE GRYS HUES;GRDS TO QTZ DIORT;
MOD HARD TO FRIABL; TR V HRD; MED CRS-
CRS; HYPIDIO TEX; SPECKLD W/LRG INSITU
MAFIC CLAST; HVLY CALC; TR EUHED PYR
SUBHED EPI; DISSEM BLK BIOT SHTS W/FN-
CRS, TR/PYRO,QTZ>10%+PLAG; FELSIC,CALCT
XLS; MOD ALTRD; SCT FELSIC DIKE FRAGS;
COM VRY FINE W/INSITU BLK MAFIC SPECKS;

SURVEY @ 10486', 25.4 DEG, 274.0 AZI
TVD 9835.62', 123.41'N, 2754.30'W.

FELSIC DIKE = LT GRY-OFF WHT; TRANSLU-
OPAQ;V HRD; CRS;FN AFHAN TEX;NO CHLOR
STNS; PEPPRD MAFIC MICROSPES; INCLU
IN GRDMS; FD UNALTRD, W/COM MOD ALTRD
PRIMRY QTZ DIORITE.

RHYOLITE = WHT, OPAQUE W/GRN HUE;
VRY HRD-BRTL; SLI CHLOR STN; SUBTLE
RNDLIKE PITTL SURFS;WHT GRANITE AP-
PRNC; APHAN/PORPHY TEX; TR HEM.

QUARTZ DIORITE = GRAY TO DRK GRAY W/
HUES OF GRN; HRD TO V HRD; CRS TO FN
GRND HYPIDIO TEXTRE; ABUNDANT CHLORITE
ALTRN; TR SERICITE; TR CUBIC PYRITE; TR
TO RR HEM STNING AND OCC VEINING; IN
SITU CALC DEPOSIT; MOD RXTION W/ HCL;
DISSEM BIOTITE SHTS; TR EUHED + SUBHED
EPIDOTE.

GRANODIORITE = WHITE TO LIGHT GRAY W/
HUES OF GRN; OPAQUE TO TRANSLUCENT
GRNS; HRD TO V HRD; MED GRND; HYPIDIO
TEXTRE; SCATTERED MAFIC CLASTS; TR HEM
RR CUBIC PYRITE + DISSEM; SUBHED EPIDOTE
LOW RXTION INSITU CALC DEPOSIT; COM
CHLORITE STNING; OCC K-SPAR >10%;
SCATTERED FELSIC DIKE CTGS.

QUARTZ DIORITE = GRAY TO DARKISH GRAY
HUES OF GRN AND BLUE; MED-CRS GRND;
HYPIDIO TEXTRE; RR BIOTITE; RR CHLORITE
ALTERATION; EUHED PYRITE + DISSEM PYRITE
RR HEM STNING, TR VEINING; INSITU CALC
DEPOSIT MOD REACTION TO HCL; SCATTERD
MAFIC INCLUSIONS; SUBHED EPIDOTE.

NOTE: DUMPING MUD AROUND EVERY 50'
IN ORDER TO ADD COLD WATER AND KEEP
MUD SYSTEM COOL.

GRANODIORITE = WHITE TO LIGHT GRAY W/
HUES OF RED AND GRN; TRANSLCT TO OPAQU
GRNS; HRD TO V HRD; CRS TO MED GRND;
HYPIDIO TEXTRE; TR-RR HEM STNING + OCC
VEINING; TR RR CHLORITE STNING; SCATTRD
MAFICS; TR-RR DISSEM + CUBIC PYRITE;
MOD RXTION TO HCL; INSITU CALC DEPOSIT;
TR SUBHED EPIDOTE; >10% QTZ, COM PLAG.

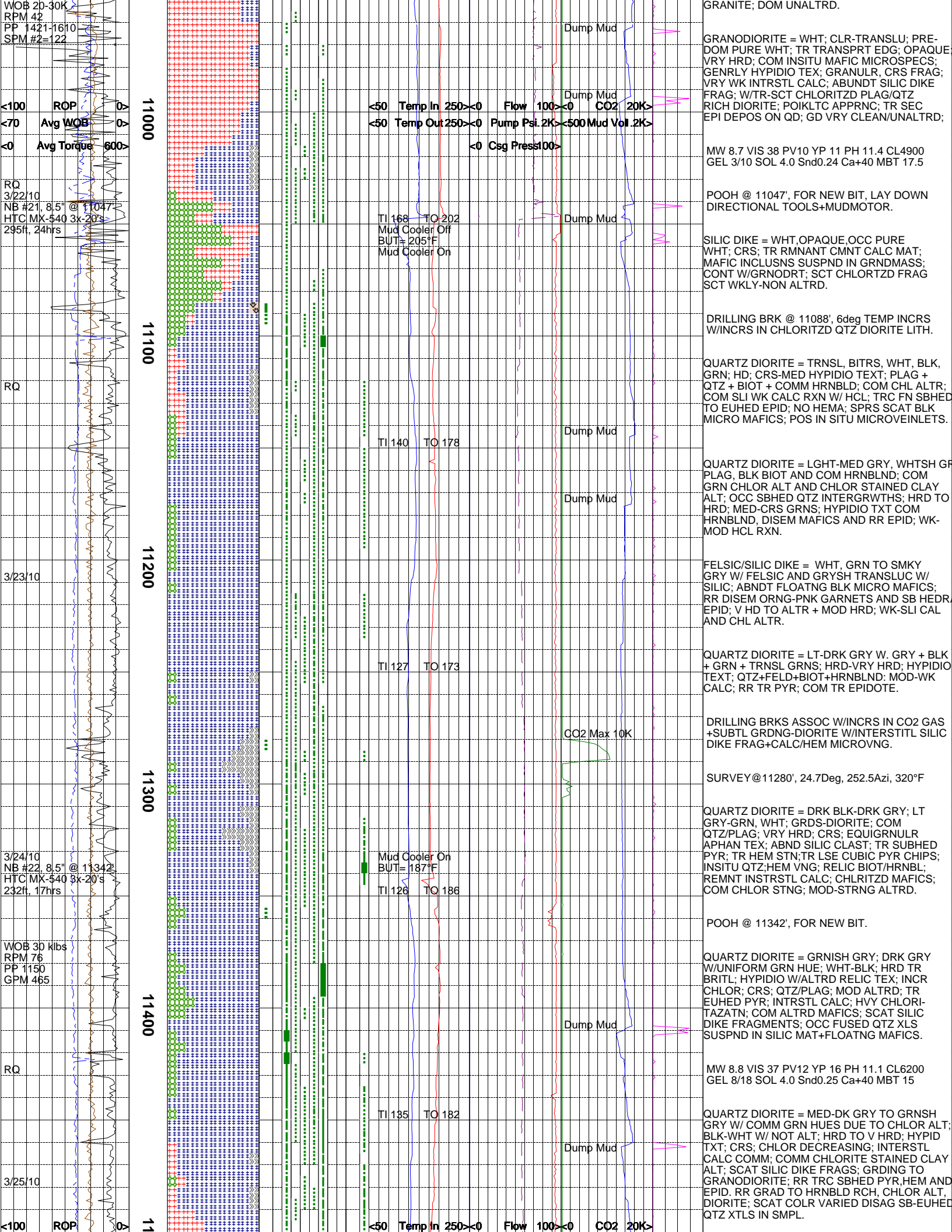
QUARTZ DIORITE = GRAY TO DRK GRAY W/
HUES OF PINK, RED AND GRN; HRD TO V HRD
CRS TO MED GRND; HYPIDIO TEXTRE; RR-TR
HEM STNING, TR HEM VEINING; SUBHED
EPIDOTE; CHLORITE ALTERATION, ALTERED
FELD; TR DISSEM PYRITE; MOD RXTION W/
CALC.

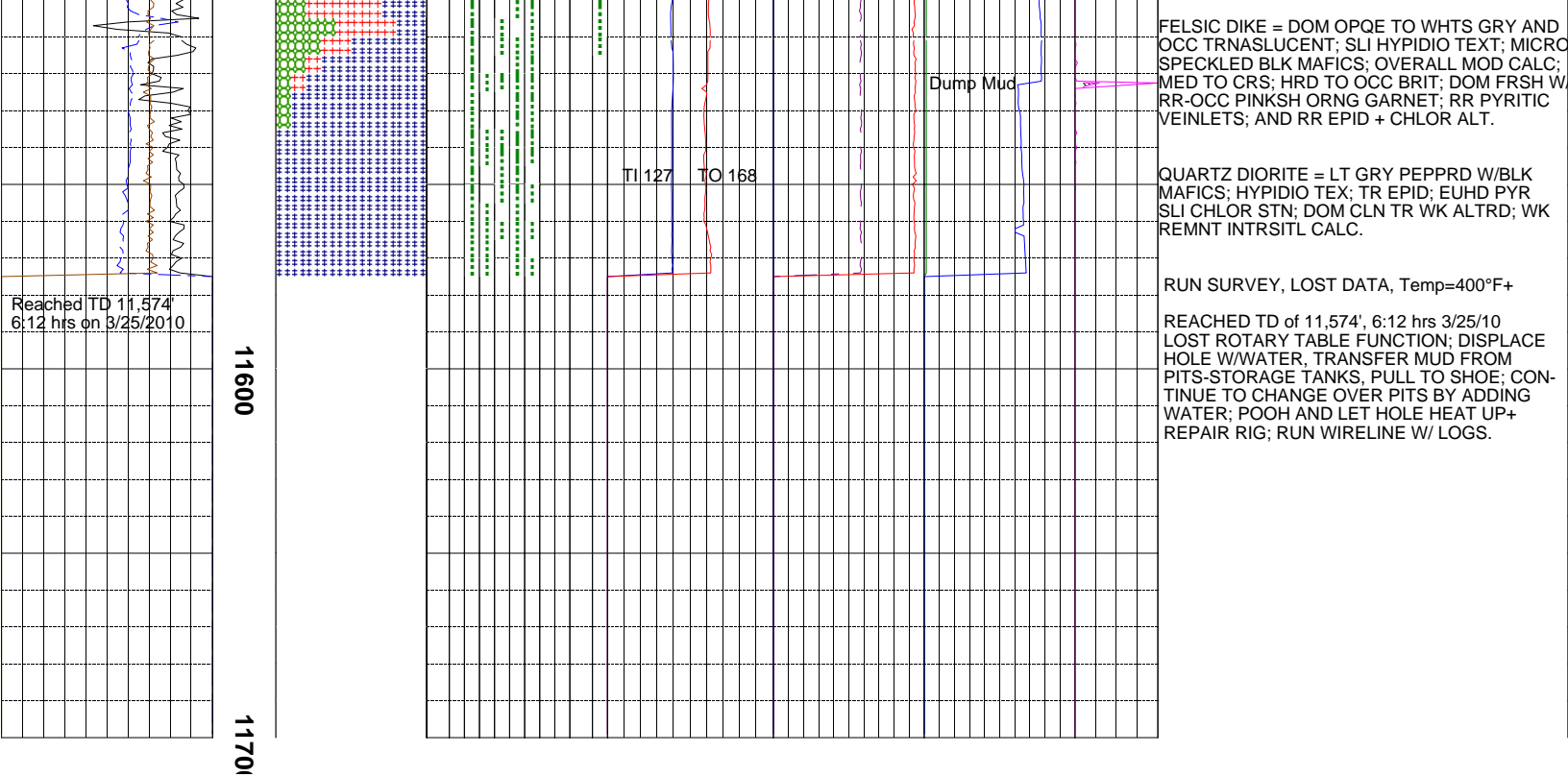
ALTERED ZONE = LIGHT GRN TO DARK GRN,
OCC OPAQUE WHITE W/ HUES OF RED;
ABUNDANT CHLORITE; RR HEM STNING;
SUBHED EPIDOTE; ALTERED FELD; MOD HARD
TO HARD; CRS GRANULAR TEXTRE; DISSEM
PYRITE; MOD TO STRG RXTION W/ HCL.

SURVEY @ 10860', 25.7 DEG, 271.4 AZI
TVD 10174', 132.03'N, 2911.68'W.

POOH @ 10910', FOR NEW BIT, RIH, POOH
FOR NEW MOTOR, RIH, DRILL.

GRANODIORITE = WHT, OPAQUE; TR DRK
MAFIC SPECS; CRS; V HRD; HYPIDIO TEX; V
GRANULR; OCC TRANSLU; PLAG+QTZ GRs;
SCT CHLORITZD QTZ FRAGMENTS; TR
INSITU EUHD PYR ON CRS SURFS; WK TO
NONCALC; NO CHLOR STN; GRDS-WHT





The log data, interpretations and recommendation provided by Epoch are inferences and assumptions based on measurements of drilling fluids. Such inferences and assumptions are not infallible and reasonable professionals may differ. Epoch does not represent or warrant the accuracy, correctness or completeness of any log data, interpretations, recommendations or information provided by Epoch, its officers, agents or employees. Epoch does not and cannot guarantee the accuracy of any such interpretation of the log data, interpretations or recommendations and Company is fully responsible for all decisions and actions it takes based on such log data, interpretations and recommendations.

