SUPPLEMENTAL
GEOTECHNICAL DATA REPORT
PROPOSED CHANGES TO MINING PLAN
SAN RAFAEL ROCK QUARRY
MARIN COUNTY, CALIFORNIA

VOLUME 2 OF 2
APPENDICES C THROUGH E

SUBMITTED

TO

DUTRA MATERIALS

SAN RAFAEL, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 6261.1.003.01

APRIL 11, 2005

APPENDIX C

Previous Drilling History Summary Table

Air-Percussion Logs
ENGEO INCORPORATED, 2004

Boring Logs
WOODWARD-CLYDE CONSULTANTS, 1981
GEOMATRIX CONSULTANTS, 1989
GOLDER ASSOCIATES, 1991

DRILLING HISTORY, PREVIOUS CONSULTANTS, SRQ

Boring No.	Date Collared	Elevation (feet)	Depth (feet)	Orientation (az/plunge)	Drilling Method	Consultant
P-1	3/4/91	18	3.0	0/90	Auger Probe	Golder
P-2	3/4/91	13	50.1	0/90	Auger Probe	Golder
P-3	3/1/91	9	13.0	0/90	Auger Probe	Golder
P-4	3/1/91	15	5.0	0/90	Auger Probe	Golder
B-1	3/1/91	5	51.1	0/90	Hollow stem auger/SPT	Golder
B-2	3/1/91	8	29.5	0/90	Hollow stem auger/SPT	Golder
B-3	3/4/91	22	23.5	0/90	Hollow stem auger/SPT	Golder
B-4	3/4/91	25	6.3	0/90	Hollow stem auger/SPT	Golder
B-5	7/24/91	19	80.0	0/90	Tricone/SPT	Golder
B-6	7/25/91	23	70.5	0/90	Tricone/SPT	Golder
B-7	7/26/91	20	40.0	0/90	Tricone/SPT	Golder
U-1	8/8/91	8	268.0	185/45	Rock bit to 48.5', HQ Core	Golder/Geomatrix
U-1A	8/22/91	20	260.0	45/60	Rock bit to 50.0', HQ Core	Golder/Geomatrix
U-2	9/3/91	12	719.0	146/45	Rock bit to 60.0', HQ Core	Golder/Geomatrix
U-3A	9/24/91	16	277.0	???/60	Rock bit to 90.0', HQ Core	Golder/Geomatrix
U-4	10/3/91	18	343.0	90/45	Rock bit to 130.0', HQ Core	Golder/Geomatrix
U-5A	10/14/91		1056.0	0/90	Rock bit to 16.2', HQ Core	Golder
U-6	7/11/91	220	250.0	0/90	HQ Core	Golder/Geomatrix
G-1A	10/20/89	140	354.9		Rock bit to 4.5', HQ Core	Geomatrix
G-2	11/6/89	38	342.7		HQ Core	Geomatrix
G-3	11/20/89	30	200.5		HQ Core	Geomatrix
1	4/17/81	166	24.0	0/90	Rotary to 13.4', NX Core	Woodward Clyde
2	4/20/81		32.5	0/90	Auger/rotary to 16', NX Core	Woodward Clyde
3	4/14/81	40	92.0	0/90	Rotary to 62.0', NX Core	Woodward Clyde

Boring No.	Date Collared	Elevation (feet)	Depth (feet)	Orientation (az/plunge)	Drilling Method	Consultant
4	4/13/81	26	100.4	0/90	Rotary to 95.5', NX Core	Woodward Clyde
5	4/16/81		19.1	0/90	Auger/rotary to 11.5', NX Core	Woodward Clyde
6	4/16/81	14	14.0	0/90	Auger/rotary	Woodward Clyde
7	4/21/81		147.8	0/90	Auger to 2.8, NX Core	Woodward Clyde
8	4/29/81	163	150.0	0/90	Auger to 9.0, NX Core	Woodward Clyde
9	5/8/81	127	43.0	0/90	Rotary to 33.2, NX Core	Woodward Clyde
10	5/11/81		59.2	0/90	Auger to 48.8, NX Core	Woodward Clyde
11	5/12/81	85	66.5	0/90	Auger/rotary to 52.5, NX Core	Woodward Clyde
			Total:	5191.7		

ENGEO INCORPORATED, 2004

Air-Percussion Logs

6261.1.003.01
April 11, 2005

ENGEO AIR-PERCUSSION BORINGS

BORING	DATE DRILLED	ELEVATION (FT)	TOTAL DEPTH (FT)	DEPTH TO GROUND WATER (FT)	LOG
AP-1	4/16/04	137	123	Not Encountered	0' to 40' **Black Shale**, weathered gray-brown to 40' to 66' Dark gray **Siltstone, Sandstone** and **Shale** inter-bedded 66' to 106' **Sandstone** and **Siltstone** 106' to 123' **No Recovery**
AP-2	4/16/04	128	119	Not Encountered	0' to 34' **Sandstone** with **Shale**, dark gray-brown to black 34' to 62' **Sandstone**, yellow-brown 62' to 109' **Sandstone** and **Shale**, dark gray to black, inter-bedded
AP-3	4/16/04	76	123	Not Encountered	0' to 46' **Sandstone** and **Shale**, dark gray to black, inter-bedded 46' to 123' No Recovery due to blowout of circulation air from ground fractures
AP-4	4/16/04	108	123	Not Encountered	0 to 27' **Sandstone**, dark gray 27' to 58' **Shale**, black 58' to 123' **Sandstone** and **Shale**, dark gray to black, inter-bedded
AP-5	4/16/04	89	91	Not Encountered	0' to 16' **Clayey Sand**, yellow-brown, **Fill** 16' to 50' **Sandstone** and **Shale**, dark gray to black, inter-bedded 50' to 91' **No Recovery**
AP-6	4/17/04	81	106	74	0' to 94' **Shale**, dark gray to black 94' to 106' **Sandstone**, dark gray
AP-7	4/17/04	79	112	Not Encountered	0' to 92' **Shale**, dark gray to black 82' to 112' **Sandstone**, dark gray

BORING	DATE DRILLED	ELEVATION (FT)	TOTAL DEPTH (FT)	DEPTH TO GROUND WATER (FT)	LOG
AP-8	4/17/04	80	123	Not Encountered	0' to 84' **Shale**, dark gray to black 84' to 123' **No Recovery**
AP-9	4/17/04	68	62	Not Encountered	0' to 52' **Shale**, gray-brown to brown and orange brown mottled 52' to 62' **Shale**, dark gray to black
AP-10	4/17/04	49	48	Not Encountered	0' to 8' **Sandy Clay**, yellow-brown, **Fill** 8' to 28' **Shale**, gray-brown 28' to 48' **Shale**, dark gray
AP-11	9/17/04	25	47	Not Encountered	0' to 25' **Sandy Gravel**, yellow brown, **Fill** 25' to 47' **Sandstone**, dark-gray
AP-12	9/17/04	29	47	Not Encountered	0' to 4' **Sandy Gravel**, yellow brown, **Fill** 4' to 47' **Sandstone,** yellow-brown
AP-13	9/17/04	29	78	30	0' to 24' **Sandy Gravel**, yellow brown, **Fill** 24' to 61 **Sand**, coarse-grained, rounded and **Sandy Gravel**, rounded, **Beach Sand,** saturated 61' to 78' **No Recovery,** hard drilling, probable bedrock
AP-14	9/17/04	25	82	Estimated at 18'	0' to 18' **Sandy Gravel**, yellow brown, **Fill** 18' to 62 **No Recovery** very soft drilling probable **Bay Mud** 62' to 82' **No Recovery,** hard drilling, probable bedrock

BORING	DATE DRILLED	ELEVATION (FT)	TOTAL DEPTH (FT)	DEPTH TO GROUND WATER (FT)	LOG
AP-15	9/17/04	37	72	Not Encountered	0' to 32' **Sandy Gravel**, yellow brown, **Fill** 32' to 60 **No Recovery** very soft drilling possible **Bay Mud?** 62' to 82' **No Recovery,** hard drilling, probable bedrock
AP-16	2/2/05	40	54	36'	0' to 15' **Sandy Gravel**, yellow brown, **Fill** 15' to 50 **No Recovery** very soft drilling 50' to 54' **No Recovery,** hard drilling, probable bedrock
AP-17	2/2/05	37	56	Not Encountered	0' to 40' **Sandy Gravel**, yellow brown, **Fill** 40' to 46' **No Recovery** softer drilling 46' to 56' **No Recovery,** hard drilling, probable bedrock
AP-18	2/2/05	35	50	Not Encountered	0' to 15' **Sandy Gravel**, yellow brown, **Fill** 15' to 42' **No Recovery** softer drilling 42' to 50'**Weathered Graywacke,** brown to gray brown, hard.
AP-19	2/2/05	32	38	8' (Perched)	0' to 15' **Sandy Gravel**, yellow brown, **Fill** 15' to 33'**Weathered Graywacke,** brown to gray brown, hard. 33' to 38' **Graywacke,** bluish-gray, hard.
AP-20	2/2/05	35	50	Not Encountered	0' to 8' **Sandy Gravel**, yellow brown, **Fill** 8' to 50' **No Recovery** soft drilling.

WOODWARD-CLYDE CONSULTANTS

Boring Logs
1981

WOODWARD-CLYDE CONSULTANTS EXAMPLE

TEST BORING RECORD

Job No. 15025A Date 4-17-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

ELEVATIONS ESTIMATED FROM FIGURES 1. AND 2.

Hole No. 0 Gr. El. Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

SURFACE ↓ DESCRIPTION	Rock No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
BRIEF DESCRIPTION OF SUBSURFACE MATERIALS						
DEPTH → 1						
2						
3						
4						
5						
6						
7						
8						
9						
10	CORE RUN NUMBER FROM DEPTH OF 9 TO 19 FEET		CORE RECOVERY (LENGTH OF CORE RECOVERED / TOTAL LENGTH OF CORE RUN)	ROCK QUALITY DESIGNATION (RQD) (LENGTH OF CORE LONGER THAN 4 INCHES / TOTAL LENGTH OF CORE RUN)	NOT INDICATED DUE TO DRILLING TECHNIQUE	NX CORE
1						
2						
3						
4						
5						
6						
7						
8						
9						
20						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-17-81

Name BASALT ROCK CO., INC. Location McNEARS QUARRY

Hole No. 1 Gr. El. 16.5' + MSL Type of Boring ROTARY, NX CORE Rig FALLING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION	Core No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
FILL - TAN GRAY SANDY SILT WITH GRAY SANDSTONE FRAGMENTS						ROTARY
SAME, ORANGE, BROWN, AND GRAY SANDSTONE FRAGMENTS						
SAME						5" CASING SET TO 6
						6.0 ROTARY WASH
SAME, TRACE WOOD						11.0 SLIGHT WATER LO
						11.5 BIT JUMPS SLIGHT
SANDSTONE - BLUE GRAY SANDSTONE FRAGMENTS (80-85%) WITH SANDY CLAY						12.0 VERY SLOW DRILLIN JUMPY
SANDSTONE - BLUE GRAY SANDSTONE, HARD, FRESH, MASSIVE, MEDIUM GRAINED, NO CLAY OR STAINING IN FRACTURES						13.4 BEGIN CORING
	1	100%	100%			
						16.5 WATER IN HOLE AT SEA LEVEL ON 4-20-81
SAME						
	2	100%	100%			
						STEADY WATER LOSS FROM 11.0'

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-17-81

Name BASALT ROCK CO., INC. Location McNEARS QUARRY

Hole No. 1 Gr. El. 16.5' +MSL Type of Boring ROTARY, NX CORE Rig FALING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION		RUN No.	Pen.	% Rec.	RQD	WTR. Level	DRILL NOTES
	1						
SAME	2	3		100%	100%		
	3						
HOLE TERMINATED AT 24.0'	24						
	5						
	6						
	7						
	8						
	9						
	30						
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	40						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-20-81

Name BASALT ROCK CO., INC. Location McNEARS QUARRY

Hole No. 2 Gr. El. 13' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION		Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
FILL - MOTTLED BROWN, TAN SANDY SILT WITH SOME GRAY AND BROWN SANDSTONE FRAGMENTS, AND SOME BOULDERS	1						AUGER
SOIL - DARK BROWN TO BLACK CLAYEY SANDY SILT WITH INTERMIXED LIGHT-GREEN GRAY SILTY SAND, AND TRACES OF SANDSTONE	2						
	3						
ALLUVIUM - MOTTLED, TAN, ORANGE, BROWN CLAYEY SAND WITH HIGHLY WEATHERED SANDSTONE FRAGMENTS, AND TRACE OF ORGANICS	4						
	5						
	6						5" CASING PUSHED TO 6.5'
ALLUVIUM - BROWN, ORANGE, TRACE GRAY SANDSTONE FRAGMENTS WITH TAN SANDY CLAY	7						6.5 ROTARY WASH FAST DRILLING
	8						
	9						
SAME, BUT TAN, GRAY, GRAY-GREEN CLAY	10						10.0 SLIGHTLY SLOWER DRILLING
SAME, INCREASE IN ROCK FRAGMENTS	1						10.5 ROUGHER DRILLI
	2						
	3						
SAME, INCREASE IN GRAY CLAY	4						
	5						15.0 SLOW DRILLING
	6						15.5 ROUGH DRILLIN
SANDSTONE - ORANGE, GRAY, BROWN, TAN, MOTTLED CLAYEY SAND WITH HIGHLY WEATHERED SANDSTONE FRAGMENTS. DENSE SANDSTONE CLAST AT 20'.	7						16.0 BEGIN CORING
	8	1		100%			
	9						
	20						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 4-20-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 2 Gr. El. 13' + MSL

Type of Boring ROTARY, NX CORE Rig FALING T60

Datum MEAN SEA LEVEL

Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SANDSTONE - LIGHT GRAYISH-TAN TO ORANGE, MEDIUM GRAINED, DARK ORANGE-BROWN COLORING AND SLIGHT CLAY IN FRACTURES	2		75%	25%		21.0 MODERATELY FAST DRILLING
SAME, SLIGHTLY GRAYER IN COLOR, HARD	3		100%	74%		24.0 SLOWER, SLIGHTLY ROUGHER DRILLING
	4		100%	100%		
HOLE TERMINATED AT 32.5'						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 5025A

Date 4-14-81

Name BASALT ROCK CO., INC. Location McNEARS QUARRY

Hole No. 3 Gr. El. 40' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

ft	DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	FILL - LIGHT BROWN, TAN, ORANGE-TAN SILTY SAND WITH ROCK FRAGMENTS						AUGER
1							
2							
3							
4							
5							
6							CASING PUSHED TO 7.5'
7							6.0 ROTARY WASH DIFFICULT DRILLING HIGH WATER LOSS, SLI
8							
9							
10							
1							5" CASING PUSHED TO 10.5'
2							
3							
4	SANDSTONE FRAGMENTS WITH LIGHT BROWN-TAN CLAYEY SAND, MINOR SHALE FRAGMENTS, MINOR WOOD						
5							14.5 SLIGHTLY SLOWER DRILLING
6							
7							5' CASING PUSHED TO 16.0'
8							
9							
20							

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-14-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 3 Gr. El. 40' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DONITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SAME, BUT DECREASE IN FINES						5" CASING PUSHED TO 24'
						24.0 HIGH WATER LOSS
						30.0 SMOOTH DRILLIN
SANDSTONE FRAGMENTS AND LIGHT TAN-BROWN SILTY SAND, SOME WOOD						5" CASING PUSHED TO 3
						33.5 HIGH WATER LOSS
BAY MUD AND ALLUVIUM — DARK GRAY-BLACK SILTY CLAY WITH SHELL FRAGMENTS						
TAN-BROWN SANDY CLAY AND CLAYEY SAND WITH SMALL ROCK FRAGMENTS						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 4-15-81

Name BASALT ROCK CO., INC. Location McNEARS QUARRY

Hole No. 3 Gr. El. 40'+ MSL Type of Boring Rotary, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	RUN No.	Pen.	% Rec.	RQD	WTR. Level	DRILL NOTES
SAME, LIGHTER IN COLOR, SMALL FRAGMENTS SANDSTONE						EASY DRILLING
INCREASE IN GRAY SILTY CLAY, SOME ROOTS						
SAME, INCREASE IN SAND, MINOR SANDSTONE AND SHALE FRAGMENTS						
SANDSTONE - TAN, WEATHERED						
						62.0 SLIGHTLY ROUGHER DRILLING
LIGHT TAN, GREEN-BLUE, LIGHT GRAY CLAY AND CLAYEY SAND, ANGULAR ROCK FRAGMENTS OF SANDSTONE, SHALE, CALCITE						
SAME, 50% SANDSTONE, SOME QUARTZ OR CALCITE						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-15-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 3 Gr. El. 40'+ MSL Type of Boring ROTARY, Nx CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
TAN-BROWN TO TAN-ORANGE CLAYEY SAND SANDY CLAY, MINOR SANDSTONE ROCK FRAGMENTS						
SANDSTONE – ORANGE, LIGHT GRAY, TAN, GREENISH-TAN, MEDIUM-GRAINED, HIGHLY WEATHERED TO CLAYEY SANDS WITH SMALL SANDSTONE FRAGMENTS, FRIABLE TO DENSE, MINOR THIN SHALE BEDS, BLACK, HIGHLY WEATHERED AND CLAYEY	1		54%	38%		62.0 BEGIN CORING
	2		67%	0%		
	3		60%	0%		
GRADES TO LIGHT BLUE-GRAY SANDSTONE, SURFACE OF FRACTURES COLORED TAN-ORANGE WITH SOME CLAY, DENSE, BECOMING LESS	4		43%	15%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-15-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 3 Gr. El. 40'+ MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SHALE - DARK GRAY TO BLACK, SHEARED AND FRACTURED, DENSE, FRESH	5		73%	18%		
	6		100%	50%		
MINOR SANDSTONE INTERBEDS	7		93%	0%		
SANDSTONE - BLUE-GRAY, MASSIVE MEDIUM-GRAINED, VERY HARD, FRESH	8		100%	90%		
HOLE TERMINATED AT 92.0'						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD PAGE 1 OF 5

Job No. 15025A Date 4-13-81

Name BASALT ROCK CO., INC. Location McNEARS QUARRY

Hole No. 4 Gr. El. 25' + MSL Type of Boring Rotary, NX CORE Rig FAILING 780

Datum MEAN SEA LEVEL Engr. L. DEVITO / R. McKINNEY

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
FILL - MOTTLED, TAN, OLIVE-BROWN SANDY SILT WITH ANGULAR SANDSTONE FRAGMENTS						AUGER
						6.0 ROTARY WASH
						5" CASING PUSHED TO 17.0'

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No 15025A Date 4-13-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No 4 Gr. El. 25' +MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DeVITO/R. McKINNEY

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
						21.0 SMOOTH DRILL
						5" CASING PUSHED TO 22.5'
BAY MUD – OLIVE-GREEN CLAYEY SILT WITH SANDSTONE FRAGMENTS, WOOD FRAGMENTS						24.5 EASY DRILLING
DARK OLIVE-GRAY SILTY CLAY WITH ANGULAR SANDSTONE FRAGMENTS, SHELL FRAGMENTS						30.0 SLIGHTLY MORE DIFFICULT DRILLING
						38.0 EASY DRILLING

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025 A

Date 4-13-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 4 Gr. El. 25' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO / R. McKINNEY

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	WW. Level	DRILL NOTES
SAME, DARK GRAY						
GRAY SANDY CLAYEY SILT						
GRAY SANDY CLAY WITH PEBBLES AND SANDSTONE FRAGMENTS						
GRAY SANDY CLAYEY SILT						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-13-81

Name BASALT ROCK CO., INC Location MCNEARS QUARRY

Hole No. 4 Gr. El. 25' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO/R. MCKINNEY

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
						72.5 EASY DRILLING
SAME						
SANDSTONE (WEATHERED) - LIGHT BROWN CLAYEY SAND AND CLAYEY SILTY SAND, STIFF						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 4-13-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 4 Gr. El. 25' + MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr L. DEVITO / R. MCKINNEY

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	WW. Level	DRILL NOTES
SAME, BUT LIGHT BROWN TO ORANGE						81.0 EASY DRILLIN BUT SLIGHTLY SLOWER
SAME, WITH LIGHT GREY, WHITE, ORANGE SANDY CLAY AND SANDSTONE ROCK FRAGMENTS						86.5 HARDER DRILLING, BIT JUMPS
SHALE - DARK GRAY, SOME LIMONITE STAINING ON FRACTURE SURFACES						95.5 BEGIN CORING
	1	56%	0%			

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025 A Date 4-16-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 5 Gr. El. 21.3' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
FILL - LIGHT BROWN, TAN, GRAY SANDY SILT WITH ROCK FRAGMENTS						AUGER
						5" CASING PUSHED TO 6.0'
SANDSTONE - TAN SANDSTONE CHIPS COATED WITH LIMONITE AND BLACK SPECKS, MEDIUM-GRAINED, WEATHERED						6.0 ROTARY WASH DRILL BIT JUMPS SLIGHTLY
						8.3 DRILL BIT JUMPS MODERATELY
						9.0 SMOOTHER DRILLING
WEATHERED SANDSTONE CORE (11.5'-19.1')						11.5 BEGIN CORING
	1		100%	53%		
FRACTURES COATED WITH CLAY (16.1'-16.9')	2		100%	55%		
	3		89%	44%		
HOLE TERMINATED AT 19.1'						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025 A

Date 4-16-81

Name BASALT ROCK CO., INC.

Location McNEARS QUARRY

Hole No. 6 Gr. El. 14' + MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr. L. DEVITO

DESCRIPTION		Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
FILL - BROWNISH-GRAY SANDY SILT WITH GRAY SANDSTONE FRAGMENTS	1						AUGER
	2						
ORANGE-BROWN SILTY SAND WITH GRAY AND BROWN SANDSTONE FRAGMENTS	3						3.0 DIFFICULT DRILLIN CHANGED TO ROTARY BARREL
	4						
	5						5" CASING PUSHED TO 6.0'
SANDSTONE - SANDSTONE FRAGMENTS, MODERATELY TO HIGHLY WEATHERED, IN MOTTLED, BROWN, TAN CLAY AND CLAYEY SAND	6						6.0 ROTARY WASH 6-2 VERY SLOW, JUMPY DRILLING
SANDSTONE - TAN TO LIGHT GRAYISH-WHITE, MEDIUM-GRAINED, ORANGE TO DARK BROWN STAINING IN FRACTURES, DENSE	7	1		100%			
	8						8.0 SLIGHT WATER LOS
	9						
	10						
SAME	1	2		100%			
	2						
	3						
HOLE TERMINATED AT 14.0'	4						
	5						
	6						
	7						
	8						
	9						
	10						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-21-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L-DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SOIL						AUGER
SANDSTONE – LIGHT BLUEISH-TAN, MEDIUM-GRAINED, MASSIVE, DARK BROWN-ORANGE STAINING OF FRACTURES	1	100%	50%			2.8 BEGIN CORING 6.0 WATER LOSS
SAME	2	100%	95%			
1" SHALE BED	3	100%	84%			
	4	75%	75%			
	5	100%	100%			

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 4-22-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' +MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	5					
SLIGHTLY MORE WEATHERED AT 24' (CLAY IN FRACTURE)	6		100%	95%		
INTERBEDDED SHALE FROM 30 to 39' SHALE IS BLACK, TO ORANGE-BROWN WHERE WEATHERED AND BROKEN	7		100%	55%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-22-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION		Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	1						
	2						
	3	8		100%	67%		
	4						
	5						
WEATHERED TRANSITION	6						
	7						
	8						
SLIGHTLY BLUER IN COLOR	9	9		100%	95%		
	50						
	1						
	2						
	3						
SAME, BUT PRIMARILY LIGHT BLUE WITH TAN ADJACENT TO FRACTURES	4						
	5						
	6	10		100%	90%		
	7						
	8						
	9						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-23-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' +MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SHALE - DARK GRAY TO BLACK, DENSE, MASSIVE, DARK BROWN - ORANGE COATING AND SOME CLAY IN FRACTURES SANDSTONE INTERBED 66.75' TO 66.75'	11		100%	50%		
SANDSTONE - BLUE, DENSE, ORANGE COATING IN FRACTURES	12		100%	75%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-24-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SANDSTONE, AS ABOVE, BUT FRACTURES NOT COATED ORANGE	13		100%	95%		
TRANSITION						
FRESH	14		100%	100%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 4-24-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' +MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	15		100%	90%		
	16		100%	100%		
THIN SHALE BEDS						
BRECCIA OF SHALE IN A SANDSTONE MATRIX FROM 116' TO 127.5', WELL CEMENTED, DENSE	17		100%	90%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD PAGE 7 OF 8

Job No. 15025A Date 4-27-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' + MSL Type of Boring ROTARY, NX CORE Rig FALLING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	17					
	18		100%	90%		
SANDSTONE - FRESH, DENSE						
	19		100%	95%		
SHALE BED (6")						
SHALE BED (5")						
THIN SHALE BEDS						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 4-28-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 7 Gr. El. 285' +MSL

Type of Boring ROTARY, NX CORE Rig FALLING 750

Datum MEAN SEA LEVEL

Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SHALE BED (4")	20		100%	95%		
SHALE BED (3")	21		100%	95%		
HOLE TERMINATED 147.8'						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-29-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 8 Gr. El. 163' +MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
FILL						AUGER
SANDSTONE AND SHALE, INTERBEDDED						5" CASING SET TO 9.0'
SANDSTONE - ORANGE BROWN TO BROWN, DENSE TO FRIABLE, ORANGE STAIN AND CLAY IN FRACTURES, OCCASIONAL SEAM OF HARD BLACK SHALE	1		100%	75%		9.0 BEGIN CORING
SHALE (13.5'-16.5') - BLACK, DENSE, LOCALLY CRUSHED, ORANGE STAIN AND CLAY IN FRACTURES, SOME CALCITE IN FRACTURES	2		95%	35%		
	3					

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 4-30-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 8 Gr. El. 163' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION		Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES →
SHALE BED (2")	1	3		100%	64%		
	2						
	3						
	4						
	5	4		100%	75%		
	6	5		100%	90%		
	7						
	8						
	9						
	30						
	1						
	2	6		100%	80%		
	3						
	4						
	5						
	6						
	7						
	8	7		100%	85%		
	9						
	10						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No 15025A Date 5-1-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No 8 Gr. El. 163' +MSL Type of Boring ROTARY, NX CORE Rig FALING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SHALE - DARK GRAY, DENSE, ORANGE TO DARK BROWN STAIN AND SOME CLAY IN FRACTURES	8		100%	60%		
SAME, BUT FIRM, SHEARED TO CLAYEY (53' TO 54.3')	9		100%	80%		
WEATHERED SANDSTONE - LIGHT BROWN TO BLUE-GRAY, DENSE, DARK ORANGE-BROWN STAIN AND SOME CLAY IN FRACTURES. SOME SHALE INTERBEDS						
TRANSITION	10					

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 5-4-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 8 Gr. El. 163' +MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION		Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	1						
	2						
THIN SHALE INTERBEDS	3	10		100%	75%		
	4						
	5						
THIN SHALE INTERBEDS	6						
	7	11		100%	70%		
SHALE INTERBEDS TO 70.9'	8						
BRECCIATED (68-5')	9	12		100%	90%		
	70						
SANDSTONE, AS ABOVE, BUT NO CLAY IN FRACTURES	1						
	2						
	3						
	4						
	5	13		100%	95%		
	6						
	7						
VERY THIN SHALE INTERBED	8						
BRECCIA (1.5') OF SANDSTONE AND SHALE, DENSE, WELL CEMENTED	9						
	80	14		100%	100%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-5-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 8 Gr. El. 163' + MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr. L. DEVITO

DESCRIPTION	RUN No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SANDSTONE AND SHALE, INTERBEDDED SHALE IS BROKEN, SHEARED, AND CLAYEY IN PLACES	15		100%	76%		
	16		100%	60%		
	17		100%	25%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-6-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 8 Gr. El. 163' +MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr L. DEVITO

DESCRIPTION		Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	1	18		100%	0%		
	2						
BRECCIA	3	19		100%	20%		
	4						
	5						
	6	20		100%	45%		
TRANSITION	7						
FRESH	8						
	9	21		100%	37%		
	110						
	1						
	2						
	3	22		75%	30%		
	4						
	5						
	6	23		100%	15%		
SANDSTONE - DENSE, FRESH	7						
	8						
	9	24		90%	15%		
	120						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No 15025A Date 5-7-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No 8 Gr. El. 163' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

Ft.	DESCRIPTION	RUN No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	SHALE BED (3")						
1							
2							
3		25		90%	20%		
4							
5							
6							
7							
8		26		80%	50%		
9							
130							
1	SHALE (131'-137') - DARK GRAY, SHEARED, CLAYEY						
2							
3							
4							
5		27		40%	0%		
6							
7							
8							
9							
		28		0%			

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 5-8-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 8 Gr. El. 163' +MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEYITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	29		100%	0%		
	30		100%	0%		
	31		60%	18%		
HOLE TERMINATED AT 150'						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 5-8-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 9 Gr. El. 127' + MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
FILL - BROWN TO TAN SANDY SILT WITH ROCK FRAGMENTS						AUGER
SHALE - BROWN TO GRAY, WEATHERED						5" CASING PUSHED TO 4.0'
						4.0 ROTARY WASH
SAME, MOSTLY GRAY						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-11-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 9 Gr. El. 127' ±MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
INTERBEDDED SHALE AND SANDSTONE						
SANDSTONE – GRAY, HARD, FRESH, LOCALLY FRIABLE						32.0 HARD, DIFFICULT DRILLING
						33.2 BEGIN CORING
	1	100%		0%		
	2	100%		50%		

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-11-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 9 Gr. El. 127' +MSL

Type of Boring ROTARY, Nx CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr. L. DEVITO

DESCRIPTION	RUN No.	Pen.	% Rec.	RQD	WTR. Level	DRILL NOTES
SAME, WITH MINOR SHALE TO 42.0'						
	3		100%	0%		
HOLE TERMINATED AT 43.0'						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-11-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 10 Gr. El. 74' +MSL Type of Boring ROTARY, NX CORE Rig FALLING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION		RUN No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
SOIL- LIGHT BROWN-TAN SANDY SILT WITH ROCK FRAGMENTS	1						AUGER
SHALE- TAN, ORANGE, GRAY	2						
	3						5" CASING PUSHED TO 4.0'
MOSTLY GRAY, DENSE	4						4.0 ROTARY WASH
	5						
	6						
	7						
	8						7.5' HARDER DRILLING 8.0 CASING SET TO 8.0'
	9						
	10						
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	20						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 5-11-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 10 Gr. El. 74' +MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	Runs No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
TRACE SANDSTONE						
SOME SANDSTONE INTERBEDS						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025 A Date 5-12-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 10 Gr. El. 74' +MSL Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL Engr. L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
TRACE SANDSTONE						
SANDSTONE – LIGHT GRAY, FRESH, DENSE TO POORLY CEMENTED AND FRIABLE, FRACTURED AND POWDERY IN PLACES. MINOR INTERBEDDED SHALE TO 47'						44.0 SLOW DRILLIN
						48.8 BEGIN CORING
	1		100%	15%		
	2		100%	10%		
	3		100%	10%		
HOLE TERMINATED AT 59.2'						

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-12-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 11 Gr. El. 85' + MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr. L. DEVITO

DESCRIPTION	RUN No.	Pen.	% Rec.	RQD	WTR. Level	DRILL NOTES
FILL - INTERMIXED WEATHERED AND FRESH SANDSTONE AND SHALE FRAGMENTS						AUGER
						8.6 ROTARY WASH
						9.0 5" CASING PUSHED TO 9.0'
						17.5 HARD DRILLING, HIGH WATER LOSS, NO CUTTINGS
						19.0 8" CASING PUSHED TO 19.0'

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A Date 5-13-81

Name BASALT ROCK CO., INC Location McNEARS QUARRY

Hole No. 11 Gr. El. 85' ±MSL Type of Boring ROTARY, NX CORE Rig FALLING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
						27.0 5" CASING PUSHED TO 32'
INCREASE TO 50% OF DARK GRAY SHALE FRAGMENTS						26.0-27.0 HIGH WATER LOSS
						27.0 5" CASING PUSHED TO 27'
						32.0 5" CASING PUSHED TO 32
SHALE - DARK GRAY						32.5 LOSS OF WATER

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-13-81

Name BASALT ROCK CO., INC Location MCNEARS QUARRY

Hole No. 11 Gr. El. 85' +MSL Type of Boring ROTARY, NX CORE Rig FALLING 750

Datum MEAN SEA LEVEL Engr L. DEVITO

Ft.	DESCRIPTION	Run No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
50	SANDSTONE - GRAY, FRESH, DENSE INTERBEDDED SHALE 51.6 – 52.5						
	SHALE BED (4")						52.5 BEGIN CORING
55		1		80%	40%		
60		2		100%	40%		

GEOMATRIX CONSULTANTS
CORE BORING RECORD

start Oct 20, 1989

PROJECT NO. 1501A DATE

PROJECT NAME San Rafael Rock Quarry LOCATION 3' NW of Hole N-1, NE Corner

HOLE NO. G-1A GR. EL. -140 TYPE OF BORING HQ Core RIG Mobile B-80

DATUM Sea Level GEOLOGIST D. Wells WATER LEVEL

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
1–4	Fill and Sandstone -	1–4	LC	—	—	—	Not sampled Drilled to 4.5' with rock bit
4	Fresh fine grained, hard, greenish black (5G 2/1) sandstone	4					4.60
5	Possible shear plane — Parting on thin brownish black (5 yr 2/1) shale bed at 5.10'	5	30°	mb 5.0/5.0		3.83/5.0	No H₂O Return
6	few calcite filled veins - Polished surface on shale -	6			100%		
7	Shearing on thin shale beds at 6.80-7.10 - open fractures	7	30	mb		77%	
8	Break on shear plane —	8		mb			
9	Break on calcite seam at 8.40' - breaks along calcite & shale are essentially mechanical - along weaker planes - calcite precipitated into all joints in sandstone (during recrystallization ?)	9		mb			9.60'
10	Break on calcite vein	10	40	mb			
11	Parting a thin shale bed at 11.00'	11		4.64/4.90		4.50/4.64	
12	- Breaks on calcite veins at 11.60' and 11.80'	12	BG			97%	
13	Core all broken up - to fit box	13		mb			Box 1 13.70
14	Healed shear zone - Breaks on calcite veins - matrix is greenish black sandstone	14		mb			No H₂O return
15	possible open fracture	15					11.10 M.S'
16		16		mb			
17	Breaks on calcite veins at 16.65', 17.50', 18.30' and 19.00'	17	60	5.3/5.3	100%	5.3/5.3	
18		18	60	mb		100%	
19	Some brownish black shale on fracture at 19.00' shale (like calcite) appears to fill joints in some places - but appears to be calcite filled	19	45	mb			
20		20	50	mb			11.30 19.8' No H₂O return 11.42

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE 10/20/89

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST _____ WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	ROQ S	NOTES
21	- Breaks on calcite veins at 20.40' and 20.60' - may be open fractures - possible healed shear zone.	mb				No casing installed. No H_2O return
2	Few calcite veins -					
3		BC		100%	4.35/5.15	In Box 2 22.80 — stop to add water to tank
4		BC	5.15/5.15		84%	
25	Break on calcite vein at 24.50' Possible open fracture →	mb				12:05 24.95' 12:17
6		BC	5.03/5.03			
7	Break on calcite vein .20" thick	mb		100%	5.03/5.03 =100%	
8		mb				
9	sandstone	mb				No H_2O return
30						12:52 29.98' 1:00
1	few calcite veins		5.03/5.03	100%	4.75/5.03	In Box 3 31.98 — stop to add H_2O to tank
2	Minor healed shear zone - Breaks on thin blackish brown shale beds at 32.0' Brecciated and	mb			94%	
3	Sheared shale beds - some calcite at 32.7'-33.1' - appear to be healed - no open fractures	mb				
4		BC				
35						35.01' 1:45
6			4.99/4.99	100%	4.99/4.99 100%	
7	Fractures on calcite veins					
8						
9		mb				No H_2O return.
40	Break on calcite vein →					

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE 10/20/87

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST _____ WATER LEVEL _____

DEPTH (ft)	DESCRIPTION
41	Parting on thin brownish black shale bed at 40.50 -possible shear plane
2	Sandstone with few calcite veins
3	Break on shear plane - polished shale - probably healed
4	Break on calcite vein
5	Fresh, hard, fine grained Greenish black (5G 2/1) sandstone
6	
7	Break on healed shear plane - subvertical slickensides - core always separates on shale beds - sometimes on thicker calcite veins
8	
9	Lots of calcite veins
50	Fracture along fresh, soft Grayish black (N2) shale bed (.08 thick) Shear plane with polished shale & calcite
1	Shear plane on shale
2	Healed shear zone in shale
3	Dark greenish gray (5G 4/1) sandstone Breaks along calcite veins
4	Breaks along healed shears in calcite with slickensides
5	Healed shears in calcite
6	Breaks on calcite veins
7	Brecciated sandstone - Calcite is partially dissolved - forming voids along veins - Partially open fractures - Abundant calcite veins
8	
9	Brecciated sandstone - matrix is partially dissolved - cemented with calcite
60	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
1	25	2.90 mb / 2.90	100%	2.9/2.9	2:27 40.0 Box 4 N: 40.50 No H2O return
2	BC BC			100%	
3					2:55 End - 10/20 47.90 Start 10/22 Raining
4	20	mb mb			
5		4.8/4.8 mb	100%	4.8/4.8 100%	
6					
7	20	mb			
8					47.70 9.22
9		mb 4.09/4.09	100%	4.09/4.09 100%	9.70 Box 5 48.82
50					
1	30				
2	30	mb			9.48 51.79
3		mb 3.10/3.10	100%	3.09/3.10 97%	
4					
5	30	mb			10.10 54.89 10.20
6	40 30	4.98/4.98	100%	3.65/4.98 73%	No H2O return - Box 6 57.60
7					
8		mb			
9					10.32 59.87
60					10.38

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Oct 25, 1989

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. -140' TYPE OF BORING _____ RIG _____

DATUM Sea level GEOLOGIST Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD S	NOTES
101	Break along part of a calcite vein. Possible open fracture/shear. Fracture along shale bed and calcite vein at 101.80. Thin shale beds to 102.00 - (Polished surface)	101	mb	5.11/5.11	100%	5.11/5.11 100%	Box 11 = 100.90 suspected bit. Drilling much faster - No H_2O return
2		2					
3		3	mb				
4	Healed shear - calcite and pyrite (?) (sheared along vein) - slickensides dip 40°	4	mb 60				8:15 104.66' 8:28
5		5		5.18/5.18	100%	4.73/5.18 91%	2.5' core in one piece. Fast Drilling
6	Break on healed shear	6	BC				
7	abundant very thin calcite veins. Break along calcite vein. Vertical slickensides on shear	7	mb 30				
8	Break on shear - slickensides dip 40	8	BC BC				
9	Break along calcite vein subvertical slickensides in calcite (healed shear)	9	55				9:04 109.84 Box 12
110		110					9:15
1		1					Core in one piece. Slow Drilling
2	Few thin shale bed, at 112.50 and 113.55. Fresh hard very fine grained Greenish black (5G 2/1) sandstone with abundant randomly oriented calcite veins.	2	BC 4.50 BC 4.50	4.50	100%	100%	
3		3	BC				
4		4					9:58 114.34 10:10
5	Thin Fragmented shale beds	5	BC	5.17/5.17	100%	100%	Core in one piece. Slow Drilling
6		6					
7	Broke core along thin shale bed.	7	BC				
8		8	BC				Box 13 118.86
9	Very thin fragmented shale beds	9	BC				11:10 119.51 12:05 Pull rod to check
120		120					

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Oct 25, 1989

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
120	Break on .03" calcite vein		.80/.80	100%	0%	12:28 Blocked off @ 120.31
121			BC BC			12:26
			4.56/4.56	100%	4.56/4.56 100%	Drilling faster
2	Fragmented shale beds to 124.87' - calcite formed after disruption of shale beds		BC BC mb			No H_2O return -
3	Possible healed shear zone					
4	Fracture along thin shale bed		mb			
	Possible healed shear zone					12:52 124.87'
5						1:06
6	Very thin blackish brown shale bed		5.10/5.10 BC	100%	100%	Core very smooth
7			BC			Box 14
	Very thin fragmented shale beds		BC			127.92
8						
9	Possible healed shear zone		mb			
	Break along thin shale bed					1:45 129.97'
130	.3" thick shale bed - with calcite at 129.50					1:52
1	Sandstone few calcite veins		BC 5.00/5.00 BC BC	100%	100%	Core in 3 pieces
2						
3	Very thin shale bed		BC			
	Break on thin shale bed		BC			
4	Shale with calcite - .07" thick		mb mb			2:34 134.97 End
	Fragmented shale beds - in healed shear zone 134.10 to 134.67					7:26 Start 10/26
5	Abundant calcite veins - steeply dipping veins are the youngest					
6	Break on .03" thick shale bed - slickensides on shale - sheared zone above this fault at 136.25 - displaced quartz veins		5.12/5.12 mb BC	100%	4.92/5.12 96%	Box 15 136.85
7			mb			
8			mb			
9	Break along very thin shale bed Thin shale bed w/calcite Possible healed shear					8:01
140						

1.25
2.3.
3.5

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE 9+26-27

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION
141	
2	Very Thin shale bed - possible healed shear zone
3	Break along healed shear - slickenside dip 35°
4	Very Thin shale bed - possible healed shear zone
	Abundant calcite veins - few fragmented shale beds
5	Possible open fracture at 145.56'
6	- Shear plane with polished shale
	Healed shear zone to 146.0'
7	
	Break on weak calcite vein
8	
9	
150	
1	Fresh, very hard, very fine grained greenish black (5G 2/1) sandstone - with few calcite veins and few very thin, fragmented shale beds.
2	- some minor brecciation of sandstone.
3	
4	
5	Break along calcite vein
6	
	Break along calcite vein
7	Few calcite veins
8	Break on calcite vein
9	Fracture on healed shear - good slickensides dip 60° offset about
160	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROQS	NOTES
141					8:11 140.12
1		4.84 / BC 4.84	100%	100%	Core in 2 pieces (4.2')
2		BC			
3	55	BC			
4		BC mb			8:56
5					9:08 144.96 C. Taylor .6' sample to Box 16 14626
6	20	5.05 / BC 5.05	100%	100%	
7		mb			
8		mb			
9		mb			
150					10:05 150.01
1		4.97 / 4.97	100%	100%	10:12
2		BC BC mb			Slow drilling very hard rock stop 10' to fill water tank
3					Core in 2 pieces
4		BC BC			11:26 154.98 Box 17
5	20	1.05 / BC 1.05	100%	10-?	12:25 15540
6					12:50 156.03 stop to change pumps
7		mb mb 4.00 / BC 4.00	100%	100%	7:07 End ① Start 10/27 7:24
8		BC			Fast drilling
9	30	mb BC			
160	35				7:24

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. CMX-1501A DATE Oct 27

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. -140 ft TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
161	Partially open fractures - calcite dissolved out of veins	1		BC			7:32 160.03
2	Fractures along healed (?) shears - weak slickensides	2	35	5.15 / 5.15 mb	100%	3.90 / 5.15 = 76%	No H2O return
3	Break along calcite vein	3		mb			Box 18
4	Fracture along healed shear - good slickensides in calcite (vertical)	4		mb			164.08
5	Partially open fracture on calcite vein	5	40	BC			7:58 165.18
6	Break on calcite vein	6	60	BC 5.03 / 5.03	100%	100%	8:08 one piece ~3.0'
7	Fresh, hard, very fine grained greenish black (5G 2/1) sandstone with few calcite veins	7	40	mb			
8	Break on healed shear zone	8		BC			
9	Very thin shale beds with calcite	9		BC			
170		170					8:47 170.21
1	Fragmented thin shale beds	1					9:16 Sample 170.21-178.34 Bob Woolbury (one piece 3.1')
2	Healed shear zone 174.5 to 177.0	2		4.70 / 4.70	100%	4.13 / 4.70 = 88%	
3	Possible healed shear on calcite	3					
4	Fractures along calcite vein - some fresh hard, very fine grained dark gray (N-3) sandstone - minor dissolution of calcite along steeply dipping vein	4		BC			9:56 174.91
5	Fragmented brownish-black (5 YR 2/1) shale with calcite	5		mb			10:26 Box 19
6	= .2" thick, shale fill fractures in sandstone. Sheared shale	6	30	5.10 / 5.10	100%	4.00 / 5.10 = 78%	175.96
7	Dark gray (N-3) sandstone and Greenish black (5G 2/1) sandstone	7	50				
8	Fracture on healed shear in shale	8		BC			
9	Thin Brownish black (5 YR 2/1) shale (Healed shear zone)	9	50				
180	Greenish black sandstone with abundant calcite	180		BC			11.05

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501A DATE Oct 27, Oct 30

PROJECT NAME LOCATION

HOLE NO. G-1A GR. EL. TYPE OF BORING HQ RIG

DATUM GEOLOGIST Wells WATER LEVEL

DEPTH (ft)	DESCRIPTION	CORE REC./RUN	% REC.	RQD %	NOTES
180–185	Abundant Fragmented white to dusky yellow green (5 GY 5/2) quartz veins in Greenish black sandstone. Shearing along very thin brownish black (5YR 2/1) shale beds (20°, 30°). Many healed shears, calcite + quartz veins displaced - 180.0-181.75'. Greenish black sandstone with few calcite & quartz veins (mb at 183). Break along healed shear zone - slickensides - horizontal slip	4.99 / 4.99	100%	4.75 / 4.99 95%	180.01 11:33 Sample - Bits Windham ?Well Hydraulics too hot - drilling very slow; 12:40 185.00 End Box 20 185.48
185–187	Few calcite veins - Fresh very hard greenish black sandstone - very hard to break core off - Thin shale beds w/calcite (BC)	2.00 / 2.00	100%	100%	8:35 start 10:30 Hard Rock - Very slow drilling - Pull Rods to 9:00 187.00' change bit
187–190.17	Healed shear zone. Few calcite veins - sandstone - (BC, BC, mb, BC, BC, BC)	3.17 / 3.17	100%	100%	10:25 Core in 2 pieces Very hard rock to break - 10:47 190.17
190.17–194.98	Few very shale beds with calcite. .01-.02" thick calcite veins	4.81 / 4.81	100%	100%	11:02 core in 1 piece; 11:33 194.98
194.98–200	Very thin shale beds with calcite. Healed shear zone - Break on calcite vein (40°, BC) - Partially open fracture - Few very thin shale beds (BC). Fracture on calcite shear - slickensides dip at 50°-60° (BC, 50). Break on calcite vein (BC). Partially open fracture (mb). Slickensides dip 30° on shear zone (75°). Shearing on very thin shale bed (35)	5.15 / 5.15	100%	4.15 / 5.15 81%	11:45 Box 21 198.98 Stop to cool rig 12:16

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Oct 30

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. _____ TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC./RUN	% REC.	ROD S	NOTES
201	~~Fragmented~~ Very thin shale beds - Minor dissolution along calcite veins	201		BC 5.00/5.00	100%	4.65/5.00	1:05 200.13
2	Break on healed shear zone - polished shale surface, fragmented sandstone	2	50°	BC		93%	Hard rock
3	Fragmented, soft, fresh brownish black (5YR 2/1) shale (with calcite and sandstone) in shear zone	3		BC			
4	Fragmented sandstone - 3' thick - Break on healed shear zone - Pressure solution veins of quartz	4		BC			
Quartz + White 5	- Dusky yellow green (5GY 5/2) - very hard - Slickensides dip 70° on Shear zone in shale/calcite	5	45°	BC			2:00 205.13
6	Few calcite veins - Thin fragmented shale beds	6		BC 4.80/4.80	100%	4.10/4.80 85%	2:15
7	Possible aquifer - soft sandstone matrix is dissolved at 207.1 - Shear zone - fragmented SS + shale	7	50°				Box 22 207.65
8	Dark gray (N-3) sandstone - Greenish black sandstone	8		BC mb			
9	Break along thin calcite vein - slickensides dip ≈ 60° (not open)	9	60°	BC			
210	Thin brownish black shale beds (healed shear zone?)	210					3:00 209.93 End 6.45 Start 10/31
1	Sheared zone - calcite + shale - polished surface on very thin shale bed	1		BC 5.00/5.00	100%	100%	Core in 2 pieces (2' & 3')
2	Abundant very thin (translucent) white quartz and calcite veins	2	30°	BC			
3		3		BC			
4		4		BC			
5	Fresh soft thin shale beds - Healed shear zone at 214.0	5		BC			7:14 214.93 7:24
6	Fresh, very hard dark gray (N-3) sandstone with very thin brownish black (5YR 2/1) shale beds and very thin calcite and quartz veins	6		5.10/5.10 mab	100%	100%	Box 23 216.53
7	Break on thin calcite vein - Greenish black (5G 2/1) sandstone with quartz + calcite veins	7	30°				Core in 2 Pieces (3.5' & 1.6')
8	Very thin shale bed	8					
9		9					
220		220					8:04

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Oct 31

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. _____ TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL 10.6'

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
221	Parting on healed shear zone .03" brownish black shale bed	221		4.37 / 4.37	100%	4.23 / 4.37 = 97%	8:25 220.03' Core in 4 pieces
224	Breaks on healed shear zone Calcite & .08' shale bed	224					9:16 / 9:34 224.40'
225	Greenish black (5G 2/1) sandstone - with translucent to white quartz and calcite veins. Breaks along calcite vein	225		4.75 / 4.75	100%	100%	Box 24 225.60 Core in 2 pieces
229	Few calcite or quartz veins no shale	229		5.04 / 5.04	100%	100%	10:16 / 10:28 229.15 Core in 4 pieces
230	Breaks on calcite veins	230					
234	Fresh, very hard Greenish black (5G 2/1) sandstone - few calcite and quartz veins. Breaks on calcite veins. Minor dissolution along vertical calcite vein - partially open fracture	234		5.00 / 5.00	100%	100%	11:28 / 12:53 234.19 Box 25 234.55 stop to cool rig. Very slow drilling rig very hot
239		239					2:20 / 7:47 239.15 End start 11/1
240		240					

Signature

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Nov 1

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1A GR. EL. _____ TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL 10.6'

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
241	Abundant quartz veins, very hard greenish black sandstone - few calcite veins. Break along calcite vein - few very thin shale beds (fragmented)	241	BC BC mb BC BC mb	5.18/5.18	100%	100%	Very hard rk. slow drilling. Core in 3 pieces. Box 26 243.26
							8:00 244.33
	Very thin shale bed. Minor dissolution on calcite vein. Few quartz and calcite veins	245	BC BC BC	5.05/5.05	100%	4.15/5.05	8:50 Core in 2 pieces
	Very thin shale bed with calcite fractures along calcite vein - dissolution of calcite appears to have occurred along this vein (partially open fracture)		BC mb BC BC			82%	
							9:50 249.38
250	Very thin shale bed	250	BC BC mb BC BC	5.11/5.11	100%	4.61/5.11	10:02 Core in ~2 pieces
	Break - along calcite vein					90%	Box 27 252.58
	Thin fragmented shale beds with calcite and quartz veins						
							11:03 254.49
							11:33
	Very thin shale bed			4.75/4.75	100%	4.50/4.75	
	Fresh hard greenish brown (5G 2/1) very fine grained sandstone with few calcite and quartz veins		BC BC BC BC BC			95%	
	Healed shear with calcite vein						12:27 259.24
260	Breaks in calcite veins	260	mb BC				1:30

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Nov 1
PROJECT NAME ______ LOCATION ______
HOLE NO. G-1A GR. EL. ______ TYPE OF BORING HQ RIG ______
DATUM ______ GEOLOGIST Wells WATER LEVEL 4.2'

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC./RUN	% REC.	RQD 5	NOTES
261	Very fine grained [moderately weathered] and bluish gray (5B 2/1) to medium gray (N-5) sandstone - rock is crumbly - breaks easily along calcite veins - moderately indurated - some dissolution of calcite veins - Minor clay along fractures	261	BC	5.08 / 5.50	92%	2.70 / 5.50 49%	Fast Drilling soft rock; Box 28; 261.62'
2 – 3	.10" thick translucent gypsum vein	2 – 3	LC				Fluid 2010; Water level rose 5' morning after drilling through this zone
4	Fragmental sandstone with voids, translucent gypsum & white calcite (Mostly gypsum)	4	BC				2:02 / 2:14 264.74
5	Soft sandstone fractures along medium gray (N-3) clay seams and calcite veins	5		5.00 / 5.00	100%	3.75 / 5.00	
6	Fragmented shale beds (Healed shears)	6	BC			75%	2:44 Fast Drilling soft rock
7	Medium dark gray (N-4) to dark gray (N-3) fresh hard very fine grained sandstone	7	BC				
8	Very thin fragmented shale beds	8	BC				
9	Fracture along calcite vein (calcite mostly dissolved); .02 - .10" thick dark brownish (5YR 2/1) fragmented shale beds (Healed shear zone)	9	BC; BC				End 269.74; 6:50 start 10/2
270	Fresh hard very fine grained greenish black (5G 2/1) sandstone with few steeply dipping calcite veins and irregular translucent to light greenish gray (5G 8/1) quartz veins -	270	BC; BC; BC	5.00 / 5.00	100%	4.6 / 5.00 92%	Box 29; 270.80; Core in 2 pieces - one 4.7' long; Harder rock
2 – 3		2 – 3	BC; BC				
4	Fracture on calcite vein; Slight dissolution of calcite veins	4	BC				7:29 / 7:41 274.74
5	Fresh, hard, very fine grained Dark green (5G 3/1) to Dark gray (N-3) sandstone with calcite & quartz veins	5		5.00 / 5.00	100%	4.55 / 5.00	Core 5 pieces
7	Few very thin shale beds	7	BC			91%	Hard rock
8 – 9		8 – 9	BC; rub				Box 30
280		280					8:21 / 8:32 279.74

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Nov 2

PROJECT NAME LOCATION

HOLE NO. G-1A GR. EL. TYPE OF BORING HQ RIG

DATUM GEOLOGIST Wells WATER LEVEL 4.2'

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC./RUN	% REC.	RQD %	NOTES
281	Few calcite veins Few small shale blebs	281		5.19 / 5.19	100%	100%	One piece Fast Drilling (Sample: Cloud Taylor)
2		2					
3	Abundant [illegible]	3					
4		4					9:07 / 9:20 284.93
5		5		BC 4.95 / [illegible]	100%	[illegible]	9:48
6	Very thin shale bed →	6					
7	Fresh, hard, very fine grained greenish black to dark gray sandstone	7		BC			Core in 2 pieces
8	Fragmented, very thin shale beds Break on calcite vein	8		BC			
9	Abundant calcite and quartz veins	9					9:4? / 10:0? 289.88
290		290		BC 5.20 / 5.20 BC	100%	100%	
1	Healed shear on calcite vein →	1		BC			Core in 4 pieces
2	Very thin, fragmented shale beds with calcite	2		BC			
3	Healed shear on calcite vein → Parting on very thin fragmented shale bed →	3		BC			Box 31 294.13
4	Abundant fragmented calcite and quartz veins -	4		BC			10:56 295.08
5		5		4.93 / 4.93	100%	100%	
6	Fracture on very thin calcite vein - mechanical breaks → Few calcite or quartz veins	6					Core in 5 pieces
7		7					
8		8		BC			
9	Fragmented very thin shale beds → Healed shear on thin shale beds	9					
300		0		BC			

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Nov 2
PROJECT NAME ______ LOCATION ______
HOLE NO. G-1A GR. EL. ______ TYPE OF BORING HQ RIG ______
DATUM ______ GEOLOGIST Wells WATER LEVEL ______

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD S	NOTES
301	Broken core. Abundant quartz veins, Fresh, hard, very fine grained Dark Gray - Greenish black sandstone with few calcite veins	301		5.10/5.10	100%	100%	Fast Drilling. Core in 2 pieces
2	Fragmented very thin shale bed with quartz veins	2		BC			Box 32
3		3		BC			303.15
4	(healed) Shear on thin brownish black (5YR 2/1) shale bed	4					
5	Dark gray (N-3) sandstone	5					12:50 305.11
6		6		4.88/4.88	100%	100%	Core in 3 pieces
7	Break on calcite vein & thin shale bed. Very thin shale bed:	7		BC			
8		8					
9	Break on calcite vein. Abundant quartz veins and fragmented shale beds (possible healed shear zone)	9		BC			
310	Few quartz and calcite veins	310		BC 5.13/5.13	100%	100%	1:16 309.99 1:25
1	Few very thin shale beds	1					Fast Drilling
2		2		BC, BC			Box 33 312.37
3	Healed shear zone. .2 thick shale bed with quartz and calcite veins	3		BC			
4	Sheared zone with thin clay (30°)	4		BC			
5	Fragmented very thin shale beds with calcite & quartz veins	5					2:03 End 315.12
6	.4 thick sheared zone - open fracture along thin clay seam at base of layer. Fragmented shale in calcite matrix (55°) shale is very soft & moist	6		BC 4.91/4.91	100%	100%	6:47 start 11/3. Core in 3 pieces
7		7					
8	(Sandstone above shale is ... [illegible])	8		BC			
9	[illegible] fragmented shale beds	9					
320	Fresh, hard, fine grained	320		BC			7:10

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE Nov 3

PROJECT NAME ____ LOCATION ____

HOLE NO. G-1A GR. EL. ____ TYPE OF BORING HQ RIG ____

DATUM ____ GEOLOGIST Wells WATER LEVEL 5.5

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC./RUN	% REC.	RQD %	NOTES
320	[illegible] thin brownish [illegible] shale bed.	320					7:22 320.03
321	Dark gray (N-3) sandstone, with [illegible] calcite and quartz veins	321		5.09 / 5.09	100%	100%	Core in 1 piece. Sample Bob Woodburn
322		322					
323	[illegible] quartz [illegible]	323					
324		324					
325		325					7:45 325.12 7:57
326	Few calcite veins	326	BC	5.01 / 5.01	100%	[illegible]	Box 34 326.50'. Core in 1 piece
327		327	BC				
328	Fragmented thin shale with calcite and quartz veins. Abundant quartz veins	328	BC, BC				
329		329					
330		330					[illegible] 330.17 [illegible]
331	Greenish black sandstone with few calcite veins abundant quartz veins at 332' - 335'	331	BC	5.04 / 5.04	100%	100%	
332		332	BC				Core in 2 pieces - broken when spring slipped
333		333	BC, BC				
334		334	BC				
335		335	MB				9:08 335.17 9:30
336	Few quartz veins -	336		5.00 / 5.00	100%	100%	
337		337					Core in 1 piece
338		338					Sample Bob Woodburn
339	Greenish black sandstone	339					
340		340					10:12

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1521.1 DATE Nov 3

PROJECT NAME _____ LOCATION _____

HOLE NO. G-1.1 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST _____ WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC./RUN	% REC.	ROQ S	NOTES
340	Greenish black sandstone	340		BC 4.90	100%	100%	340.17 Box 3
1		1		BC 4.90			340.62
2	Healed fractures on calcite veins	2		BC			Core in 4 pieces
3		3		BC			
4	Dark gray sandstone - slightly softer, some dissolution of matrix above fracture at 344.50' - Good slickensides on calcite vein (65°)	4					surface of core is highly pitted
5		5					345.07
6	Fresh hard dark gray sandstone with few calcite veins	6		BC 5.05 / 5.05	100%	100%	11:22
7	Breaks along calcite veins .02' thick calcite vein	7		BC			
8		8		BC			
9		9					Box 36
350		350					349.37'
1	Fracture on Healed shear plane	1		BC 4.80 / 4.80	100%	100%	11:50 350.12
2	Healed shear planes - some clay within calcite vein	2		BC			12:03
3		3		mb			
4	Fracture on Healed shear plane (80°)	4		mb			Box 37
5	break along calcite vein	5		mb			12:25 354.92' End Hole
6		6					
7		7					
8		8					
9		9					
360		360					

PAGE 1 OF 2

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A DATE 11/6/95 11/7

PROJECT NAME San Pedro Bluff LOCATION Between Powder Magazine & SRRQ office

HOLE NO. G-2 GR. EL. 38' estimated from topo map TYPE OF BORING 4Q RIG

DATUM Sea Level GEOLOGIST Wells WATER LEVEL —

DEPTH (ft)	DESCRIPTION
1–4	Highly weathered moderately hard fine grained dusky yellow (5Y 6/4) & light olive gray (5Y 5/2) sandstone Dissolution pitting - fractures along joints (calcite dissolved out) .03" thick dusky yellow clay at 5.70' & rootlets.
5–9	Few quartz veins break on healed shear
10–14	iron stained fracture-partially open - broken by drilling .01 - .10 thick calcite vein healed fracture .02" thick clay seam
15–20	Broken along iron stained healed fractures - rock is highly weathered. Hard, fine grained light olive gray (5Y 5/2) to medium bluish gray (5B 5/1) sandstone Few calcite veins

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD 5	NOTES
1–4	L.C.	1.3 / 4.5		.9 / 4.5 = 20%	- counting last core
					4.5'
5–9	mb	4.97 / 4.97	100%	3.67 / 4.97 = 74%	Using bentonite for drilling - no polymer Fast Drilling soft rock
					9.47
10–14	mb	4.90 / 4.90	100%	4.40 / 4.90 = 90%	Box 1 11.37 50% H_2O return
					14.37 End 6:49 Start
15–20	mb BC mb	5.20 / 5.20	100%	3.4 / 5.2 = 65%	7:07 19.57 7:16

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501A- DATE 1:1-

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST Dibble WATER LEVEL _____

DEPTH (ft)	DESCRIPTION
21	Sandstone
2	Open iron stained fracture - Fragmented dark gray (N 2) shale - partially open fractures - healed / dissolved from weathering - Breaks along partially open fractures - some iron staining
3	
4	
5	Clay fragments - dissolution pitting on joints and matrix of sandstone
6	1.2' thick zone of brecciated sandstone in calcite matrix (>50% calcite with crystals)
7	
8	Core all broken up - clayey matrix - rounded pieces angular pieces
9	Moderately weathered, soft, fine grained, clayey medium bluish gray (5B 5/1) sandstone moist rock
30	
1	1-1.2' thick, vertical calcite vein (with crystals)
2	dissolution pitting on sandstone
3	Core all broken up - angular pieces - weak matrix
4	
5	Hard sandstone - slight yellowing of calcite along fracture
6	
7	
8	Dissolution pitting along healed fractures
9	Moderately hard - core all broken up - weak matrix - moist rock.
40	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES Box 2
21	mb	4.9/4.9	100%	4.5/4.9	20.31
2	mb			92%	
3	mb				
4	mb				7:35 / 7:42 29.47'
5	mb	4.6/5.0	92%	1.6/5.0	
6	mb			32%	
7					
8	mb				
9	mb				Box 3
					7:53 / 8:00 29.47'
30	mb	4.8/5.0	96%	1.8/5.0	
1	mb				50% H2O return
2	mb			36%	
3	mb				
4	mb				8:16 / 8:40 34.47'
5	mb	5.0/5.0	100%	3.0/5.0	
6	mb			60%	
7	mb				
8	mb				Box 4 38.50'
9	mb				9:00 / 9:40 39.47'
40					

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501A DATE 11/7

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST J. Wells WATER LEVEL 3.6' [illegible]

DEPTH (ft)	DESCRIPTION
41	Slightly weathered, moderately hard, fine grained medium dark gray (N4) sandstone surface is pitted, .1' thick calcite vein - some veins are displaced by healed shears
2	
3	Core all broken up into angular fragments - iron staining on numerous ≈45° dipping shears
4	
5	Brecciated zone - (healed) calcite vein. in shear, very fine grained sandstone and shale
6	Fresh, hard, medium - fine grained medium gray (N-5) sandstone with few calcite veins
7	Pitting + dissolution of calcite around healed shear - on shale iron staining - possible brecciated sandstone above shear - Very fine grained sandstone below - abundant calcite veins
8	
9	
50	Fresh, hard coarse - fine grained dark gray (N3) sandstone - few very thin brownish black (5YR 2/1) shale beds - within very fine grained sandstone
1	One .02 thick quartz vein - Breaks occur on calcite veins - slight conchoidal fracture on breaks
2	Core broken up along vertical calcite vein
3	medium - coarse grained sandstone
4	Brecciated shale and calcite in healed shear zone
5	
6	Fresh, hard fine grained dark gray (N-3) sandstone with few steeply dipping .01' thick white calcite veins - Lots of heavy mineral inclusions - forming dark swirls in sandstone - some recrystallization of silica has occurred (to 61.3')
7	
8	
9	
60	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
41	mb	4.9 / 4.9	100%	1.6 / 4.9	Fast drilling
2	mb			33%	Good H_2O return 80%
3	mb				
4	45°				9:57 44.37
5		5.0 / 5.0	100%	3.4 / 5.0	10:05 Harder Rock.
6					
7	mb 65°			68%	Box 5 47.00
8	45° mb				
9	mb				10:25 49.37
50	BC	5.10 / 5.10	100%	4.25 / 5.10	10:35 Harder drilling
1	mb				
2	BC mb			83%	
3	mb mb				
4					10:54 54.47 Box 6
5					12:32 55.00
6	mb	4.96 / 4.96	100%	10:%	Core in 3 pieces
7					90% H_2O return Adding drilling polymer
8	BC				
9	45° mb				12:57 59.43
60					1:07

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501.1 DATE 11-7

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING LD RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL 13.6 ± 5'

DEPTH (ft)	DESCRIPTION
61	
2	Fresh soft, blocky to friable grayish black (N-3) shale/siltstone. Core all broken up - 61.2' to 63.47' Very fine grained dark gray (N-3) sandstone - possible bedding (brecciated shale & calcite) Fractures along shale beds Interbedded grayish black (N-2) shale (.1' to .5' thick) and very fine grained dark gray sandstone with quartz veins Fine vertical calcite veins - siltstone
3	
4	
5	
6	
7	
8	Fresh soft, fine grained grayish black (N-2) shale (<.01' to .2' thick) siltstone
9	Dark gray very fine grained SS
70	Breaks on calcite veins (shale and calcite)
1	
2	Fresh - moderately hard Mixed shale (siltstone?) to very fine grained dark gray (N-3) to grayish black (N2) sandstone Parting along shale beds
3	
4	
5	Hard dark gray (very fine grained) sandstone and moderately hard grayish black siltstone (?)
6	
7	
8	Mostly fresh moderately hard grayish black siltstone with calcite veins
9	
80	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD 5	NOTES
61		4.0 / 4.0 mb	100%	1.65 / 4.0 41%	shower drilling Water turned darker - (shale) Blocked off 1:40 Box 7
2					
3					63.47
4		4.0 / 4.0	100%	1.3 / 4.0 33%	1:55 slow drilling Tub sitting up
5					
6					
7					2:30 End 2:30 67.47 shale
8		3.62 / 3.62 mb mb	100%	1.75 / 3.62 48%	6:55 90% H_2O return Blocked off
9					
70					7:21 71.09 Box 8
1	63°				7:37 71.80
2	45°	3.71 / 3.71 mb mb BC	100%	2.84 / 3.71 77%	100% H_2O return - slow drilling Tub sitting up
3					
4					8:13 74.80
5		4.91 mb BC BC BC BC	100%	100%	8:30 drilling fluid getting darker Core in 2 pieces - bit is drifting
6					
7					
8					
9					9:20 79.71 9:35
90					

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501 A DATE Nov 8

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST Hall WATER LEVEL _____

DEPTH (ft)	DESCRIPTION
	siltstone.
81	Medium dark gray sandstone
	Parting on thin shale beds -
2	possible healed shear zone
	- shale and siltstone
3	Very fine grained sandstone
	and siltstone - partially open
4	fractures where calcite is
	dissolved - few calcite veins
	Brecciated zone - pieces of
5	siltstone & sandstone, minor
	calcite, quartz veins - from
6	83.4' to 87.4' - angular inclusions
	of siltstone up to .3' thick -
	Breaks on calcite veins
7	Medium - coarse sandstone matrix
	.02' thick calcite vein at
8	bottom of breccia zone
	Medium - coarse grained medium
9	dark gray (N-4) sandstone -
	Possible healed shear zone -
	weak slickensides in shale
90	Fresh, very hard dark gray (N3)
	medium - coarse grained sandstone
1	abundant quartz veins
2	Breaks on healed shear -
	slickensides on calcite vein
3	(not open) - slight dissolution
	of calcite in some veins -
4	Fresh, very hard fine - medium
	grained dark greenish gray (5G 4/1)
5	sandstone - abundant quartz veins
6	Break on healed calcite shear
	zone - slickensides
7	Fresh hard fine grained
	greenish black (5G 2/1) sandstone
8	with quartz and calcite veins
9	Break on horizontal calcite vein
100	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD s	NOTES
		4.86	100%	4.70	Box 9
81	BC	4.86		4.56	80.86
					Core in 5
2				97%	pieces
	mb				
3	BC				
	Bc				
4	mb				
	BC				10:13 84.57'
5		5.08	100%	4.28	10:41 Drained Sump
	mb	5.08		5.08	
6	mb				
				86%	
7					
8	BC				
	mb				
9					Box 10
					11:07 89.65'
90		5.12	100%	10[illegible]%	11:20
	BC	5.12			
1					Core in
	Bc				4 pieces
2	mb				
	BC				
3	mb				
	Bc				
4	mb				12:07 94.77'
5	BC	4.87	100%	10[illegible]%	12:16
	mb	4.87			
6	BC				Core in
					3 pieces
7	BC				
	BC				
8					
	mb				
9	BC				Box 11
					99.06
					12:56 99.64'
100					1:07

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501.2 DATE 11/8 9

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2. GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST J. Jelli WATER LEVEL _____

DEPTH (ft)	DESCRIPTION
101	Fine-medium grained greenish black sandstone
	Break on healed shear - slickensides is calcite vein dip at 75°
2	
	Break on calcite vein
3	Steeply dipping quartz & calcite veins
4	Break on .03' calcite vein
	Fresh hard coarse grained medium bluish gray (5B5/1) - medium dark gray (N4) sandstone with .01-.04" thick calcite and quartz veins. Brecciated ss; slickensides dip 45° on calcite in shale shear zone at 106.2'
5	
6	
7	
8	Core all broken up Brecciated ss with steeply dipping calcite veins -
9	Core broken up along vertical fracture. good vertical slickensides on one piece
110	Core fragmented from 106.2' to 111.8' - brecciated sandstone w/ss, Hstone inclusions
1	
2	
	Brecciated coarse sandstone with quartz veins
3	Fracture on healed shear zone - partially open on calcite vein horizontal slickensides
4	
	Break on calcite vein
5	Fracture on healed shear - slickensides is calcite dip 45°
6	
7	
8	Brecciated coarse grained sandstone with quartz veins
9	
	Break on healed shear - slickensides is calcite dip 25°
120	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD 5	NOTES
101	mb BC mb	1.75 / 1.75	100%	100%	1:31 101.39
2	mb BC mb	2.83 / 2.83	100%	100%	1:40
4					2:10 End 104.22 shear
5	mb mb BC mb mb	4.3 / 4.3	100%	2.6 / 4.3 = 58%	Box 12 107.8
8					105.5
9		1.0 / 1.0	15%	1.0 / 0	
110	mb			25%	
2					112.50
3		4.80 / 4.80	100%	100%	8:30 80% H_2O return
4	BC BC mb				
5					Box 13 116.20
6	mb mb				
7					8:50 117.30'
8	mb BC BC mb BC BC	4.40 / 4.40	100%	100%	9:00 Core in 3 pieces
9					
120					

WOODWARD-CLYDE CONSULTANTS

TEST BORING RECORD

Job No. 15025A

Date 5-14-81

Name BASALT ROCK CO., INC

Location McNEARS QUARRY

Hole No. 11 Gr. El. 85' +MSL

Type of Boring ROTARY, NX CORE Rig FAILING 750

Datum MEAN SEA LEVEL

Engr. L. DEYITO

DESCRIPTION		RUN No.	Pen.	% Rec.	RQD	Wtr. Level	DRILL NOTES
	1						
	2						
	3						
	4	3		100%	70%		
	5						
HOLE TERMINATED AT 66.5'	6						
	7						
	8						
	9						
	70						
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						

GEOMATRIX CONSULTANTS

Boring Logs
1989

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501A DATE 7/19

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION
121	Coarse grained ss to 122.70'
2	Fresh hard medium bluish gray Fine to medium grained sandstone with few quartz + calcite veins ~Vertical slickensides on shear zone at 123.2' ≈70° Lin on slickensides on calcite at 123.7' (1st shear open, 2nd healed)
5	Possible healed shears - displaced quartz veins -
7	Quartz vein displaced by healed shear at 127.4'
8	Partially open - dissolved calcite vein (or shear?) (broken in box)
9	
130	Coarse grained sandstone
1	Fresh hard greenish black (5G 2/1) Fine grained sandstone Few calcite or quartz veins
3	Breaks on healed shears - ≈horizontal slickensides
4	
5	
6	Break along calcite vein
6	Break along healed shear with (horizontal) slickensides
7	Fresh, very hard, medium-coarse grained greenish black sandstone Few calcite or quartz veins -
8	Possible healed shears
Fresh	soft, waxy greenish black shale or soapstone - core broken up
9	Fracture along (partially open) shear zone - slickensides in calcite (may be healed?)
140	Fine-medium grained sandstone

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD 5	NOTES
121	BC				9:21 121.70
2	3.06 / 3.06	100%	100%		9:30 Core in 3 pieces
3	22° / 50° BC				
4					9:50 124.76 Box 14
5	BC 5.04				9:58 125.36
6	BC 5.04	100%	100%		Core in 1 Piece 10:31
7	BC				
8	BC				
9	BC				10:31 129.80
130	4.50				10:40
1	BC 4.50	100%	100%		
2	mb				
3	mb 20 / 20				Box 15
4	50				11:25 134.30
5	5.05 / 5.05	100%	4.35 / 5.05		12:41 100% H_2O return
6	mb mb 31 30 BC mb		86%		1:41
7	mb 40° 40°				1:50
8	mb				2:20
9	mb				1:41 139.35
140	BC				1:50

PAGE 2 OF 12

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501-F DATE 11/9 11/10

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING 4" Ø RIG _____

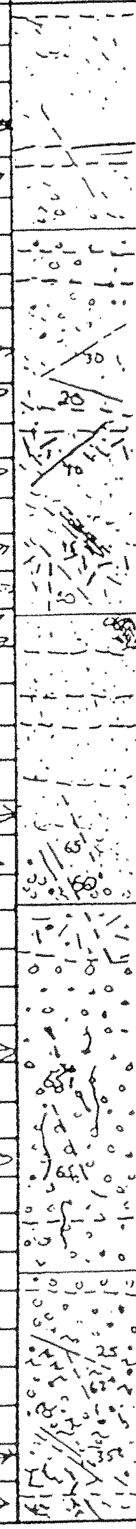
DATUM _____ GEOLOGIST Wells WATER LEVEL 19.8'

DEPTH (ft)	DESCRIPTION
140	Fresh very hard greenish black Fine - medium grained sandstone with abundant quartz veins to .03' thick.
150	sandstone with abundant quartz veins - rock is very hard to break -
	Vertical quartz veins —
	very hard sandstone
160	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
140		1.48 / 1.48 Bc	100%	100%	2:20 stop 5:50 140.83 start 11/10
141		Bc 3.95 / 3.95	100%	100%	Core in 2 pieces - broke when pulling core barrel.
142		mb			Box 16
143		Bc			143.48
144		Bc			
		Bc			7:40 144.78
145		Bc 2.00 / 2.00	100%	100%	8:00 100% H_2O return -
146		Bc			8:52 146.78 -
147		Bc 3.08 / 3.08	100%	100%	9:37 Pulled rods to inspect bit - Core in 2 pieces
148		mb			
149		Bc			9:53 149.86
					9:54
150		Bc 4.75 / 4.75	100%	100%	Core in 4 pieces
151		Bc			
152		mb			Box 17
		Bc			152.68
153					100% H_2O return —
154		mb			
		Bc			10:30 154.61'
155		Bc 4.45 / 4.45	100%	100%	10:45 Core in 1 piece
156		Bc			
157		Bc			
158		Bc			
					11:20 159.06'
159		Bc			11:27
160					

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE 11/10 11/13
PROJECT NAME LOCATION
HOLE NO. G-2 GR. EL. TYPE OF BORING RIG
DATUM GEOLOGIST Wells WATER LEVEL 21.9'



DEPTH (ft)	DESCRIPTION	CORE REC./RUN	% REC.	RQD %	NOTES
160–162.95	very hard SS. / 161: Shear plane with a horizontal slickensides (Partially open fracture on calcite vein) / 162: BC, BC – Break along calcite vein; mb / Fresh, hard, greenish black Coarse grained sandstone	BC 3.90/3.90	100%	100%	Core in 2 Pieces; Box 18 161.88; 12:17 162.95' 12:26
162.95–168.08	BC, BC; mb / 4.9: Healed shear - horizontal slickensides / 5: Partially open shear fracture - with vertical slickensides on shale (20) / 6: BC, BC – Partially open shear fracture - slickensides dip 60° - some dissolution of calcite (165.0 / 167.0) / 7: mb – Possible healed shear zone - ~.1' of brownish black (5YR 3/2) shale - vertical slickensides; BC; mb	5.12/5.12	100%	4.72/5.12 92%	90% H_2O return; 1:05 168.08' End (~~Start~~) 8:25 Left 1' in hole.
168.08–171.93	8: Possible healed shear / Very fine - fine grained sandstone / Shale inclusions; mb, BC, mb / Fine - medium grained sandstone with quartz & calcite veins / 170.8: mb, BC – Break along healed shear with vertical slickensides in calcite / 171.5: Partially open fractures - due to dissolution of calcite veins (65°, 60°); mb	3.85/3.85	100%	100%	Box 19 170.88; 9:04 171.93 9:17
171.93–176.78	Coarse grained sandstone - breccia; mb / 174: mb – Break along shale inclusion / Partially open fractures along subvertical calcite veins / 175: mb – Break along calcite vein (64°) / 176: BC	4.85/4.85	100%	4.15/4.85 86%	4:52; Slightly softer rock - drills faster -; 9:52 176.78 10:03
176.78–180	Coarse grained greenish black sandstone with few quartz & calcite veins; mb / Partially open shear plane - on calcite & shale 0.15' thick (25°); mb / 179: 0.10' thick shear zone with shale & calcite - slickensides dip 60° (35°); mb / 180: BC, mb – Break along subvertical calcite vein	5.13/5.13	100%	4.80/5.13 94%	Box 20 179.70'

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501 B .100 DATE 11/13/88

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST J. Hall WATER LEVEL 21.9

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD 5	NOTES
180	Breaks on healed shears in calcite - vertical slickensides	180		mb mb BC			
1	Break on calcite vein Fine - medium grained sandstone						10:27 181.91
2		2		2.77 mb 2.77	100%	100%	10:34 Core in 2 pieces
3	Break on calcite vein Fresh, hard fine grained ss.	3		BC			
4		4					10:58 184.68
5	Break on calcite vein Fine grained greenish black ss.	5	35°	mb 4.92 mb 4.92	100%	100%	11:14
6		6					
7	Calcite veins - steeply dipping - to .01' thick - Break on healed shear - slickensides Break on calcite vein	7	10	BC BC BC mb			
8	slight dissolution along calcite veins	8		mb			Box 21
9	Break on healed shear plane - slickensides in calcite Break on healed shear plane with horizontal slickensides	9	40°	BC BC			188.85 11:57 189.60
190	Break on healed shear plane with vertical slickensides	190	20	5.10 mb BC	100%	4.60 5.10	12:11
1	Breaks on healed shear planes - slickensides dip 35° on and an sub horizontal	1	33 55°	mb BC			
2	Break on .02' thick calcite vein Minor dissolution of calcite has formed partially open fractures -	2		mb mb		90%	
3	Break on calcite vein	3		mb			
4		4	68 T.T	mb BC BC mb			12:57 194.70
5	Break along calcite vein	5		mb 4.89 BC 4.89	100%	100%	1:21 Charged H_2O in sump - Core in 3 pieces
6	Fresh, very hard medium - fine grained dark greenish gray (5G 4/1) to greenish black (5G 2/1) ss, with quartz and few calcite veins	6		BC			
7		7		BC mb			Box 22 197.80
8		8		BC BC			
9		9		BC			2:05 199.59
200		200					2:15

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501B DATE 11/13

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST J. Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD S	NOTES
201	Few calcite & quartz veins	201		DC 4.77 / 4.77	100%	100%	Core in 2 pieces
2	Break along calcite vein. Thin shale bed possible healed shear zone below calcite vein.	2	BC mb				
3		3					
4		4	BC				3:10 EL. 204.36 SL.
5	Slight dissolution of calcite along several veins.	5	BC BC BC	BC 4.65 / 4.65	100%	100%	6:55 Core in 4 pieces
6		6	BC				Box 23 207.05
7	Break on partially open fracture (dissolved calcite vein) slickensides are sub horizontal	7	mb				
8	Break on partially open fracture (dissolved calcite vein) slickensides dip 65° in calcite/shale	8	mb DC BC				slow drilling
9		9	mb 65				8:02 209.01
210	Fresh, hard, fine grained Greenish black sandstone	210	BC	3.77	100%	100%	9:11 2 pieces
1		1	mb				
2		2	BC				8:52 212.78
3		3	mb BC BC	BC 1.84 / 1.84	100%	100%	2 pieces core Pull rods to inspect bit.
4		4					214.62
5	Partially open fractures along Calcite veins - Breaks along vein -	5	70	4.75 / 4.75	100%	4.25 / 4.75 89%	11:11
6		6	mb				
7	Few quartz veins - steeply dipping .01' thick calcite veins -	7	43 mb 55				
8		8	mb				
9	Break on steeply dipping .01' thick calcite vein	9	mb 70 75				11:53 214.37
220		220					12:03

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 455 1B DATE 11/14 11/15

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST _____ WATER LEVEL 21.5'

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD S	NOTES
221	Fresh, hard, fine-medium grained greenish black sandstone with few calcite & quartz veins	221		5.25/5.35	100%	100%	Core in 2 pieces
2		2	BC				
3	Breaks along healed shear planes with slickensides	3	BC				
4		4	BC mb				Box 25 12:05 224.62' 12:45
5		5		5.04/5.04	100%	100%	
6		6	BC				Core in 2 pieces
7	(Possible old shear planes) Fragmental shale & quartz veins (are displaced) by younger shear planes - no open fractures -	7	BC				100% H2O return
8		8	BC				
9	Break along calcite vein	9	mb 60°				1:25 229.66' 1:35
230	Break along healed shear - 2 sets of slickensides in calcite	230	BC	5.13/5.13	100%	100%	Core in 4 pieces
1	Few quartz and calcite veins	1	mb BC 20 60°				
2	Break along healed shear with horizontal slickensides	2	BC 40° mb				
3	Breaks along healed shear planes (with slickensides)	3	BC				Box 26 233.65'
4	Break along healed shear with 2 sets of slickensides in calcite -	4	BC 22° mb				2:16 234.79 End shoe
5	Break on healed shears (shale & calcite)	5	BC 45° mb BC	4.00/4.00	100%	100%	6:46 Core in 3 pieces
6		6					
7	Greenish black sandstone with few calcite & quartz veins	7	BC				
8	Break on calcite vein	8	mb 60°				7:45 238.79 8:02 added rod
9		9					
240	Slight dissolution of calcite veins - partially open fractures - not broken	240	BC				

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE 11/15/89
PROJECT NAME SRP Q LOCATION
HOLE NO. G-2 GR. EL TYPE OF BORING RIG
DATUM GEOLOGIST Wells WATER LEVEL 22.7

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD 5	NOTES
241	Healed shear zone - fragmented shale & calcite abundant quartz veins	241		4.70 / 4.70	100%	100%	Slow drilling Core in 2 pieces Box 27 242.32
1				BC BC			
2	Few calcite veins	2		BC BC BC			
3		3		BC mb			9:13 242.32 9:26
4		4		BC 5.21 / 5.21	100%	4.2 / 5.21 = 81%	
5	Partially open subvertical fracture along calcite vein Healed shear with vertical slickensides in calcite	5		mb BC mb			
6		6					
7	core all broken up along calcite veins - few quartz veins -	7		mb mb			
8		8		BC			10:07 248.70 10:12
9	Break along possible healed shear plane in calcite	9		mb BC 4.35 / 4.35	100%	100%	Core in 3 pieces
250	Abundant quartz & calcite veins	250		BC			Box 28 251.15
1		1		BC BC			
2	Healed shear zones - fragmented shale & calcite	2		BC mb			
3		3					10:36 253.05 10:57
4		4		4.55 / 4.55 mb	100%	100%	Core in 3 pieces
5	Break on calcite vein .2' thick brecciated zone above calcite vein - probably a healed fault/shear zone - fragments of sandstone - Few calcite and quartz veins	5		BC mb			
6		6		BC			
7		7		BC			11:23 257.60 12:35
8		8		5.20 / 5.20 BC	100%	100%	
9	Fresh very hard fine grained greenish black (5G 2/1) to grayish black (N2) sandstone with few quartz & calcite veins	9		BC			
260		260					

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 150 'B DATE 11/15

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST D. Hill WATER LEVEL 22.7

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD S	NOTES
261	Break along healed shear plane with horizontal slickensides	261	30	mb			Box 29 260.55 Core in 3 pieces
2	Break along possible healed shear plane	2	45	mb BC			1:05 262.80'
3	Break on calcite vein	3		BC 2.30 / 2.30	100%	100%	1:15 one piece
4	Partially open fracture - dissolved calcite vein	4		BC			
5	Brecciated sandstone below quartz & calcite veins	5					1:29 265.10
6	Break on healed shear with subhorizontal slickensides	6	30	BC 5.00 / 5.00 mb	100%	100%	1:42 Core in 3 pieces
7		7		BC			
8	Brecciated sandstone with quartz & calcite veins	8		Bc			99% H_2O return
9		9		mb			Box 30 269.65
270		270		BC			2:20 270.10
1	Abundant very thin quartz veins	1		5.03 / 5.03 BC BC	100%	100%	2:28 Core in 3 pieces
2	Healed shear zones with shale & calcite	2					Cutting wet!
3	Broken on shear planes with slickensides in calcite	3		mb BC			
4	Possible open shear plane slickensides dip 30° - pyrite (iron sulfide mineral) on shear plane (shale & calcite also)	4	40	mb?			
5		5					3:00 End 275.13 start
6	Fresh hard, fine grained dark greenish gray (5 GY 4/1) sandstone with few quartz and calcite veins	6		5.05 / 5.05 mb BC BC BC mb	100%	100%	5:58 Core in 4 pieces. Box 31 278.80
7		7					
8		8					
9	Soft to moderately hard sandstone (due to dissolution of matrix) porous zone	9		mb BC			surface of core is very rough 7:25
280		280					

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501 B DATE 11/16/88
PROJECT NAME SPRO LOCATION
HOLE NO. G-7 GR. EL. 23' TYPE OF BORING RIG
DATUM Sea level GEOLOGIST Wells WATER LEVEL 7.9'

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
280	Fresh, hard, fine grained, Greenish black (5G 2/1) sandstone with very thin quartz & calcite veins		5.00 / 5.00	100%	100%	7:41 280.08
1	Break along partially open shear plane - slickensided in calcite dip 80°	mb				Core in 3 pieces
2		70				
3	Break along healed shear plane slickensided dip 60° .01' thick calcite vein	40 mb				
4						
Soft 5	Fresh, very fine grained dusky red (5R 3/4) mineral (Hematite) disseminated through core & along calcite veins					8:06 285.06
6			5.02 / BC 5.02	100%	100%	8:14 Core in 1 piece Box 32 287.80
7	Few very thin shale beds - probably are healed shear planes -	BC				
8		BC				
9		BC				
290		BC				8:46 290.10
1	Abundant calcite veins		4.92 / BC 4.92	100%	100%	9:00 Core in 1 piece 9:35
2	Brecciated sandstone	BC				
3	Fragmented very thin shale beds in zones to .3' thick - probable healed shear zones	BC				
4		BC				
5						9:35 295.02 9:47
6	Few fragmented very thin shale		5.04 / mb 5.04	100%	3.60 / 5.04 71%	Box 33 296.82
7	Break on healed shear plane - polished shale & pyrite - slickensides dip 65°	BC				
8	Break on healed shear plane with subvertical slickensides	25/40 mb				
9	Break on healed shear plane with horizontal slickensides	mb				
300	Breaks along calcite veins -	60 mb				10:23

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE 11/16

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST _____ WATER LEVEL 7.5'

DEPTH (ft)	DESCRIPTION
300	Dark greenish gray (5G 4/1) sandstone
1	Breaks on calcite veins (possibly healed shear planes)
2	Brecciated sandstone
	Possible open fracture on shear plane - polished shale surface
3	Break along healed shear plane calcite & shale with slickensides
4	
5	
6	Fresh hard fine grained greenish black sandstone with abundant calcite & quartz veins
7	
8	Few very thin fragmented shale beds w/calcite (Probably healed shear planes)
9	
310	
1	Break on healed shear - with slickensides
2	Brecciated sandstone (1.2' thick)
3	Break on healed shear plane, calcite & pyrite on polished surface two sets of slickensides
4	Fragmented shale beds (healed shear planes)
5	
6	
7	
8	Break on healed shear zone slickensides in calcite dip 65°
9	
320	

DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD 5	NOTES
300					300.06
1	60 / 40	5.00 / 5.00	100%	100%	
	mb				
2	mb				
	35				
3	mb				
4	32 / mb				
5					305.06
		5.06			Box 34
6		BC 5.06	100%	100%	306.16
7	Bc				
8	BC				Core in 1 piece
9	BC / BC				
310					12:28 310.12
					12:36
1		5.05 / 5.05	100%	100%	Core in 2 pieces
2	mb / BC				
3	BC / BC				
4					Box 35
5					1:02 315.17
					1:10
6		4.72 / 4.72	100%	100%	
7	BC				
8	mb / BC / 60				Core in 2 pieces
9	Bc / Bc				
320					1:25 319.89

1:50

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501 C DATE 11/15 11/17

PROJECT NAME _____ LOCATION _____

HOLE NO. G-7 GR. EL _____ TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST Lobell WATER LEVEL 5.3

DEPTH (ft)	DESCRIPTION	DEPTH (m)	GRAPHIC LOG	CORE REC/RUN	% REC.	ROD S	NOTES
321	Few fragmented healed shear zones (shale beds) Quartz & calcite veins.	321		BC 5.17 / 5.17	100%	100%	1:50 Core in 1 piece
2		2		Bc			
3		3		Bc			
4		4		Bc			Box 36 324.06
5		5		Bc			2:36 325.06 End
6	Break on healed shear in calcite vein - subvertical slickensides	6	60	mb Bc 5.22 / 5.22	100%	100%	0:52 Start 100% H_2O return
7		7	45 40	mb			
8	Numerous mechanical Breaks on healed shear planes partially open fracture above shear - at 328.89 slickensides dip 40°	8	49	mb Bc Bc			
9	Brecciated sandstone Horizontal slickensides possible open fracture?	9	50 40	mb			
330	shale beds on shear plane	330	25	mb			7:17 330.28
1	Partially open fracture along calcite vein (dissolution of calcite)	1		pc 4.90 / 4.90	100%		7:29 Core in 3 piece Box 37 332.93
2	Partial Break on healed shear plane - slickensides dip 60°	2	60	mb Bc		100%	
3	Few steeply dipping calcite veins. few quartz veins Break on calcite vein	3		Bc mb			
4	Fresh hard fine grained greenish black sandstone	4		Bc Bc			
5		5					7:58 335.18
6		6	50	2.43 / mb BC 2.43	100%	100%	8:06 Core broke - only pulled half out
7		7	55	mb			8:38
8	Break on healed shear plane - slickensides in calcite dip 25°	8	50	BC 5.13 / 5.13	100%	100%	9:00 337.61
9		9		Bc			
340		340					

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501B DATE 11/17

PROJECT NAME _____ LOCATION _____

HOLE NO. G-2 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST L. Hill WATER LEVEL 5.3

DEPTH (ft)	DESCRIPTION
1	.02' thick calcite vein
2	Fresh hard fine grained greenish black sandstone

DEPTH (ft)	GRAPHIC LOG	CORE REC./RUN	% REC.	RQD 5	NOTES
1		BC			Core in 2 pieces
		mb			
2		BC			Box 38
					9:16 342.74 End
3					Core barrel jammed - hard to pull rods to remove

GEOMATRIX CONSULTANTS

CORE BORING RECORD

PROJECT NO. 1501 B.100 DATE Nov 20 1985

PROJECT NAME SRRQ LOCATION West side of [illegible] at base of hill behind batch works

HOLE NO. G-3 GR. EL. 30 TYPE OF BORING HQ RIG M B-50

DATUM Sea level GEOLOGIST Wells WATER LEVEL

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD s	Steve NOTES
0–4.5	Highly weathered, moderately hard, fine grained light olive gray (5Y 5/2) sandstone - weathered to dark yellowish orange (10YR 6/6) along joints, fractures, etc. Numerous open fractures - indicated by weathered surface colors - some sections of core are broken up along fractures - some yellowish gray (5Y 7/2) clay near surface - matrix is weak	L.C.	4.3 / 4.5	93%	1.75 / 4.5 = 39%	used polymer throughout drilling
4.5–9.3	Fractures on weathered surfaces Brecciated sandstone - Highly weathered & friable		4.8 / 4.8	100%	2.2 / 4.8 = 46%	
9.3–14.48	slightly weathered along joints and fractures - Moderate brown (5YR 4/4) weathered surfaces on fractures Moderately hard, medium bluish gray (5B 5/1) sandstone Weathered fractures		5.18 / 5.18	100%	4.93 / 5.18 = 95%	
14.48–19.50	Weathered fracture surface Fresh, hard, fine grained medium gray (N 4) sandstone - Few partially dissolved calcite veins Fractures on weathered surfaces		BC 5.02 / 5.02	100%	4.62 / 5.02 = 92%	12:30
19.50–20			BC		1.03 / 1510	

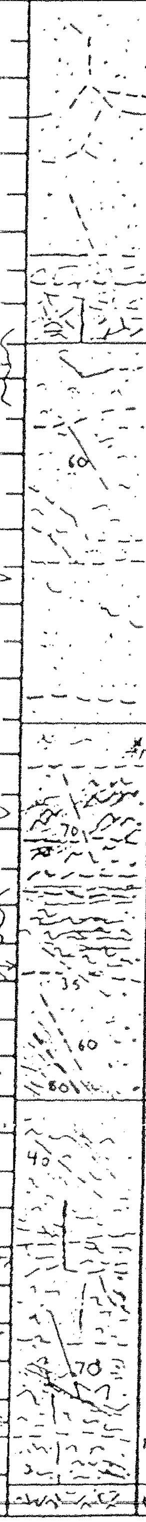
GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE 11/20 11/21

PROJECT NAME ______ LOCATION ______

HOLE NO. G-3 GR. EL. ______ TYPE OF BORING ______ RIG ______

DATUM ______ GEOLOGIST Wells WATER LEVEL above ground



DEPTH (ft)	DESCRIPTION	CORE REC./RUN	% REC.	RQD %	NOTES
20–24.5		5.0 / 5.0	100%	3.9 / 5.0 78%	May all be mechanical breaks –
24–25	Brecciated sandstone – fragmented shale & calcite in shear zone (slickensides) – numerous healed shear planes				1:45 24.50 1:58
24.5–29.5	Brecciated medium gray (N 5) medium grained sandstone	5.03 / 5.03	100%	4.73 / 5.03	100% H₂O return
27–28	Healed shear zone. Moderately hard, fresh, medium grained medium gray (N 5) sandstone.			94%	Box 3 27.48
29.53					2:17 29.53 2:42 Change H₂O color in sump water – turned very dark.
29.5–34.5	very fine grained sandstone	5.01 / 5.01	100%	100%	
32–33	Numerous healed shear planes with fragmented shale & calcite. Medium grained sandstone				
34	Fresh, moderately hard Brownish-black (5YR 2/1) siltstone or very fine grained sandstone				3:12 End 34.54 3:47 Start
34.5–39.7	Fresh hard fine-grained medium dark gray (N 4) sandstone. Medium-coarse grained brecciated sandstone with fragmented shale & calcite – partially open vertical fracture	5.15 / 5.15	100%	2.80 / 5.15	Box 4 36.40
37–39	Highly weathered open fracture, somewhat porous sandstone – [illegible] partially dissolved gypsum [illegible]			54%	7:12 39.69 7:22
40	Fragmented/brecciated shale & ss [illegible] slickensides				

Graphic log annotations: mb, BC (at 21, 22, 23.5, 24, 25, 27, 29.5, 30, 31, 31.5, 32, 33, 34, 34.5, 36.5, 37, 38, 39, 40); dip angles 60, 70, 35, 60, 80, 40, 70.

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE Nov 21

PROJECT NAME SARG LOCATION

HOLE NO. G-3 GR. EL. TYPE OF BORING RIG

DATUM GEOLOGIST [illegible] WATER LEVEL

DEPTH (ft)	DESCRIPTION	CORE REC./RUN	% REC.	RQD S	NOTES
40–44.5	Healed (?) shear zone - may be some open fractures - Coarse grained porous sandstone core - fragmented along shale - may [illegible] direction and ages [illegible] younger than [illegible] shear planes (mb, BC, mb, mb, BC)	4.95 / 4.95	100%	3.4 / 4.95 69%	Change [illegible] 7:52 44.54 8:12 Box 5 45.00'
44.5–49.8	Fresh, hard Fine grained medium dark gray sandstone Break along (not calcite) ~~calcite~~ vein Fresh, moderately hard medium-coarse grained medium dark gray sandstone Breaks on subvertical calcite veins (BC, BC, BC, mb, mb, mb)	5.18 / 5.18	100%	4.78 / 5.18 92%	100% H_2O return 8:39 49.82' 8:48
49.8–54.9	some dissolution of calcite (?) along veins (not calcite → dolomite) - soft white mineral - soft, chalky - Polished surface - possible open fracture on shear plane (mb, BC, mb, mb, mb, mb)	5.10 / 5.10	100%	4.7? / 5.10 92%	Box 6 54.2? 9:10 54.92' 9:18
54.9–59.8	Partially healed (open) Sheared zones - shale with subhorizontal slickensides, Brecciated sandstones with quartz veins Healed shear zone with subvertical slickensides Fragmented shale in healed shear zone Brecciated coarse grained ss (mb, mb, mb)	4.91 / 4.91		3.4? / 4.9? 69%	9:44 59.83.

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501.3 DATE [illegible]

PROJECT NAME [illegible] LOCATION ___

HOLE NO. G-3 GR. EL ___ TYPE OF BORING ___ RIG [illegible]

DATUM ___ GEOLOGIST ___ WATER LEVEL ___

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	ROQ S	NOTES
1	Brecciated zone - healed shear or fault - some partially open fractures - parts along shale beds Vertical slickensides on shear	mb 4.90 / 4.90	100%	4.6 / 4.9	9:51
2	Brecciated zone	mb, Bc, mb		94%	
3	Fresh, hard - fine - medium grained medium light gray (N6) to medium gray (N5) sandstone.	Bc			Box 7 63.42 changed 64.0
4	Partially open fractures. Brecciated shale & sandstone	mb			10:24 64.73
5					
6	Break along healed shear zone with vertical slickensides partial dissolution of matrix	Bc 5.22 / 5.22 mb	100%	4.72 / 5.22	
7	Break along calcite/dolomite vein medium to coarse sandstone	Bc		90%	
8	Interbedded, very thin grayish (N 2) black shale beds	Bc			
9	Fine grained medium dark gray (N-4) sandstone	mb, mb			
70	Breaks along calcite veins Break along healed shear plane slickensides dip 25°				69.95' 11:22
1	Partially open fracture along shear zone in grayish black (N-2) shale .05' thick zone	mb 4.81 / mb 4.81	100%	2.62 / 4.81	
2	Breaks along calcite/dolomite veins .5' thick grayish black (N2) shale			54%	Box 8 72.44'
3	Break along healed shear zone subhorizontal slickensides	mb			
4	Partially open vertical fracture Open fracture - calcite dissolved along healed shear - sub horizontal slickensides	mb, mb, Bc			12:11 74.76 1:33
5	Breaks along partially healed shear zones some w/ shale, clay or slickensides	5.08 / 5.08	100%	1.92 / 5.08	
6				38%	
7	Partially open sub vertical fractures & dissolution of calcite	mb			
8	Moderately hard, fresh fine grained medium dark gray sandstone Quartz appears to have replaced parts of the sandstone	BC, mb			
9		mb			
80		BC			2:10 79.84 2:35

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE Nov 21, 22

PROJECT NAME _____ LOCATION _____

HOLE NO. G-3 GR. EL. _____ TYPE OF BORING HQ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD 5	NOTES
0–5	soft, fine grained medium dark gray sandstone - broken up along calcite veins, matrix is partially dissolved - clayey in parts, fragmented shale - lots of open fractures - (partially healed shear zone?)		5.15 / 5.15	100%	2.04 / 5.15 = 40%	2:36 Box 9 Core all 81.04 broken up Losing some water 3:02 End 84.99 Start
4	Breaks on calcite veins with slickensides dip in 30°	45	mb, mb			
4–5	Shale is healed shear zone					
5–10	Breaks along healed shear in shale and along subvertical calcite veins Minor quartz & calcite veins soft - weak matrix is ss. Breaks along calcite veins	75	5.07 / 5.07	100%	3.07 / 5.07 = 61%	7:00 Box 10 7:25 70.06
9	Break along healed shear plane with vertical slickensides		mb, ml			7:39
0–5	Moderately hard sandstone Greenish gray (5G 6/1) fine grained -		5.03 / 5.03	100%	3.73 / 5.03 = 74%	
2	Partially open fracture - calcite dissolved along vein		BC			
3	Break along healed shear plane slickensides dip 30° in calcite		ml			
4	soft sandstone - broken up along subvertical calcite veins		mb			8:13 95.09' 8:25
5–10	Break on calcite vein Moderately hard fine grained greenish gray sandstone with few calcite veins	60 65	mb, DC, mb 4.72 / 4.72 = 100%		4.00 / 4.72 = 85%	2:33 943. Box 11 99.45 8:55 99.81
9	Talc or gypsum? on shear plane Break on healed shear plane with slickensides	45	mb			

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE 11/22
PROJECT NAME CRRQ LOCATION
HOLE NO. G-3 GR. EL TYPE OF BORING RIG
DATUM GEOLOGIST Wells WATER LEVEL

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD S	NOTES
0–1	Few calcite veins		5.10 / 5.10	100%	3.70 / 5.10	9:03 Losing a little water
2	Break on calcite vein				73%	
3	Breaks along shale beds - possible healed shear zones					
	Break on calcite vein					
4						9:33 / 9:43 104.91
5–6	Fresh hard medium dark gray fine grained sandstone with calcite & quartz veins - Break on healed shear plane with sub horizontal slickensides		5.28 / 5.28	100%	4.98 / 5.28	
7	Break on healed shear with fragmented shale beds				94%	
8						Box 12 108.66
9	Break on calcite veins					
9–10	Break on healed shear plane polished shale -					10:23 110.19
10–1	Fresh hard very fine grained medium gray (N5) sandstone		4.83 / 4.83	100%	4.23 / 4.83	10:53
1–2	Partially open fractures - dissolved calcite veins in sheared zone - shale & quartz				88%	
2–3	grayish black siltstone / shale beds are displaced by calcite veins					
3–4	Very fine grained medium gray (N-5) hard sandstone					
4–5	Shear plane - polished shale with slickensides dipping 30°					11:40 115.02
5–6	- Thin black shale beds at shear zone (Brownish black 5YR 2/1) Fragmented shale below shear zone		5.25 / 5.25	100%	4.55 / 5.25	11:50
6–7	Medium gray (N5) very fine grained sandstone				87%	
7	Break along calcite vein					Box 13 117.77
8	Partially open fracture - core not broken					
9	Partial break along healed shear					
9–10	Break on healed shear - slickensides in shale dip 30°					12:25

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE Nov 27

PROJECT NAME _____ LOCATION _____

HOLE NO. G-3 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST Wells WATER LEVEL _____

Heavy Rain on Saturday.

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD S	NOTES
120	Break along talc/gypsum? veins - possible vertical slickensides.	120		mb 5.07/5.07	100%	2.72/5.07	8:30 120.27 Final start
1		1	65				
121		121					
2	Break along calcite vein	2	80 40	mb ml		54%	
3		3		mb BC			
4	Fine grained, moderately hard medium dark gray (N4) sandstone. Partial dissolution of matrix. partially open fracture along calcite veins	4		mb			
5		5		BC			9:00 / 9:10 125.37' Box 14
6	Healed shear zone - calcite & chl.	6		5.16 BC 5.16	100%	4.76/5.16	126.32' Water turned darker - ≈ 100 ft H2O return
7	Fragmented, moderately hard, brownish black (5YR 2/1) siltstone to 129.5' - offset by subvertical veins .01 - .04 thick calcite veins	7	95	BC mb		92%	
8		8					
9	Partially open fracture - some clay along faces of break. slickensides dip ≈10°	9	65	mb			
130		130	177°	mb			9:56 / 10:12 130.53'
1	Breaks on very thin calcite veins	1	INT	mb 4.83/4.83	100%	2.0/4.83	
2	Fine grained medium gray sandstone .03' thick calcite vein	2				41%	
3		3		mb			
4	Fresh, moderately hard brownish black siltstone / v.f. grained ss.	4		mb mb			
5	Fine grained moderately hard medium gray (N5) sandstone	5					Box 15 10:48 / 10:57 135.36'
6	Calcite vein ≈ 1.2' thick - with fragments of sandstone / siltstone Damp, brecciated?	6		DC 4.90/4.90	100%	4.45/4.90	
7		7		BC mb		91%	
8 (1)	Very soft sandstone - matrix dissolved - coarse grained, clayey layer .10' thick	8		mb ml			
9	Fresh, moderately hard, medium to coarse grained medium gray sandstone	9		BC BC mb			
140	Medium grained sandstone - partial dissolution of calcite along	140					

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501 R DATE Nov 27
PROJECT NAME ______ LOCATION ______
HOLE NO. G-3 GR. EL. ______ TYPE OF BORING ______ RIG ______
DATUM ______ GEOLOGIST Wells WATER LEVEL ______

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC./RUN	% REC.	RQD %	NOTES
141–145	Fresh, coarse grained, moderately hard medium gray brecciated sandstone with partially open fractures along calcite veins - calcite fills voids. Fragments of veins to .03' thick. Soft coarse grained damp sandstone. Breaks along healed (?) shears with slickensides - some clay along shear.	141–145	mb, mb, mb, mb, mb, mb; 45	4.95 / 4.95	100%	3.55 / 4.95; 72%	11:35 / 11:42 140.26; Box 16 144.31; 12:13 / 12:22 145.21'
146–150	Healed shear zone (.5' thick) - Fragmented shale + calcite veins. Fresh, moderately hard, medium grained medium gray sandstone with few calcite veins - some partially open fractures where calcite is dissolved along veins - quartz veins fill voids - Breaks along calcite vein - possible slickensides	146–150	mb, BC, BC, BC, mb, mb; 30, 45, 50	5.20 / 5.20	100%	4.85 / 5.20; 93%	Nearly 100% H_2O return in sump. 12:50 / 12:58 150.41'
151–155	Moderately hard, medium-coarse grained medium gray sandstone with quartz & calcite veins. Breaks along calcite veins	151–155	BC, mb, mb, mb, BC, BC, mb, BC; 75, 75	5.08 / 5.08	100%	100%	Box 17 153.28; 1:27 / 1:36 155.49'
156–160	Break along healed shear zone - slickensides in shale & calcite vein dip 25° - partially open fractures along healed shear zone. Breaks along calcite veins. Medium - coarse grained sandstone. Abundant talc/gypsum veins - minor calcite and quartz	156–160	mb, mb, mb, mb, mb, mb; 56, 55	4.76 / 4.76	100%	4.16 / 4.76; 87%	1:55

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501B DATE Nov 27-28

PROJECT NAME _____ LOCATION _____

HOLE NO. G-3 GR. EL. _____ TYPE OF BORING _____ RIG _____

DATUM _____ GEOLOGIST L. Hill WATER LEVEL _____

DEPTH (ft)	DESCRIPTION	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD s	NOTES
						1:55 / 2:03 160.25'
1	Healed shear zone	BC	5.22 / 5.22	100%	100%	Core in 3 pieces
2	Fine - coarse grained medium gray (N5) moderately hard sandstone with few calcite quartz veins	BC				Box 18
3	Break from healed shear zone Fragmented shale & calcite	BC mb				162.58'
4	Healed shear zone	BC				
5		BC mb				2:25 / 7:27 EW 165.47' start
6	Healed shear zones with fragmented shale & calcite veins - some quartz veins -	BC	4.97 / 4.97	100%	100%	Core in 1 piece
7	- Brecciated, moderately hard light gray (N7) to medium gray (N5) medium - coarse grained sandstone with few calcite veins	BC				
8		BC				
9	Healed shear zone (?) - ? Brecciated sandstone ?	BC				
170		BC				8:05 / 8:12 170.44'
1	slight dissolution along calcite veins					
	Break on healed shear plane - with shale & calcite		5.00 / 5.00	100%	100%	
2	Medium grained, medium light gray (N6) ss.	mb				
	Break on calcite vein					
3	Healed shear zone with shale, quartz & calcite	mb				
4	Few vertical calcite veins	mb				
	Healed shear zone					
5	Break (open fracture ?) - minor shale, calcite & pyrite (?) on healed shear plane - horizontal slickensides,	mb				8:36 / 8:45 175.44
6	Break on calcite veins	mb	4.84 / 4.84	100%	4.44 / 4.84 92%	
	Clay on shear plane - slickensides dip 20	BC				
7	Break on partially open fracture - dissolution along calcite vein - ss. is softer & damp-matrix partially dissolved ?	BC mb				
8	Fragmented shale in healed shear zone	mb				
9	Healed shear zone - shale & calcite veins -	BC				
180		mb				

GEOMATRIX CONSULTANTS
CORE BORING RECORD

PROJECT NO. 1501 B DATE Nov 28

PROJECT NAME LOCATION

HOLE NO. G-3 GR. EL. TYPE OF BORING RIG

DATUM GEOLOGIST Wells WATER LEVEL

DEPTH (ft)	DESCRIPTION	DEPTH (ft)	GRAPHIC LOG	CORE REC/RUN	% REC.	RQD s	NOTES
							9:05
							9:16 180.28
181	Break along calcite vein	181		mb 5.14 / 5.14	100%	100%	Core in 4 pieces, ≈100% H_2O return
2	Healed shear zone - breccinated sandstone & calcite	2		Bc mb			
3	Partially open fractures - dissolution along calcite veins	3		mb			
4	Break along healed shear zone? sub horizontal slickensides in calcite/shale	4		Bc			
5	Soft - moderately hard, medium - fine grained medium light gray (N-6) sandstone with calcite veins	5		Bc			9:39 185.42'
							9:47 sample & Wall, 0.8'
6	Breaks along healed shear planes - subhorizontal slickensides in calcite	6		Pc mb 5.00 / 5.00	100%	4.75 / 5.00	
7	.20' thick calcite vein	7					
8	Healed shear zone - brecciated sandstone fragmented calcite veins	8		Bc Bc		95%	
9	Weakly cemented sandstone (matrix is dissolved) - Moderately soft, breaks easily	9		mb mb			
190	partially open fracture - due to dissolution of calcite	190		Bc			Box 21 189.88
							10:12 190.42'
1		1		mb 5.10 / Bc 5.10	100%	3.80 / 5.10	10:19
2	Break on healed shear - subhorizontal slickensides, Brecciated sandstone .02' thick calcite vein	2		mb		75%	
3	Broken along partially dissolved calcite veins	3		mb			core all broken up
4		4		mb			
5	Break along healed shear - slickensides dip 40° in calcite vein	5		Bc Bc			10:47 195.52
							11:00
6	Brecciated, moderately hard, medium - grained, medium gray (N4) sandstone. partially open fractures due to dissolution of calcite, weakly - moderately cemented.	6		5.00 / 5.00	100%	4.50 / 5.00	
7		7		Bc mb			
8	Break on healed shear plane - ? slickensides dip 15° in shale	8		mb		90%	Box 22 198.50
	Breaks on calcite veins			mb			
9	Calcite fills some fractures & open spaces	9		Bc			Box 23
200		200					200.52

GOLDER ASSOCIATES

Boring Logs
1991

RECORD OF AUGER PROBE # P-1

STA. P-1 OFFSET L R ELEVATION SHEET 1 OF 1
PROJECT NO. 913-7043.400 DRILLING DATE 3/4/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE / SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/6 IN.	SAMPLES: RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
0		Light olive brown (2.5Y 5/6) Well Graded Gravel. (FILL).		GW						No groundwater encountered.
1										
2										
3		Highly weathered, pale greenish yellow (10Y 8/2) very weak SANDSTONE.							Refusal @ 3.0 ft.	
		Bottom of hole @ 3.0 ft.								
4										
5										
6										
7										
8										
9										
10										

DEPTH SCALE 0.75 inch = 1 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednath
CHECKED P. K. Mundy
DATE April 1991

RECORD OF AUGER PROBE # P-2

STA. P-2 OFFSET L R ELEVATION SHEET 1 OF 1
PROJECT NO. 913-7043.400 DRILLING DATE 3/4/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE / SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
0		Loose, yellow (2.5Y 8/8 ;7/6) to dark brown c-f SAND with Silts and Gravel (FILL).		SW						Groundwater not measured.
25		Soft, dark gray (5Y 4/1) f. Sandy CLAY (BAY MUD).		CL						
40		Highly to completely weathered, pale greenish yellow (10Y 8/2), very weak SANDSTONE								
50		Bottom of hole @ 50.1 ft.			1	SPT	50/0.1 in.			

DEPTH SCALE 0.75 inch = 5 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF AUGER PROBE # P-3

STA. P-3 OFFSET L R ELEVATION SHEET 1 OF 1

PROJECT NO. 913-7043.400 DRILLING DATE 3/1/91 DATUM MSL

INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE / SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/6 IN.	SAMPLES: RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
0		Light olive brown (2.5Y 5/6) c-f SAND with silt and Gravel (FILL).		SW						Groundwater not measured.
12		Highly weathered, pale greenish yellow (10Y 8/2), very weak SANDSTONE.							Soil wet @ 11.0ft.	
		Bottom of hole @ 13.0 ft.							Refusal @ 13.0 ft.	

DEPTH SCALE 0.75 Inch = 2 foot

DRILLING CONTRACTOR Miller Pacific Engineering Group

DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash

CHECKED P. K. Mundy

DATE April 1991

RECORD OF AUGER PROBE # P-4

STA. P-4 OFFSET L R ELEVATION SHEET 1 OF 1
PROJECT NO. 913-7043.400 DRILLING DATE 3/1/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE / SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/6 IN.	SAMPLES: RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
0		Light olive brown (2.5Y 5/6) Gravelly SAND (FILL).		SW						No groundwater encountered.
1										
2										
3										
4										
5		Highly weathered, pale greenish yellow (10Y 8/2), very weak SANDSTONE.								
		Bottom of hole @ 5.0 ft.							Refusal @ 5.0 ft.	
6										
7										
8										
9										
10										

DEPTH SCALE 0.75 inch = 1 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-1

STA. B-1 OFFSET L R ELEVATION SHEET 1 OF 3
PROJECT NO. 913-7043.400 DRILLING DATE 3/1/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
0		Compact, mottled , yellow (2.5Y 8/8; 7/6) to dark brown Well Graded c-f GRAVEL, Gravel is Blue Sandstone, trace glass fragments. (FILL).		GP	1	SPT	14/15/12	67	Start Time : 0745 Hammer Weight = 140 lbs Drop = 30 in. S-1 0-1.5 asphalt driveway is 1 in. thick. Road base is approx. 18 in. thick.	
2		Compact, light olive brown (2.5Y 5/6) Well Graded Gravelly SAND (FILL).		SW						
					2	SPT	14/22/15	67	S-2	
4		Dense, mottled dark gray (2.5Y N4/0) with light yellow brown Poorly Graded Sandy Gravel (FILL). 5.0'-5.5'. Sandstone Boulders.		GP						
6					3	SPT	9/22/30	67	S-3	▽ 6'
		Very dense, light yellowish brown (2.5Y 6/4) Well Graded c-f SAND with Clay and c-f Gravel. (FILL).								
8				SW SC	4	SPT	8/19/18	67	S-4	
		Dense, light yellowish brown (2.5Y 6/4) Well Graded c-f Sandy GRAVEL. (FILL).		GW						
10				GW						
12										
		Compact Sandy GRAVEL.			5	SPT	2/6/14	33	S-5	
14										
16										
18										
		Loose, dark gray (2.5Y N4/0) Clayey SAND.		SC	6	SPT	2/3/4	67	S-6	
20									SPT = Standard Penetration Test P = Piston Sampler	

DEPTH SCALE 0.75 inch = 2 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-1

STA. B-1 OFFSET L R ELEVATION SHEET 2 OF 3
PROJECT NO. 913-7043.400 DRILLING DATE 3/1/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
20		Loose, dark gray (2.5Y N4/0) Clayey SAND. (FILL).		SC						
22		Soft, dark gray (5Y 4/1) Fat Clay (BAY MUD).		CH	7	SPT	2/2/2	100	S-7 W = 55.1 %	
24					1	P		67	U-1 W = 52.8 %	
26										
28										
30		Sand and Shells increase with depth.		CH	2	P		94	U-2 W = 44.2 %	
32										
34										
36					8	S	1/12/1		S-8 W = 60.8 %	
38										
40										

SPT = Standard Penetration Test
P = Piston Sampler

DEPTH SCALE 0.75 inch = 2 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-1

STA. B-1 OFFSET L R ELEVATION SHEET 3 OF 3
PROJECT NO. 913-7043.400 DRILLING DATE 3/1/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
40		Soft, dark gray (5Y 4/1) Fat CLAY		CH	9	SPT	1/1/2		S-9 W = 35%	
42										
44										
46					10	SPT	1/1/12		S-10 W = 40.1%	
48										
50		Moderately weathered, moderately strong, blue green Interbedded Shales and Sandstones (BEDROCK).			11	SPT	2/36/50		S-11	
52		Bottom of hole @ 51.1 ft.							End time : 1200	
54										
56										
58										
60										

SPT = Standard Penetration Test
P = Piston Sampler

DEPTH SCALE 0.75 Inch = 2 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lantz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-2

STA. B-2 OFFSET L R ELEVATION SHEET 1 OF 2
PROJECT NO. 913-7043.400 DRILLING DATE 3/1/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES PIEZOMETER / STANDPIPE INSTALLATION
0		Asphalt driveway. Compact, pale olive (5Y 6/3) Clayey m-f SAND with c-f Gravel(FILL).		SC	1	SPT	27/15/11	67	Start time : 1230 Hammer weight = 140 lbs. Drop = 30 in. S-1	
2										
4					2	SPT	11/8/11	67	S-2	
		Color : Mottled pale olive (5Y 6/3) with brownish yellow (10YR 6/6) (FILL).								
6		Soft, mottled, dark gray (2.5Y N4/0) with black Lean CLAY (BAY MUD).		CL	3	SPT	1/2/2	67	S-3 W = 35.1%	
8					1	P		67	U-1	▽ 8.5'
10		Loose, gray (5Y 5/1) Clayey SAND. (BAY MUD).		SC						
12										
14		Soft, black CLAY with Gravel. (BAY MUD).		CL	4	SPT	2/3/2	67	S-4	
16										
18		Compact, gray (5Y 5/1) Clayey GRAVEL.		GC	5	SPT	8/7/10	44	S-5A S-5B	
		Highly to completely weathered, extremely weak SANDSTONE.								
20										

SPT = Standard Penetration Test
P = Piston Sampler

DEPTH SCALE 0.75 inch = 2 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-2

STA. B-2 OFFSET L R ELEVATION SHEET 2 OF 2
PROJECT NO. 913-7043.400 DRILLING DATE 3/1/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
20		Highly to completely weathered, extremely weak SANDSTONE.			6	SPT	18/22/39	67	S-6	
22										
24		Highly weathered, extremelyto very weak SANDSTONE.			7	SPT	22/37/24	33	S-7	
26										
28					8	SPT	30/50	50	Sampler driven 12 in. S-8	
30		Bottom of hole @ 29.5 ft.							End time : 1500.	
32										
34										
36										
38										
40										

SPT = Standard Penetration Test
P = Piston Sampler

DEPTH SCALE 0.75 inch = 2 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-3

STA. B-3 OFFSET L R ELEVATION SHEET 1 OF 2
PROJECT NO. 913-7043.400 DRILLING DATE 3/4/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
0		Compact, light yellowish brown (10YR 6/4) Well Graded GRAVEL (FILL).		GW					Start time : 0930 Hammer weight = 140 lbs. Drop = 30 in.	No groundwater encountered.
					1	SPT	6/7/7	33	S-1	
2										
		3.5'. Boulder								
4		Compact, grayish brown (10YR 5/2) Well Graded GRAVEL with roots and weed fragments (FILL).			2	SPT	3/13/15	22	S-2	
				GW						
6										
		Color changes to light yellowish brown (10YR 6/4), roots decrease.			3	SPT	12/13/11	22	S-3	
8										
		Color changes to a mottled, grayish brown (10YR 5/2) with black, decomposed wood present.			4	SPT	13/22/17		S-4	
10		Compact, mottled, grayish brown (10YR 5/2) with black Well Graded GRAVEL, gravel composed of Sandstone, decomposed wood present.		GW						
12										
		Color changes to a mottled, very pale orange (10YR 8/2) to moderate yellow brown (10YR 5/4).		GW	5	SPT	22/5/16	22	S-5	
14										
16										
18										
		Completely weathered, brown, very weak SANDSTONE. Well graded GRAVEL (FILL?).			6	SPT	22/23/39	22	S-6	
20									SPT = Standard Penetration Test P = Piston Sampler	

DEPTH SCALE 0.75 inch = 2 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednarek
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-3

STA. B-3 OFFSET L R ELEVATION SHEET 2 OF 2
PROJECT NO. 913-7043.400 DRILLING DATE 3/4/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE / SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/6 IN.	SAMPLES: RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
20										
22										
24		Bottom of hole @ 23.5 ft.							Auger breaks. End time : 1115.	
26										
28										
30										
32										
34										
36										
38										
40										

SPT = Standard Penetration Test
P = Piston Sampler

DEPTH SCALE 0.75 inch = 2 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednarsh
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # B-4

STA. B-4 OFFSET L R ELEVATION SHEET 1 OF 1
PROJECT NO. 913-7043.400 DRILLING DATE 3/4/91 DATUM MSL
INCLINATION 90° AZIMUTH NA DRILL RIG Hollow Stem Auger/Rotary

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE / SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/6 IN.	SAMPLES: RECOVERY	SAMPLE DESCRIPTION	NOTES / PIEZOMETER / STANDPIPE INSTALLATION
0		Light olive gray (2.5Y 5/6) f. GRAVEL (FILL).		GP					Start time : 1100 Hammer weight = 140 lbs. Drop = 30 in.	No groundwater encountered.
1										
2										
3		Highly weathered, very pale orange (10YR 8/2) to moderate yellowish brown (10YR 5/4), extremely weak to very weak SANDSTONE.			1	SPT	15/22/19	33%	S-1	
4										
5					2	SPT	15/30/50	33%	S-2	
6										
7		Bottom of hole @ 6.3 ft.							End time : 1215.	
8										
9										
10									SPT = Standard Penetration Test P = Piston Sampler	

DEPTH SCALE 0.75 inch = 1 foot
DRILLING CONTRACTOR Miller Pacific Engineering Group
DRILLER Bob Lanz

Golder Associates

LOGGED BY R. W. Bednash
CHECKED P. K. Mundy
DATE April 1991

RECORD OF BOREHOLE # 3-2 5

STA. B-2 5 OFFSET -L R
PROJECT NO. 913-7055.200
INCLINATION 90° AZIMUTH
ELEVATION
DRILLING DATE 7/24/91 B-5
DATUM
DRILL RIG FAILING 1500

BORING METHOD: MUD ROTARY / 4 7/8 Ø TRICONE BIT - 1 3/8" Ø SPLIT SPOON SAMPLER - 2 3/8" Ø FAILING DRILL ROD

DEPTH SCALE (FEET)	SOIL PROFILE DESCRIPTION	USCS	NUMBER	TYPE	BLOWS/6 IN.	RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
0	0.-3.5'. Dense, olive (5Y 5/3) c-f SAND with f. Gravel, well Sorted (FILL).	SW	1	SPT	22/21/16	1.2/1.5	START 0810 SAMPLE 1. Dense, olive (5Y 5/3) c-f SAND with f. Gravel, moist (FILL).	
2–4	3.5-5.5'. Dense, olive brown (2.5Y 4/3) m. SAND, few f. Gravels, poorly sorted (FILL).	SP	2	SPT	9/11/91	1.2/1.5	SAMPLE 2. Dense, olive brown (2.5Y 4/3) m. SAND, few f. Gravels, trace Shells, moist (FILL).	
6	5.5-17.5'. Compact, olive gray (5Y 5/2), c-f SAND with c-f Gravels, few Clays, well sorted (FILL).	SW	3	SPT	10/8/5	0.5/1.5	5'. sets mud tub using Super Gel-x - 1½ bags SAMPLE 3. Compact, olive gray (5Y 5/2), c-f SAND with c-f Gravels increasing to a depth of 5.5' (FILL). Color change at 6'.	
8		SW	4	SPT	3/6/5	0.6/1.5	SAMPLE 4. Compact olive gray (5Y 5/2) and olive brown (2.5Y 4/3), c-f SAND with c-f Gravel, few Clays, well sorted (FILL).	
10				SPT	2/4/6	0/1.5	NO SAMPLE - FELL THROUGH SHOE - LOOSE.	
12–14								
16		SW	5	SPT	5/6/8	0/1.5	Driller adds 7th bag mud. NO SAMPLE - SHOE BLOCKED OFF - COMPACT SAMPLE 5. Drill CUTTINGS - SAME AS SAMPLE 3.	
18	17.5-24'. Compact, strong brown (7.5Y 4/6) and very dark gray (2.5Y 3/0) m-f SAND, poorly sorted (FILL)							▽ Depth to mud 18.90' (0635) 7/25/91

DEPTH SCALE 1 = 2'
DRILLING CONTRACTOR PITCHER DRILLING
Golder Associates
LOGGED BY E. MAC DONNELL
CHECKED

RECORD OF BOREHOLE # B-25

SHEET 2 OF 4

STA. B-25 OFFSET -L R ELEVATION DATUM

PROJECT NO. 913-7055.200 DRILLING DATE 7/24/91 DRILL RIG FALING 1500

INCLINATION 90° AZIMUTH

(FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
0	MUD ROTARY 4 7/8" ϕ TRICONE BIT	17.5-24'. Compact, strong brown (7.5Y 4/6) and very dark gray (2.5Y 3/0) m-f SAND, poorly sorted (FILL).		SP	6	SPT	5/10/7	0.6/1.5	SAMPLE 6. Compact, dark gray (2.5Y 4/0) and strong brown (7.5YR 4/6), m-f SAND, poorly sorted (FILL). Driller adds 3rd bag of mud.	
		24-27'. Compact, medium bluish gray (5B 5/1), C. GRAVEL, few m. Sands, trace wood, poorly sorted (FILL).		GP	7	SPT	9/8/9	0.2/1.5	24'. Lose circulation. Wood slivers in cuttings then regains partial circulation. SAMPLE 7. Compact, grayish black (N2) and medium bluish gray (5B 5/1) with bluish white (5B 9/1) C. GRAVEL (BLUE SANDSTONE), few m. Sands, trace wood (FILL). Driller adds 4th bag mud.	
		27.0-42.5'. Compact, olive (5Y 5/4), m. SAND with f. Gravel, poorly Sorted (FILL).		SP	8	SPT	9/7/7	0.4/1.5	27'. Driller says out of gravel zone, in finer Sands. SAMPLE 8. Compact, olive (5Y 5/4) m. SAND with f. Gravel (BLUE SANDSTONE), poorly sorted (FILL).	
						SPT	10/10/9	0/1.5	NO SAMPLE - FELL THROUGH SHOE - Compact	
					B.5				SAMPLE B.5. DRILL CUTTINGS. SAME AS ABOVE.	

DEPTH SCALE 1" = 2'

DRILLING CONTRACTOR BUTCHER DRILLING

Golder Associates

LOGGED BY B. MACDONNELL

CHECKED

RECORD OF BOREHOLE # B-~~2~~5

SHEET 3 OF 4

STA. B-~~2~~5 OFFSET - L R ELEVATION DATUM

PROJECT NO. 913-7055.200 DRILLING DATE 7/24/91 DRILL RIG FAILING 1500

INCLINATION 90° AZIMUTH

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
40	MUD ROTARY 4 7/8" TRICONE BIT	27.0-42.5'. Compact, olive (5Y5/4) to dark gray (5Y4/1) m-f SAND, few c-f Gravels poorly sorted (FILL).		SP	9	SPT	14/11/17	0.5/1.5	SAMPLE 9. Compact, light olive brown (2.5Y5/6) m-f SAND, few c-f Gravels, poorly sorted (FILL), at 40.7' Compact, olive (5Y5/3) to dark gray (5Y4/1) m-f SAND, few f Gravels, wet (FILL).	
42										
44		42.5-51. Compact, light olive brown (2.5Y5/6) C-f SAND, poorly sorted Silt increases with depth and color becomes dark gray (5Y4/1). (BEACH SAND).		SP	10	SPT	8/10/20	1.1/1.5	SAMPLE 10. Compact, light olive brown (2.5Y5/6) C-f SAND, poorly sorted, wet. At 45.5' Compact, olive (5Y5/4) m-f SAND, wet, poorly sorted. Not getting 100% return circulation.	
46										
48										
50				SM	11	SPT	2/7/7	1.5/1.5	SAMPLE 11. Compact, dark gray (5Y4/1) C-f SAND with Silt. At 51' Firm. dark gray (7.5YR4/0) CLAY, few Silts few f Sands, UC = 1.0 tsf (51.5'), (BAY MUD).	
52		51-76'. Firm, dark gray (7.5YR4/0) CLAY, few Silts, few f. Sands (BAY MUD).		CL						
54										
56				CL	12	SHELBY		2.6/3.0	SAMPLE 12. SAME AS 51-51.5' UC = 1.5 tsf (57.6'), (BAY MUD). Driller gets 3rd load water adds 8th - 12th bag mud.	
58										

DEPTH SCALE 1" = 2'

DRILLING CONTRACTOR P. CHEIR DRILLING

Golder Associates

LOGGED BY ~~MCDONNELL~~

CHECKED

RECORD OF BOREHOLE # B-~~25~~

SHEET 4 OF 4

STA. B-~~25~~ OFFSET -L R ELEVATION DATUM

PROJECT NO. 913-7055.200 DRILLING DATE 7/24/91 DRILL RIG FALCON 1500

INCLINATION 90° AZIMUTH

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
60	MUD ROTARY 17/8" Ø TRICONE BIT	51-76'. Firm, dark gray (7.5 YR4/0) CLAY, few Silts, few f. Sand (BAY MUD).		CL	13	SHELBY		1.3/3.0	SAMPLE 13. Firm, dark gray (7.5YR4/0) CLAY, few silts, few m-f sands, trace shells, UC = 1.0 tsf (62.3'), (BAY MUD).	
						SHELBY		0/3.0	NO SAMPLE - SHELBY CAME UP EMPTY	
						SHELBY		0/3.0	NO SAMPLE - SHELBY CAME UP EMPTY	
						OSTERBERG		0/3.0	NO SAMPLE - OSTERBERG DOESN'T FIRE. PROBABLY P. Gravel unseating check valve.	
				CL	14	SHELBY (DISTURBED)			SAMPLE 14. Disturbed samples retrieved with Shelby tube from 70-71.5'. Same as Sample 13.	
				CL	15	SHELBY		3.1/2.5	SAMPLE 15. SAME AS SAMPLE 13 from 74.5-76.0'. AT 76' Dark gray (7.5YR4/0), m-f SAND with Silt, trace shells. Driller used 600 lbs down pressure. Driller gets 4th load of water.	
		76'-77'. Completely weathered, massive, dark gray (N3), m-f grained, very weak SANDSTONE.		SS					77' Driller hits harder material.	
		77-80'. Slightly weathered, massive, dark yellowish orange (10YR6/6), m grained, med. strong SANDSTONE. EOB at 80' (1645)		SS	16	SPT	50/1in	0.2/0.2	SAMPLE 16. Slightly weathered, massive, dark yellowish orange (10YR6/6), medium grained, medium strong SANDSTONE.	

DEPTH SCALE 1" = 2'

DRILLING CONTRACTOR PITCHER DRILLING

Golder Associates

LOGGED BY B. Mc Donnell

CHECKED

RECORD OF BOREHOLE # B-6

SHEET 1 OF 4

STA. B-6 OFFSET - L R

PROJECT NO. 913-7055.200

INCLINATION 90° AZIMUTH

ELEVATION

DRILLING DATE 7/25/91 B-6

DATUM

DRILL RIG FAILING 1500

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLE NUMBER	TYPE	BLOWS/ 6 IN.	RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
0	GARBAGE BARREL * 6" Ø CYLINDER DRILL * PITCHER INVENTION	0-3'. Very dense, olive gray (5Y 5/2) c-f Sandy c-f GRAVEL with Clay, Well Graded (FILL).		GW	1	GAR			0830 START DRILLER TRIES SPLIT SPOON AT SURFACE CANNOT ADVANCE, USES GARBAGE BARREL TO 1'. TRIES AGAIN CANNOT ADVANCE. USES GARBAGE BARREL TO Sample 1. Very dense, OLIVE GRAY (5Y 5/2) C-f Sandy c-f GRAVEL with Clay Well Graded FILL.	
2				GW	2	CH	50/5.5"	5.5/5.5	Sample 2. Very dense, OLIVE GRAY (5Y 5/2) C-f Sandy C-f GRAVEL with Clay WELL GRADED (FILL).	
4		3-10'. Compact, light olive brown (2.5Y 5/6) m-f SAND, Poorly Sorted (FILL).		SP	3	SPT	6/9/12	1.3/1.5	Sample 3. Compact, light olive brown (2.5Y 5/6) m-f SAND, Poorly Sorted (FILL) DRILLER SETS MUD TUB USES 2 BAGS MUD.	
6	MUD ROTARY 4⅞" Ø TRICONE BIT CASED TO 58' (4" Ø CASING)			SP	4	SPT	5/6/9	1.0/1.5	Sample 4. Same as above.	
10				SP	5	SPT	6/9/14 (0925)	0.7/1.5	Sample 5. 7.5-10'. SAME AS ABOVE 10'-10.2'. Compact, black (N2), olive (5Y 4/3) and gray (7.5YR 5/0) C. GRAVEL, POORLY SORTED (FILL).	
		10-20'. Compact, black (2.5Y 2/0), olive (5Y 4/3) and gray (7.5YR 5/0), C. GRAVEL, Poorly Sorted (FILL).		GP						
12										
14									14.5-16'. LOST CIRCULATION AT 14.5'. DRILLER ADDS 4th BAG OF MUD. DRILLER GETS 2nd LOAD OF WATER (1000). SAME AS ABOVE (BASED ON CUTTINGS).	
				GP	7	SPT	3/5/11	0.1/1.5		
16										
18										
				GP	8	SPT	7/7/9	0.3/1.5	Sample 8 19.5-20'. SAME AS ABOVE [illegible]	

DEPTH SCALE 1" = 2'

DRILLING CONTRACTOR [illegible]

DRILLER

Golder Associates

LOGGED BY B. MacDONNELL

CHECKED

RECORD OF BOREHOLE # B-6

STA. B-6 OFFSET - L R
PROJECT NO. 9 3-7255 200
INCLINATION
AZIMUTH

ELEVATION
DRILLING DATE 7/25/91

SHEET 2 OF 4
DATUM
DRILL RIG Failing 1500

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	NUMBER	TYPE	BLOWS/ 6 IN.	RECOVERY	SAMPLE DESCRIPTION	NOTES PIEZOMETER STANDPIPE INSTALLATION
20	MUD ROTARY 4 7/8" Ø TRICONE BIT CASED TO 58' (4" Ø CASING).	20-23'. Dense, light olive brown (2.5Y 5/4) f. Gravelly c-f SAND with Clay, well graded (FILL).		SW	8	SPT	7/17/17	0.7/1.5	Driller has 3rd load water 12th bag mud. 20-20.2 Dense, light olive brown (2.5Y 5/4) f. Gravelly c-f SAND with CLAY, well graded (FILL).	▽ 20.65' @ 0700 7/27/91
22										
24		23-28'. Same as above except Compact.		SW	9	SPT	8/9/10	1.3/1.5	Sample 9. Compact, dark gray c-f GRAVEL (BLUE SANDSTONE - FILL) 25.1 - 25.3. Compact, light olive brown (2.5Y 5/4) f Gravelly c-f SAND with CLAY, well GRADED. (FILL) 1140 - Driller HAS 4th LOAD OF WATER. INSTALLS CATCHER TO TRY FOR BETTER RECOVERY.	
26										
28		28-33'. Dense, gray (2.5Y 5/0) c-f GRAVEL, poorly sorted (FILL).								
30				GP	10	SPT	6/13/10	0.5/1.5	DRILLER HAS USED 26 BAGS. Sample 10. Dense, gray (2.5Y 5/0) C-f GRAVEL. POORLY SORTED (FILL)	
32										
34		33'-43'. Dense, gray (2.5Y 5/0) and light olive brown c-f GRAVEL, few Clayey m-f Sands poorly sorted (FILL).		GP	11	SPT	8/22/17	0.3/1.5	Dense, gray (2.5Y 5/0) and light olive brown (2.5Y 5/4) C-f GRAVEL, few Clayey m-f Sands. POORLY SORTED (FILL). DRILLER ADDS 30TH BAG OF MUD (1300). Driller gets 4th load of water.	
36										
38										
40				GP	12	SPT	20/17/14	0.6/1.5	Sample 12. SAME AS ABOVE. Driller has 5th load of water.	

DEPTH SCALE 1 : 24
DRILLING CONTRACTOR

Golder Associates

LOGGED BY
CHECKED

RECORD OF BOREHOLE # B-16

STA. E-16 OFFSET - L R
PROJECT NO. 913-7055 200
INCLINATION 90°
AZIMUTH
ELEVATION
DRILLING DATE 7/25/91
DATUM
DRILL RIG FAILING 1500

BORING METHOD: MUD ROTARY 4 7/8" TRICONE BIT / CASED TO 50' (4" ø CASING)

DEPTH SCALE (FEET)	SOIL PROFILE DESCRIPTION	USCS	NUMBER	TYPE	BLOWS/ 6 IN.	RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
40	33'-43'. Dense, gray (2.5Y 5/0) and light olive (2.5Y 5/4) c-f GRAVEL, few Clayey m-f Sands, Poorly Sorted (FILL)	GP	12	SPT	26/17/19	0.4/1.5	Sample 12. Dense, gray (2.5Y 5/0) and light olive brown (2.5Y 5/4) c-f Gravel, few Clayey m-f Sands, (FILL) poorly Sorted. Driller gets 6th load of water.	
42–44	43'-56.5'. Same as above except Very dense.							
50			13	GRAB		GRAB	Sample 13 at 50'. GRAY (2.5Y 5/0) and light olive brown (2.5Y 5/4) GRAVEL (DRILL CUTTINGS). Sporadic return of mud.	
54		GP	14	SPT	100/5.5"	.55/.55	53.5'. DRILLER CANNOT ADVANCE. TRIES TO GET ROCKS UP BEFORE SPLIT SPOON. (1710) END OF DRILLING at 53.5'. Sample 14. Very dense, gray (2.5Y 5/0) and light olive brown (2.5Y 5/4) c-f GRAVEL, few m-f Sands. Poorly Sorted (FILL) 7/26/91 (0720) START DRILLING [illegible] 56-57. Driller says in softer material. [illegible]	
56–58	56.5'-65.5'. Firm, dark gray (2.5Y 4/0), Silty CLAY, trace m. Sand, trace shells (BAY MUD).	CL	15	SHELBY		2.3/2.0	Sample 15. Firm, dark gray (2.5Y 4/0), Silty CLAY, trace m. Sand, UC = 1.75 tsf (BAY MUD).	

DEPTH SCALE
DRILLING CONTRACTOR

Golder Associates

LOGGED BY [illegible]
CHECKED

RECORD OF BOREHOLE # B-16

SHEET 4 OF 9

STA. B-16 OFFSET - L R
ELEVATION
DATUM
PROJECT NO. 913-7655-200
DRILLING DATE 7/26/91
DRILL RIG FALCON 75
INCLINATION 90° AZIMUTH

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
60	3" Ø TRICONE ROLLER BIT WITH GUIDES TO 4.0 MUD ROTARY	56.5-65.5' Firm, dark gray (2.5Y 4/0), Silty CLAY, Trace m Sand, trace shells. (Bay Mud).		CL	15	SHELBY		3.0		
62										
64				CL	16	SHELBY		1.5	Sample 16. Firm, dark gray (2.5Y 4/0), Silty CLAY, trace m Sand, trace shells. UC = 1.5 tsf (Bay Mud).	
66		65.5' Fresh, massive, dusky green (5G 3/2), m. crystalline, strong Quartzite (Blue Sandstone) with fresh, dike, white (N9), m. crystalline, strong, Quartz.		SS	17				SAMPLE 17—CUTTINGS 65.5-69'	
68				SS	18	SPT	29/50/5	3.5/.75	Sample 18 Fresh, massive, dusky green (5G 3/2), microcrystalline, strong Quartzite (BLUE SANDSTONE), with Fresh, dikes, white (N9), m. crystalline, strong QUARTZ.	
70		BOH at 70.5' (1115).								
72										
74										
76										
78										

DEPTH SCALE 1 = 2'
DRILLING CONTRACTOR
DRILLER

Golder Associates

LOGGED BY C. MACDONNELL
CHECKED
DATE

RECORD OF BOREHOLE # B-57

STA. 3-57 OFFSET - L R
PROJECT NO. 913-7055.200
INCLINATION 90° AZIMUTH
ELEVATION
DRILLING DATE 7/26/91 B-7
SHEET 1 OF 2
DATUM
DRILL RIG FALCON 1500

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
0	GARBAGE GRAB & DRILL (6" Ø CYLINDER)	0-0.35': Very dense, olive gray (5Y 4/2), c-f Gravelly c-f SAND with Silt, well graded (FILL).		SW	1	SPT	50/4"	0.25/0.35	START 1335. SAMPLE 1. Very Dense, olive gray (5Y 4/2), c-f Gravelly c-f SAND with SILT. Well Graded.	
		0.35-4.0': Very dense, yellowish brown (10YR 5/6) to olive (5Y 5/4) Clayey c-f SAND with Silt, few c-f Gravels, well graded (FILL).			2					
4				SW	3	SPT	33/31/21	1.0/1.5	SAMPLE 3. Very dense, yellowish brown (10YR 5/6) to olive (5Y 5/4) Clayey c-f Sand with Silt, few c-f Gravels, well graded. (FILL).	
		4.0-6.0': Dense, light olive brown (2.5Y 5/4) Clayey c-f SAND with Silt, few c-f Gravels, well graded (FILL).								
6	MUD ROTARY 4 7/8" Ø TRICONE BIT CASED TO 34.5' (4" Ø CASING)			SW	4	SPT	10/16/19	1.5/1.5	Driller sets Casing for mud tub to 5'. Driller starts mixing mud. 2 Bags mud used. SAMPLE 4. Dense, light olive brown (2.5Y 5/4) Clayey c-f SAND with Silt, few c-f Gravels, well graded (FILL).	
8		6.0-13.0': Same as above except Compact.		SW	5	SPT	6/8/7	0.3/1.5	SAMPLE 5. SAME AS ABOVE. except Compact.	
10				SW	6	SPT	4/6/9	0.2/1.5	Sample 6. Shoe blocked off. Recovered SAME AS ABOVE.	
12										
14		13.0-18.0': Very dense, light olive brown (2.5Y 5/4) c-f Sandy c-f GRAVEL with Clay (FILL).		GC	7	SPT	11/26/37	2.5/1.5	SAMPLE 7. Very dense, light olive brown (2.5Y 5/4) c-f Sandy c-f GRAVEL with Clay. (FILL).	
16										
18		18.0'-29.0': Same as above except Compact.								
20										

DEPTH SCALE 1" = 2'
DRILLING CONTRACTOR PITCHER DRILLING
DRILLER

Golder Associates

LOGGED BY J. MACDONALD
CHECKED

RECORD OF BOREHOLE # B-57

SHEET 2 OF 2

STA. B-57 OFFSET - L R ELEVATION DATUM

PROJECT NO. 913-7055.200 DRILLING DATE 7/26/91 DRILL RIG FALING 1500

INCLINATION 90° AZIMUTH

DEPTH SCALE (FEET)	BORING METHOD	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	USCS	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/6 IN.	SAMPLES RECOVERY	SAMPLE DESCRIPTION	NOTES — PIEZOMETER — STANDPIPE INSTALLATION
20	MUD ROTARY 4 7/8" Ø TRICONE BIT CASED TO 34.5' (4" Ø CASING) AT 29' 3" Ø TRICONE WITH 4" Ø GUIDES	18.0'-29.0'. Compact, light olive brown (2.5Y 5/4) C-F Sandy C-F GRAVEL with Clay (FILL).		GC	8	SPT	5/9/8	0.3/1.5	Compact, light olive brown (2.5Y 5/4) C-F Sandy C-F GRAVEL with Clay (FILL).	
22										
24										
26				GC	9	SPT	7/7/10	0.8/1.5	Driller gets 2nd load water. On 6 bags mud. Sample 9. SAME AS ABOVE.	
28		29.0-30.0'. Firm, dark gray (2.5Y 4/0), silty CLAY, trace m. Sand, trace shells (BAY MUD - FILL).		CL					DRILLER HIT BAY MUD AT 29'. LOSE Circulation. Case to 29.5'. Driller uses Revert (out of gel x) for thickener. BAY MUD ONLY NOTED IN DRILL CUTTINGS, Approximately 1 ft Thick.	
30		30.0'-36.5'. Compact, olive gray (5Y 5/2) C-F Sandy C-F GRAVEL with Clay (FILL).		GC	10	SPT	12/7/7	0.7/1.5	SAMPLE 10. Compact, olive gray (5Y 5/2) C-F Sandy C-F GRAVEL with clay.	
32										
34									DRILLER CASED TO 34.5'. Has Circulation.	
36	MUD ROTARY WITH GUIDES TO 4" Ø. 3" Ø TRICONE ROLLER BIT	36.5'-38.0'. Moderately weathered, massive, light olive brown (5Y 5/6), C-F grained, weak SANDSTONE.		GC	11	SPT	6/50/6"	0.8/1.0	Sample 11. Moderately weathered, massive, light olive brown (5Y 5/6), C-F grained, weak SANDSTONE.	
38		38.0'. Same as above except Slightly weathered and med. to Strong. EOB (1740)		SS	12	SPT	50/1"	0.1/0.1	Sample 12. Slightly weathered, massive, light olive brown (5Y 5/6), C-F grained, [illegible] SANDSTONE.	

DEPTH SCALE 1" = 2'

DRILLING CONTRACTOR ~~PITCHER DRILLING~~

DRILLER ROGER KOSTELKO

Golder Associates

LOGGED BY B. MAC DONNELL

CHECKED

DATE

RECORD OF DRILLHOLE

Sheet 1 of 13

PROJECT: San Rafael Rock Quarry
PROJECT NO.: 1845
LOCATION: Hole U-1
DRILLING DATE: August 8, 1991
DRILL RIG: Truck Mounted Longyear 44
DATUM: Mean Sea Level
COORDINATES: N: E:
AZIMUTH: 185°
COLLAR ELEV.:
INCLINATION: 45°

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ◆Axial ●Diametral	NOTES, WATER LEVELS, INSTRUMENTATION
0	Fill Consisting of Quarry spoil, boulder-size blocks of weathered ss, bricks, sand, etc	NC							NC				START 12:45pm Rock Bit to CASE UPPER PART No Circulation
5													
10													
15													1:45 stop for water
20													
25													
30		NC							NC				3:30pm Harder to Drill @ 30'
35													
40													Bedrock

DEPTH SCALE: 1" = 5'
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hall
LOGGED: T. Baird (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

Sheet 2 of 13

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: Hole U-1

DRILLING DATE: August 8, 9, 12 - 1991 DATUM: MSL
DRILL RIG: TRUCK MOUNTED LONGYEAR 44 AZIMUTH: 185°

COORDINATES N:
E:

COLLAR ELEV.:
INCLINATION: 45°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, Sm—Smooth, R—Rough, VR—V. Rough

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV/DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ◆ Axial ◆ Diametral	NOTES: WATER LEVELS, INSTRUMENTATION
40	FILL - BRICK, ANGULAR BLOCKS SS	NC							NC				Rotary, rock bit to 48'
45	Bay Mud on Drill Tip N3 Dark Gray (m) N5-6 Med-Light Gray (dry)												Drilled to 48.5' to set casing 5:15
50	SLIGHTLY WEATHERED, MED DARK TO MED LIGHT GRAY (N4-N6), MASSIVE SANDSTONE	MB M3		1	1.5'/2.0'	0/2.0'	4	FR+J, PL-C, R coated with oxide	20 30 45		R3-4		3:05 BOX 1 3:10 no orientation
	Bay Mud (N2 - Gray)												
	SLIGHTLY WEATHERED MB MED. DARK TO MED LIGHT GRAY (N4 wet - N6 dry), MASSIVE SANDSTONE			2	3.0'/3.0'	0/3.0'	2		60		S5		
							2		MB 30 45	SW	R3-4		
							4		47				
55	FRACTURED WITH OXIDIZED STAINING ON JOINT SURFACES						1						5:15 STOP B/9 54°-58°
	NUMEROUS CALCITE FILLED VEINLETS	MB		3	4.2'/4.0'	1.0'/4.2'	3		38 MB 43		R4		
		MB					1		60				
		MB					3		62 40 MD 55 M3 26				
	SS with zone of clay and breccia with clasts of GRAYISH GREEN (10G 4/2m) to PALE GREEN (10G 6/2d) CHERT.			4	1.5'/5.2'	1.1'/5.5'	NA	F, PL, K SLICKS RAKE 30° TO DIP	55	FR	R3-4		5:15 STOP B/9 7:30 START B/10
60		NC			NO CORE				NC	NO CORE			BOX 2
	Fault? - Face coated w/ clay (mylonite?)						NA	F, PL, K					
	Fragments bounded by clays w/ mylonitic fabric	MB		5	1.0'/4.3'	0/4.2'			30	FR	R3-4		8:30 8:40
65		NC			NO CORE			F, R, K	NC	NO CORE			

DEPTH SCALE: 1": 5'; 2": 5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: BILL HILLINGFORD

LOGGED: T. BALLARD (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

FIGURE 4

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: Hole U-1
DRILLING DATE: August 12
DRILL RIG: Truck Mounted Longyear 44
DATUM: MSL
COORDINATES{ N: E:
AZIMUTH: 185°
COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough. Point Load Index: ● Axial, ◆ Diametral

Depth (ft)	Description (Rock Type)	Graphic Log	Run No.	Core Recovery	RQD	Fractures per Foot	Discontinuity Data: Type and Surface Description	Graphic Log	Weathering Index	Strength Index	Notes / Water Levels / Instrumentation
65		NC		NO CORE				NC	NO CORE		BOX 2
	Fault Breccia, fragments of veined SS-graywacke, calcite infillings; fragment surfaces coated with clay (mylonite), some slickensides; frags of pale green chert cemented with calcite contained in graywacke. Base of core consists of fragments of SS in clay	MB, MB	6	1.0/1.5	0.0/1.5	>10(?)	F, PL, K slicks 50°; F, PL, K slicks 45 (15°-20° wrt dip)	MB	FR	R4	9:40 - out
		NC		NO CORE				NC	NO CORE		
70		MB	7	1.0/3.0	0.0/3.0	>2(?)	F, PL-C, SHR 60° 80°	MB, 15°	FR	R4	9:55 - out
		NC		NO CORE				NC			
	Breccia zone, SS and chert; Fresh, med. dark to med. light gray, massive sandstone (graywacke), fractured and faulted; clay lined surfaces, some pyrite on fract; calcite veincets most <1mm, some up to 3mm wide	MB, MB, MB, MB	8	4.5/5.0	1.3/5.0	>2; 5 -	FR, PL, S-R 50; Totally sheared zone but prominent fractures preserved 40, 60; FR, PL-C, R 30, 45	MB, 25, MB, MB, MB	FR	R3-4; R4	10:28 10:40 Mud is flowing into mud pit through wall; Hole caving at bit.
75		NC		NO CORE				NC	NO CORE		11:20 11:43
80		NC	9	0.0/4.5	NO CORE			NC	NO CORE		
	Fragments of brecciated graywacke/SS. Pale green chert w/ SS. calcite veinlets + sparry calcite		10	1.0/2.0	0.0/2.0	?	Fragments, but some slicks, no orientation	NA	FR	R4	12:20 12:30
		NC		NO CORE				NC	NO CORE		
			11	0.5/1.5	0.0/1.0	NA		NA	FR	R4	12:55 - Changed bit 1:00
85		NC		NO CORE				NC	NO CORE		Box 3

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hungerford
LOGGED: TF Bullard (Geomatrix)
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: Hole U-1

DRILLING DATE: August 12, 13 1991
DRILL RIG: Truck Mounted Longyear 44

DATUM: MSL
COORDINATES: N: E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

Point load index: ● Axial, ● Diametral

Columns: DEPTH SCALE (FEET) | ROCK TYPE: DESCRIPTION | GRAPHIC LOG | ELEV / DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX (FR, SW, MW, HW, CW, RS) | STRENGTH INDEX (R6, R5, R4, R3, R2, R1) | POINT LOAD INDEX (psi) (1500, 800, 400, 250, 100, 30) | NOTES, WATER LEVELS, INSTRUMENTATION

Depth (ft)	Description	Graphic log	Run no.	Core recovery	RQD	Fractures per foot	Type and surface description	Graphic log	Weathering	Strength	Notes
85		NC		No core				NC	No core		Box 3
	Breccia		12	1.0 / 2.0	0.3 / 1.0	>1	F, PL, K; Slicks 60°-70° from dip	30, 38, 30, 60	FR	R4	
				1.5 / 4.5	0.4 / 4.5	?					2:45 / 2:50
		NC	13	No core				NC	No core		
90											
	Brecciated zone with pale green chert frags					>4	J, PL-C, R	MB, 2, 15			
	MB, MB		14	1.3 / 2.5	0.8 / 2.5	>4	F, PL-U, K; Slicks 40° to Dip; FR or F, PL, K; Clay coating, slicks	27, MB, 45, MB, 45	FR	R4, 40°	
		NC		No core				NC	No core		
						NA		60°	FR	R4	3:35 / 3:39
95		NC	15	No core				NC			
	MB, MB, MB, MB			1.2 / 4	0.2 / 4	>4	F, P, K (Slicks 40° to Dip); FR, P, R; F, P, K; FR, P, R	MB, 50, 30, MB, 45, 10, MB	FR	R4	Stop: 4:45 8-12
				0.9 / 3.3	0.2 / 3.3	NA					Start 8-13-91 7:00
100		NC	16	No core				NC	No core		Had to pull string to remove rock caught in bit
	Fresh, grayish blue green (5BG 5/2, m), massive fine-med grained meta-sandstone, fractures filled with calcite. Some pitting of calcite veins. Brecciated, green fills fractures in gray SS. Grinds to greenish gray (5G 6/1) clay	MB Green, Gray, Black shale, Green	17	2.0 / 2.3	0.6 / 2.3		FR-J, P, R; Shear; FR, PL-C, SM	75, 50, 50, 30, 50, 40, 45	FR	R3-4	8:20 / 9:00
		NC		No core				NC	No core		10:00
105		Green	18	2.5 / 4.2	0.9 / 4.2	NA			FR	59-5 w/ Frag R3-4	10:10

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hungerford

LOGGED: T F Bullard (Geomatrix)
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

Sheet 5 of 13

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: HOLE U-1

DRILLING DATE: AUGUST 13, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (Axial / Diametral)	NOTES: WATER LEVELS, INSTRUMENTATION
105	GREEN, BRECCIA AND FAULT GOUGE DARK GRAY (N3) TO GRAYISH BLACK (N2) CLAY			18	5E / 4°	NA	NA	F(?), P, SM 45		FR	S4-5 with FRAGS R3-4		BOX 4
		NC			NO CORE				NC	NO CORE			
				19	0° / 3°								10:35 / 10:42
110		NC			NO CORE				NC	NO CORE			
	FRESH, GRAY, SS; FRACTURED W/SHALE IN FRACTURES, CALCITE VEINLETS				0.5E / 3E	0° / 3°	NA			FR	R4		11:15 / 11:23
		NC		20	NO CORE				NC	NO CORE			
		NC		21	NO CORE				NC	NO CORE			11:45 / 2:15 Pull string to clear bit / 2:30 / 2:35
115	MELANGE(?) FRESH, DARK GRAY TO BLACK GROUNDUP SHALE, GRAY SANDSTONE AND PALE GREEN SS OR CHERT; COARSE SANDY CLAY MATRIX WITH PEBBLE-SIZE CLASTS. LAST 0.5' OF CORE IS BRECCIATED SS MB			22	4S / 5B	NA	NA	SR, PL-U, SM SHALE		FR	S5		PHOTO PRIOR TO BOXING
		SHALE IN SHEAR					>2	F, PL, S SLICKS ON BLACK CLAY COATS AT RAKE 45° TO DIP	80 MB 45 MB		R4		
120	GROUNDUP SHALE AND SS. SS FRAGS IN LOWER PART W/CALCITE VEINS ERODED 3-5mm deep	NC			NO CORE				NC	NO CORE			3:15 / 3:30
				23	1.5 / 2R	NA	>2	FR, PL, R	MB 50 MB	FR	S4-5		
		NC			NO CORE		NA				R4		
	SHEARED SS AND SHALE. SMALL LENGTHS OF INTACT SS, INTENSELY SHEARED & FRACTURED CALCITE VEINLETS MB MB								NC	NO CORE			3:50 / 4:00
				24	4S / 4.3	NA	2	FR, PL, R 45 45 SR, PL, SM CALCITE			S4-5		BOX 5
125							NA	SHEARED			R3-4		
											S5		

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: BILL HUNGERFORD

LOGGED: TF BULLARD (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

FIGURE 4

RECORD OF DRILLHOLE

Sheet 6 of 13

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1

DRILLING DATE: August 13, 14, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (Axial / Diametral)	NOTES, WATER LEVELS, INSTRUMENTATION
125	FRESH, DARK GRAY MASSIVE FINE-GRAINED SANDSTONE HIGHLY FRACTURED AND SHEARED WITH BLACKSHALE			24	4" / 4½"	NA	NA				S4-5		Box 5
				25	1½" / 1½"	NA	NA			FR	R3-4		4:45 END 8-13-91
		NC			NO CORE				NC	NO CORE			8:10 START 8-14-91
	FRESH, PALE GREEN OOLITIC CHERT, CALCITE OOLITES.	MB		26	1" / 2½"	NA	1	SR, PL, SM CHERT W/SHALE SHEARED SLICKS // SHEAR	MB N70 45	FR	S4-5 R3		8:30 / 9:00
130		NC			NO CORE				NC	NO CORE			
	FRESH, MED-DARK GRAY, FINE-MED MASSIVE SS, W/ BRECCIATED ZONE AT TOP			27	0" / 2½"	NA	1	FR, PL, R	30 FR		R4		10:00 / 10:15
		NC			NO CORE				NC	NO CORE			
				28	1½" / 12"	NA	?						10:50 / 11:00
135	FRESH DARK GRAY CLAY AND SANDSTONE; CALCITE VEINS, SOME SHEARING, LOOKS LIKE FAULT GOUGE, PERHAPS MELANGE			29	5½" / 5½"	NA		SR, P, SM	10	FR	S4-5 R3-4		11:15 / 11:30
													BOX 6
140				30	3" / 3"	NA	NA	J, P, SM K SHALE BETWEEN SS	45				12:10 / 12:20
				31	5½" / 5½"	NA	NA						12:50 / 1:00
145													

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: BILL HUNGERFORD

LOGGED: T F BULLARD (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

FIGURE 1

RECORD OF DRILLHOLE

Sheet 7 of 13

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1

DRILLING DATE: AUGUST 14, 15, 1941
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ● Axial ✱ Diametral	NOTES WATER LEVELS INSTRUMENTATION
145	CLAY & ANGULAR SS CLASTS, BRECCIA OR MELANGE												BOX 7
	THIN BRECCIATED ZONE // TO FRACTURE, BUT WITHIN SS.			31	5.3/5.3	NA	NA	J, PL-C, SM-R			S4-5 + R3-4		
	FRESH, MOD-DARK GRAY, MASSIVE, FINE-GRAINED SS MB TO SILTSTONE; FRACTURED AND SHEARED, INTERCALATED WITH SHALE (?). DEFORMED, FOLDED, VEINLETS OF CALCITE				1.3/5.3		1+ / 3	SOME W/SHALE INFILLING; SR ~ 1" wide		FR	R4		1:45 / 1:50
	SHALE/SS "MELANGE" TYPE MATERIAL MB				2.3/5.1	NA	NA				S4-5 + R3-4		
150		NC		32	NO CORE				NC	NO	CORE		
	FRESH, MED. DARK GRAY (N4, d) CLAY, SHALE AND SANDSTONE BROKEN UP,				0/5.1	NA				FR	R3-4		
				33	0.8/1.2	0.3/1.3	NA						
		NC			NO CORE				NC	NO	CORE		5:00 STOP 8/14
155	FRESH MED. DARK GRAY (N4, d) MASSIVE SS AND SHALE → MB	MB			2.0/2.0	1.2/2.0	NA / 2	FR, PL, SM; SR, PL, SM SHALE IN SHEAR ZONE ~10mm wide	MB		S4-5		8:30 START 8/15
	FRESH, DUSKY BLUE GREEN (5BG 3/2, m) TO GRAYISH GREEN (5G 6/1, d), MASSIVE QUARTZITE. (could be volcanic) MB			34							R4		
	GREEN SS/QUARTZITE → MB										S4		9:20 / 9:30
	DARK GRAY SHALE + SS → MB			35	1.6/1.6	0°/1.6	1 / NA	FR, PL, SM			R3		
											S4-5		10:05 / 10:10 BOX 8
	BLUE GREEN TO GRAYISH GREEN QUARTZITE/SS (volc?)			36	2.6/2.6	0.5/2.6	1 / NA	SR, PL, SM SHALE IN SHEAR		FR	R3-4		
160	MED. DARK GRAY SHALE												
	SHALE + SS. MANY SMALL PARTING FRACTURES						>10	FR, PL, SM-R			S4-5		10:50 / 11:00
	SS W/CALCITE VEINS										R3-4		
	SHALE + SS			37	5.2/5.2	NA	>1				S4-5		
	GRAY SS W/CALCITE VEINS						2	FR, PL, SM-R			R3-4		
	MB										S4-5		
165	MB						2	SR, PL, SM, SHALE	MB		R3-4		

DEPTH SCALE: 1": 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: BILL HUNGERFORD

LOGGED: T. BULLARD (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1

DRILLING DATE: August 15, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES { N: E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough. Point load: ● Axial, ∗ Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
165	MED-DARK GRAY SS AND SHALE. SHALE FILLING FRACTURES AND GROUND UP (MB)	37	5²/5²	NA	1	FR, PL, SM SHALE	45, MB		S4-5 R3-4	Box 8
	MED. DARK GRAY MASSIVE SS W/ CALCITE VEINLETS, NUMEROUS FRACTURES FILLED W/ SHALEY MATERIAL				4	FR-SR, PL, SM SHALE INTERLAYER	20, 30, 25, 20		R3-4	12:00 12:10
		38	5³/5³	0⁶/5³	3		30			Box 9
					2		50, 50	FR		
170					2				S4-5	
	FRESH, DARK GRAY (N2) 'MELANGE-LIKE' CLAY WITH SS FRAGS, AND SHALE WITH THIN SS LAYERS (< 2") (MB)				?	FR, PL-C, R	60		R3-4	
		39	4⁸/5³	NA	NA		MB, MB, MB		S4-5 + R23	1:00 1:05
175	(MB)						MB, MB, MB, MB, MB			
	NC	NO CORE					NC	NO CORE		
	GRAY SS, MASSIVE, CALCITE VEINLETS, SHALE IN CLOSED FRACTURES (MB)	40	3⁵/4⁴	1⁵/4⁴	3	FR, PL, SM SHALE IN FILLING	30, 50, 64, MB, MB			1:45 1:55
					1		MB, 60		R3	Box 10
					1					
180					NA		30			
	NC	NO CORE					NC	NO CORE		
	FRESH, GRAY, MASSIVE FINE GRAINED SS TO COARSE SILTSTONE OR SHALE (MB)	38 (41)	1⁰/5⁵	5⁵	0	FR, PL, SM SHALE	55	FR	R3	2:30 2:35
					>2		MB, MB, 60, 20			
	NC	41	NO	CORE			NC	NO	CORE	
185	(MB)						50, MB	FR	R3-4	

DEPTH SCALE: 1" : 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: BILL HUNGERFORD

LOGGED: T BULLARD (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1

DRILLING DATE: AUGUST 15, 16, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ● Axial ✱ Diametral	NOTES WATER LEVELS INSTRUMENTATION
185	FRESH, MED-DARK GRAY MASSIVE FINE GRAINED SANDSTONE WITH NUMEROUS CALCITE VEINLETS			41									Box 10
				42	19/26	NA	>10			FR	R3-4		
		NC				NO CORE			NC	NO	CORE		
190					3/16					FR	R3-4		
		NC		43		NO CORE			NC	NO	CORE		
	MACHINE BROKEN			44	28/29					FR	R3-4		Box 11
		NC				NO	CORE		NC	NO	CORE		
													STOP 8/15/91
195													START 8-16-91
		NC		45	0°/45	NO	CORE		NC	NO	CORE		
		NC				NO	CORE		NC	NO	CORE		9:05
200				46	18/25	NA	NA						
	BROKEN ROCK												9:40
	FRESH, MED. DARK GRAY, MASSIVE CALCITE VEINED SANDSTONE	MB						FR, PL, SM	45 MB				9:50
		MB		47	28/30	0³/3⁰	>2		MB	FR	R3-4		
							2	FR, PL, SM SHALE FILLER	60 MB				
		MB							MB 40 60				
		MB					3		MB 45				10:20
		MB		48	29/33	0³/3³			45 MB				10:30
205									MB 55				

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: BILL HUNGERFORD

LOGGED: T. BULLARD (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1

DRILLING DATE: August 16, 1991
DRILL RIG: Truck Mounted Longyear 44

DATUM: MSL
COORDINATES{ N: E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
FR = Fracture

Point Load Index: ● Axial, ● Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES / WATER LEVELS / INSTRUMENTATION
205	Fresh, med, light to med dark gray (N4 to N6), massive, fine-grained metamorphosed sandstone or siltstone fractured and numerous calcite veinlets brittley + ductiley deformed.	MB		48			2+	FR, PL, SM-R	MB, 60, 37	MB, MB, FR, 50	S3-4		Box 11
							2						
		NC			No core								
		NC			No core				NC	No	Core		11:20 / 11:30
		MB					NA						
				49	4'/49	1²/42	2	FR, PL, SM-R	25, 60, MB, 60	MB, MB, MB, FR	R3		
210							3		60, 55, 20	MB			Box 12
							1						12:25 / 12:35
		NC		50	No		Core		NC	No	Core		
215	Breccia zone ⊥ axis shale, SS, calcite				1³/5³	0⁹/5³	≥4	FR, PL, ST	80, 68, 90, 85, 15	FR	R3		
							1	FR, PL-C, K/P parallel to dip; FR, PL, SM					
		NC		51	0²/0²	No	Core		NC	No	Core		1:10 / 1:25 Tripped out rods
220		NC		52	0⁵/3⁹	No	Core		NC				
	Loose sand + gray SS	MB			0/3⁹		NA	FR, PL, SM K/P	15, 10	MB, FR	R5-4		3:15 / 3:30
		NC		53	0⁶/3⁹	No	Core		NC	No	Core		
225													

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hungerford

LOGGED: T. Bullard (Geomatrix)
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

Sheet 11 of 13

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1

DRILLING DATE: August 16, 19, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION: 45°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
FE – Fe Oxide, CL – Clay In Fill, CH – Chlorite, FR – FRACTURE

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV/DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISC. GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES: WATER LEVELS, INSTRUMENTATION
225		NC		53	0/32	0/32	≥1	FR, PL, SM, CL	MB 35	FR	R3		BOX 12
				54	14/27	0/22	≥1	FR, PL, SM; CL	20 25	FR	R3		3:50 / 4:05
					NC	NC CORE		FR, PL, K/P SLICKS RAKE DIR'N 10° TO DIP DIR'N OF FRACTURE	70 NC	NO	CORE		
					0/15	0/15	NA			FR	R3		4:25 STOP 8/16/91; 9:00 START 8/19
		NC		55	NO CORE				NC	NO	CORE		
230		MB MB MB		56	2/33	0/33		FR, PL, SM-R	MB 70 MB MB 60	FR	R3-4 S4 R3-4 S4		9:30 / 9:40
		NC			NO	CORE			NC	NO	CORE		
	FRESH, MED-LIGHT TO MED DARK GRAY (N4 to N6), MASSIVE, V. FINE-GRAINED META SANDSTONE OR SILTSTONE ?				28/34	0/34	4+	FR-J, PL, SM-R	MB 70 MB 70	FR	R3		10:25 / 10:45 BOX 13
235		NC		57		NO	CORE		NC	NO	CORE		
							3+		MB				
								FR, PL, SM	70 60	FR	R31		11:15 / 11:30
				58	1/2	0/2	>1	FR, P, SM-K	40				
		NC			NO	CORE			NC	NO	CORE		
		MB MB MB		59	19/19	0/19	>3	FR, PL, SM-R CL	10 MB				11:55 / 12:05
								SR, PL, SM CL	55 70				
240								FR, PL, SR	45 70				12:40 / 12:55
		MB MB					>1		MB				
				60	25/25	0/25	3+	FR, PL, SM CL	60 MB MB 70		R2-3		
		MB					3+		45 45				
				61	47/47		2		45 MB 15 45				1:30 / 1:55
245							4		46 70				

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
LOGGED: D. BULLARD (GEOMATRIX)
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 12 of 1?

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1
DRILLING DATE: AUGUST 19
DRILL RIG: LONGYEAR 44 TRUCK MOUNTED
DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 185°
COLLAR ELEV.:
INCLINATION: 45°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
Fe — Fe Oxide, CL — Clay In fil, CH — Chlorite, FR — FRACTURE

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
245	FRESH, MED-LIGHT TO MED-DARK GRAY (N4-6), MASSIVE VERY FINE SANDSTONE TO SILTSTONE			61	4.9/4.3	3"/42	1	FR, PL, SM-R CL		FR	R3		Box 14
							2						
							4						2:55
													3:15
				62	3.3/4.0	0"/40"	2	FR, PL, SM CL					
250							3						
							NA	FR, PL, SM-K SLICKS ORIENTED 60° TO DIP.			S4		
		NC				NO	CORE		NC		NO	CORE	4:10
				63	2.1/2.1	0"/2.1	>1						4:35
							3	FR, PL, SM					
							3+						Box 15
	MB	MB											STOP 5:00 8/19
255				64	2.5/2.8	0.3/2.5	2+	FR, PL, SM-R CL		FR	R2-3		START 8/20
							5+						
	FRESH, MED-DARK GRAY (N4-6), MASSIVE, V. FINE-GRAINED MUDSTONE TO SHALE. LOCALLY PLATY TO FISSILE, ESPECIALLY IN SOME FRACTURES AND SHEARS, HOWEVER, MOSTLY MASSIVE												
				65	2.6/2.6	0.5/2.5	3+						
							3						
							3			FR			
260				66	2.8/2.2	0.3/2.2	4				R1-2		9:30
							5+						9:40
		NC				NO	CORE		NC	NO	CORE		10:20
													11:10
				67	1.4/1.9	0"/1.9	NA	FR, PL, SM-R		FR	R1-2		11:40 Box 16
				68	1.8/2.5	0"/1.9	6						12:00
265							4						

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER:
LOGGED: J.B ULLMAN (GEOMATRIX)
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1

DRILLING DATE:
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N: E:
AZIMUTH: 185°

COLLAR ELEV.:
INCLINATION:

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, CL – Clay Infil, CH – Chlorite

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES / WATER LEVELS / INSTRUMENTATION
265	FRESH, MED-DARK GRAY, MASSIVE, V. FINE GRAINED SILTSTONE AND SHALE	NC		68		NO	CORE	FR, PL, SM CL	NC	NO	CORE		Box 16
					NA	NA	NA		60, 50, 30				12:35 / 12:50
				69	1.5 / 2.3	0 / 2.3	3		50, 75, 30	FR	R1-2		
		NC				NO	CORE		NC	NO	CORE		1:25 TD 268'

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: [illegible]

LOGGED: T. BULLARD (GEOMATRIX)
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 1 of 1

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1A

DRILLING DATE: August 22, 23 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 045

COLLAR ELEV.:
INCLINATION: 60°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
FR—Fractured

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (Axial / Diametral)	NOTES: WATER LEVELS, INSTRUMENTATION
0.0	BRICKS AND FILL	NC						NO CORE	NC				Box 1 HQ pipe w/ diamond bit on end to set casing in bedrock
25	FRESH, MED-LIGHT TO MED. DARK GRAY (N3 to N4), MASSIVE, CALCITE VEINED, FINE-TO-MED GRAINED SANDSTONE AND SHALE AT DOWNEND OF CORE. PICKING UP BRECCIA-LIKE FRAGS IN SHOE	MB		1	2.0 / 3.4	1.1 / 3.1	0	JN, PL-C, SM-R SHALE LINING	MB	FR	R3		
							?		20				
		NC			No	Core			NC	No	Core		
55		MB			3.1 / 4.1	1.2 / 4.1	1	FR, PL, SM-R	SHALE-CL MB	FR	R3		4:00 STOP 8/22 START 8/23
		NC		2	No	Core			NC	No	Core		
	Breccia zone	MB							MB				
	Clay & fragments of green & gray ss							JN, PL-C, SM CL	50				~8:30 ~8:40
							NA						
60		MB					3		45	FR	R2-3		
		MB		3	5.1 / 5.1	3.2 / 5.1	4	FR, PL, R	MB				
		MB						FR, PL-ST, SM	45 30				
		MB					2		65 MB				
									30				
		MB					0	FR, PL-ST, R	10 MB				
									45				
		MB					1	FR, PL, R	20 MB				Box 2
		MB		4	5.2 / 5.3	2.9 / 5.2	3		60 MB				9:40 9:45
65		MB					4		65 30				

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: E. HUNGERFORD

LOGGED: T. BULLARD (GEOMATRIX)
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

Sheet 2 of 11

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1A
DRILLING DATE: AUGUST 23, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44
DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 045
COLLAR ELEV.:
INCLINATION: 60°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
Fe – Fe Oxide, CL – Clay Infil, CH – Chlorite

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES: WATER LEVELS, INSTRUMENTATION
65	ROCK TYPE											Axial / Diametral	
				4	5²/5²	2⁸/5²	2	FR, PL, R		MB, MD			Box 2
							3+	FR, PL, S CL					
	SHALE LENSE/BRECCIATED MB						NA			MD	R2-3	1040 / 1045	
70				5	3³/5³	2⁷/5²	NA			FR			
	SHEAR ZONE OF INTACT SHALE						1	F, PL-C, K (CL) RAKE 135° TO DIP DIR'N (DOWNHOLE, RIGHT HAND RULE, D° ± BOTTOM)					
	SHALE LENSE						3						
		NC			NO	CORE	3	F, PL, K (CL) RAKE 80° TO NP; FR, PL, R; SULFIDE COATINGS; FR, PL, SM; CL		NC	NO	CORE	
					0²/3⁷	3+		FR, PL, SM; CL					1135 / 1145 Box 3
75		NC		6	2²/3⁹	NO	CORE	SR, U, SM; CL		FR	R2-3		
	HIGHLY FRACTURED SS AND SHALE.						>10			NC	NO	CORE	
							NA			FR	R1-2		
							NA						1215 / 1220
				7	5³/5⁵	3⁵/5⁵	3+	FR, PL-C, R					
							2+	FR, PL, R					
80		MB					1	FR, PL-C, SM-R; CL		MD			
							0				R2-3		
	BROKEN UP ON END						0						1305 / 1310
	PALE GREEN SANDSTONE (?) WITH BRECCIA OF SS, SHALE; SHALE OR CLAY INJECTION DEFORMATION			8	5°/5°	5°/5°	0			FR			
							0				R2-3		Box 4
85							0						

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
LOGGED: T BULLARD (GEOMATRIX)
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1A

DRILLING DATE: Aug 23, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N: E:
AZIMUTH: 045°

COLLAR ELEV.:
INCLINATION: 60°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe — Fe Oxide, CL — Clay Infil, CH — Chlorite

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES / WATER LEVELS / INSTRUMENTATION
85				8	5.0/5.0	5.0/5.0	0 / 1	FR, PL, R	70				Box 4
													1335 / 1300
				9	4.8/5.2	4.2/5.2	0	CLY COATING PL, SMOOTH		FR	R2-3		* P Axial
90	SHEARED SHALE W/SS "POOS" FRAGMENTS						1	FR, PL, R; CLAY IN 70° FRACTURE	30	MP / FR	S/CLY		
							0				R1		
	SANDSTONE W/SHEARED SHALE		92.2	10	5.3/5.3	4.0/5.3	2	FR, PL, SLICKS, CLY	30° / 30	MB	R1-2		14:40 / 14:45
95	CLAY							PL, P, K CLY	30	FR / MB			Box 5
	CLAY SEAM; CLAY SEAM							S, P, K, SM CLAY	30 / 70		R1-2		
	SHEARED SHALE W/ SANDSTONE		97.5	11	4.8/5.5	4.0/5.5	1			MB / MB	R1-2		15:20 / 15.30
100	CLAY SEAM							S, B, SM, CLY	30° / 70°	FR / C			
	SANDSTONE						2		30°		R2-3		
	LOST CORE - CLY SHALE	NC	103.0		NO	CORE			NC	NO CORE			16:10 / 16:15 BOX 6
105	SHEARED SHALE W/S.S. S.S			12	2.5/4.0	2.1/4.0		S, B, SM, CLY 30		MB	R1		

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: R. [illegible]

LOGGED: J BULLARD, C TAYLOR
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 4 of 11

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-14

DRILLING DATE: August 23, 26 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44

DATUM: MSL
COORDINATES: N: E:
AZIMUTH: 045°

COLLAR ELEV.:
INCLINATION: 60°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe — Fe Oxide, CL — Clay Infill, CH — Chlorite

Depth (ft)	Description (Rock Type)	Graphic Log	Elev/Depth (ft)	Run No.	Core Recovery	RQD	Fractures per foot	Discontinuity Type and Surface Description	Weathering Index	Strength Index	Notes / Water Levels / Instrumentation
105	SHEARED SHALE W/SOME SILTSTONE			12	2.5/4.0	2.1/4.0	N/CORE		MB		Box 6
		NC	107.0						NO	CORE	17:00
		NC			NO CORE				NO	CORE	17:05
	INTENSELY SHEARED FINE SS			13	1.2/3.0	2.5/3.0	>3	FR, PL, SM-R; CL (55°, 40°, 2V)	FR	R1-2	
110		NC	110.0		NO CORE				NO	CORE	Trip Rods Grout; Stop 8/23; Start 8/26; Trip rods, clean bit; 11:40
	FRESH, MED-LIGHT TO DARK GRAY (N4), SHEARED FINE-GRAINED, MASSIVE SS, SHALE, SOME PALE GREEN FAULT GOUGE.			14	1.5/1.5	0.5/1.5	NA	FR, PL, SM; CL (45°)		R3	11:50
115				15	5.3/5.3	0.5/5.3	NA, NA, NA, NA, NA, >2	S, PL, SM; CL (50°, 10°)	FR	S4 + R3	Box 7
	PALE GREEN, MASSIVE FINE-GN SS (?)						NA	S, PL-C, ST; SHL (10°, 20°)	MB		12:45; 12:55
		NC			NO CORE				NO	CORE	
120	MASSIVE, V. FINE SS TO SILTSTONE, INTENSELY SHEARED			16	2.8/4.0	0.0/4.0	SHEARED ZONE	S, PL, SM; SHL (20°)	FR	R2 + S4-5	13:40; 13:50
				17	1.2/3.2	0.0/3.2	NA	S, PL, SM; SHL (10°)			
		NC			NO CORE				NO	CORE	14:40
125				18			NA		FR	R2-S5	14:50

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
DRILLER: [illegible]

LOGGED: C. TAYLOR, J. BULLARD
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 5 of 11

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1A

DRILLING DATE: August 26,27 1991
DRILL RIG: LONGYEAR 44
T.M.

DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: 045°

COLLAR ELEV.:
INCLINATION: 60°

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough
Fe – Fe Oxide, Cl – Clay In fil, CH – Chlorite, C – Clay/Shale

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	ROD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
125	BRECCIA of MED-LIGHT TO DARK GRAY MASSIVE FINE GN SS (CALCITE VEINS), SHALE, & PALE GREEN SILTSTONE. POORLY CONSOLIDATED			18	4'/4'	0³/4⁵	NA, Sheared	FR, U-ST, R; CL	65				Box 8
130				19	3²/3²	0'/3²	NA, SHEARED			FR	ALT-ERNATING S4-5 AND R1,2,3		1530 / 1540
135	INTENSE SHEAR ZONE DARK GRAY SS, SHALE, PALE GREEN SILTSTONE BRECCIA	MB MD		20	4²/4³	0⁰/4³		S, PL-C, S-R; CL S, PL-C, S-R; CL FR, PL, R	40 50 50 45 20 MD 50				1610 / 1620 Box 9
	GREEN, FINE-GN, SILTSTONE (?)			21	2⁵/3¹		2, NA	FR, U, R; CL FR, PL, S; CL	40 60				1710 / 1715
		NC				NO	CORE		NC	NO	CORE		1745 STOP START 8/27
140	SHEARED & BRECCIATED ZONE			22	3⁵/4³	1⁵/4³	NA, NA			FR	SS, R23		
	SHEAR ZONES IN MASSIVE, V. FINE SS OR SILTSTONE							S, PL, S-R; CL	40 30				
		NC				NO	CORE		NC	NO	CORE		
		NC				NO	CORE		NC	NO	CORE		
145				23	2²/2⁴	0/2⁴	NA		NA	FR	S4		

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
LOGGED: T BULLARD
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 6 of 11

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1A
DRILLING DATE: August 27, 1991
DRILL RIG: TRUCK MOUNTED LONGYEAR 44
DATUM: MSL
COORDINATES N:
E:
AZIMUTH: 045° INCLINATION: 60°
COLLAR ELEV.:

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
Pl–Planar, C–Curved, U–Undulating, St–Stepped, I–Irregular
P–Polished, K–Slickensided, Sm–Smooth, R–Rough, VR–V. Rough
Fe – Fe Oxide, Cl – Clay In Fl, Ch – Chlorite, Cl – Clay/Shale

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	ROD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES: WATER LEVELS, INSTRUMENTATION
145	BRECCIA / MELANGE			23	2.3/2.4	0/2.4	NA				S4,5		Box 10
	SHEARED, GRAY SS			24	2.0/2.2	0°/2.0	NA						0810 / 0820
	DARK GRAY SILTSTONE AND BRECCIA/MELANGE			25	2.2/2.2	0°/2.2	NA			FR	R2,3 / R2		0850 / 0900
150	MELANGE												0935 / 0945
	PALE GREEN, WEAKLY CEMENTED BRECCIA			26	5.2/5.2	0/5.2	NA				S4-6		
155	MELANGE INTENSELY SHEARED												Box 11
	INTENSELY SHEARED MELANGE			27	2.2/2.2	0/2.2	NA						
160	SHEAR ZONE IN V. FINE MASSIVE ~~DARK~~ GRAY SS - SHEARS FILLED W/ LAMINATED CLAYS/SHALE			28	3.2/3.2	0°/3.2	NA	S,Pl-U,SM-R;CL	40/40				1130 / 1140
								S,Pl-U,SM-R;CL	79				1235 / 1245
165				29									Box 12

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
LOGGED: T. Bullard
CHECKED:
Golder Associates

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1A

DRILLING DATE: AUGUST 27, 1991
DRILL RIG: TH LONGYEAR 44

DATUM: MSL
COORDINATES{ N:
E:
AZIMUTH: 045°

COLLAR ELEV.:
INCLINATION: 60°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, CL – Clay In fil, CH – chlorite

Columns: DEPTH SCALE (FEET); ROCK TYPE: DESCRIPTION, GRAPHIC LOG; ELEV DEPTH (FT); RUN NO.; CORE RECOVERY (%); RQD (%); FRACTURES PER FOOT; DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION, GRAPHIC LOG; WEATHERING INDEX; STRENGTH INDEX; POINT LOAD INDEX (psi) (● Axial, ○ Diametral); NOTES, WATER LEVELS, INSTRUMENTATION

Depth (ft)	Description	Elev/Depth	Run No.	Core Recovery	RQD	Fractures per foot	Type and surface description	Graphic log angles	Weathering	Strength	Notes
165			29			NA	S, PL-C, SH-R; CL	50, 40, 30		S5-6	Box 12
	Sandstone w/ some shale & calcite	MB				NA			MB		
		MB	30	2.1/2.1	1.8/2.8	0	FR, PL, SM; CL	50	MB	R3-4	
						2	169.4 S, PL; SM; CL	50	FR		1415
170	Shear zone w/ shale & sandstone polished surfaces on joints						PL, SM, CL	30, 48, 50	FR	R3	1420
			31	3.0/3.5	2.1/3.5	2		70°, 40°			
						1			MB		
	NC				NO	CORE		NC	NO	CORE	1505
	Green chlorite						172.9				
	Sandstone/siltstone	30°				1	J, PL, B, CL	30°		R3	1515 Box 13
175	Shear zone, clay w/ sandstone frags	30	32	4.5/4.7	3.2/4.7			30°	FR	S3	
	Sandstone/siltstone					3		30°	MB	R2	
								30		R3	
						3	177.5 [illegible]	30°, 50°	MB		16:05 16:10
			33	1.3/2.3	1.2/2.3	1	J, PL, B, SM	60°	FR		
180	Shear zone, clay						179.8			S3	16:55 17:05
	Sandstone/siltstone w/ [illegible]		34	3.5/3.8	3.7/3.8		[illegible] S, PL, B, CL	20°, 30°	FR	R3-4	
						1		35°			
							183.6				17:[illegible]
185			35	[illegible]	[illegible]		J, PL, [illegible]				

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
LOGGED: T BULLARD, C TAYLOR
CHECKED:

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U-1A

DRILLING DATE: August
DRILL RIG: TM LONGYEAR 44

DATUM: MSL
COORDINATES N:
E:
AZIMUTH: 045°

COLLAR ELEV.:
INCLINATION: 60°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe – Fe Oxide, CL – Clay Infil, CH – chlorite

Point Load Index: ● Axial ◆ Diametral

Depth Scale (feet)	Rock Type – Description	Graphic Log	Elev / Depth (ft)	Run No.	Core Recovery (ft)	RQD	Fractures per Foot	Discontinuity Data – Type and Surface Description	Graphic Log	Weathering Index	Strength Index	Point Load Index (psi)	Notes, Water Levels, Instrumentation
185	SANDSTONE/SILTSTONE w/ calcite veins, clay zones			35			1			FR	R3-R4		
							3	J, PL, R, CL	25°, 20°				
							0						
	SAND SANDSTONE INCLUSION, 3"Ø		188°				1	J, PL, R	56				7:30
								J, P, K, CL	50	FR	R3-R4		
190	Shear zone. Foliated clay, green chlorite inclusions, 1"Ø			36	4.1 / 4.4	2.5 / 4.1	NA	SHEARED ZONE S, PL, P, CL, CH, foliated	30		S3		
	SANDSTONE/SILTSTONE w/ calcite veins, <5% shale stringers						1	S, PL, K	40		R3-4		
		NO CORE					NC				NC		8:00 Box 1 / Box 1
			193±	37	4.0 / 4.2	2.4 / 4.2	0				R3-4		
							1	J, PL, P, calcification	50	FR			
195	Shear zone; foliated shale with clay						NA SHEARED	S, PL, K	20		S3		
	2" SANDSTONE/SILTSTONE w/ increase in calcite veins. Top 3" of recovery is ground up rock w/ clay.	NC	196±				NC				NC		9:04
				38	0.5 / 2.0	0 / 2.0	NA			FR	R3-4		
		NC	NO CORE				NC				NC		
	INTENSELY SHEARED MELANGE OF SANDSTONE/SILTSTONE AND SHALE WITH CLAY		198±	39	2.5 / 3.2	0 / 3.2	NA	S, PL, P, CL	50		S4		9:55
200								S, P-I, K, CL	25	FR			
		NC	NO CORE				NC				NC		
			201±	40	2.0 / 2.2	1.3 / 2.2	3	J, P, P, CL	25, 25, 10	FR	R3		11:15
	PALE GREEN FINE GRAINED SANDSTONE [illegible] WAVY SURFACES						1	F, PL, K, CH	30				
205			204°				2	J, U, I, CL			R2		12:00

DEPTH SCALE: 1" : 2.5'
DRILLING CONTRACTOR: LONGYEAR
LOGGED:
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 9 of 11

PROJECT: SRRQ
PROJECT NO.: 1892
LOCATION: U-1A
DRILLING DATE: 28 AUGUST '91
DRILL RIG: TM LONGYEAR 44
DATUM: MSL
COORDINATES { N:
E:
AZIMUTH: 045°
COLLAR ELEV.:
INCLINATION: 60°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, VR—V. Rough
Fe – Fe Oxide, Cl – Clay Infil, CH – chlorite

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
205	PALE GREEN FINE-GRAINED SS			41	3'/4'	1'/4'	3	J, U, P, CL	30 55 70 50 70 50 40	MW	R2		
							2						
							2						
			208±				1						13:05
	CHLORITE			42	2'7/2'0	0'7/2'8	NA-Sheared	J, U, P, CL, CH	35 45 45	FR	R0-R1		
210	INTENSELY SHEARED MELANGE OF PALE GREEN SS, DARK GREY SS, SHALE, and CHLORITE		210?					S, U, P/K, Sm	30° 35°	FA	R3-4		13:50/13.55
	FAESH, GREY to GREEN, BLUE, SANDSTONE and SILTSTONE & CHLORITE SEDIMENTS			43	4' 35/43		1						
							0						
							1	S, P, K, CH	50°				
	FAESH, GREEN-GRAY SILTSTONE w/ CHLORITE(?)						2	S, Pl, K CH	50		R-1		
215			215?										14:40
													14:55
				44	5.0 5.0/5.0 5.0	5.0/5.0	0		MB		R3,4		
									FA				
									MB				
							1	S, P, K, CH	30				
							0		MB				
			220?						MB				15:40/15:55
								J, U, VR, CHL	15	MB			
				+5	5.0/5.3		1	J, U, VR, C			R3?		
								J, U, VR	20 30				
								J, U, VR					
							5	V, V, K	25 10				

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: LONGYEAR
LOGGED: C.D YOUNG
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 10 of 11

PROJECT: [illegible]
PROJECT NO.:
LOCATION: [illegible]
DRILLING DATE:
DRILL RIG:
DATUM: MSL
COORDINATES N:
E:
AZIMUTH:
COLLAR ELEV.:
INCLINATION:

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, CL – Clay Infill, CH – Chlorite

Columns: DEPTH SCALE (FEET) | ROCK TYPE DESCRIPTION | GRAPHIC LOG | ELEV DEPTH (FT) | RUN NO. | CORE RECOVERY (%) | RQD (%) | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX | STRENGTH INDEX | POINT LOAD INDEX (psi) (● Axial, ○ Diametral) | NOTES, WATER LEVELS, INSTRUMENTATION

Depth	Description	Depth (ft)	Run No.	Core Recovery	RQD	Fractures per foot	Type and surface description	Angle	Weathering	Strength	Notes
225	[illegible] (meta-greywacke), w/ chlorite sediments, [illegible] friable	225	46	4.8/4.8	1.7/4.8	2, 3, 1, 1, 1	J, U, CH 20°; J, U, R; J, U, R; J, U, R, calcite; J, U, K; J, U, K; J, U, R; J, U, R	50, 45, 60, 50, 30, 65, 55	FR	R1	16:00
230		230.0	47	0.8/0.8	0/0.8	NA			FR	R1	7:50 9/29/91
		230.8	48	0.6/0.6	0/0.6	NA					8:10
	very friable	231.4	49	2.9/2.9	1.3/2.9	1+, 1, 3	J, I, P; calcite, J, I, R; J, P, SM	70, 60, 70, 55, 25	FR	R1	8:33 bit wasted?; Box 18; Box 19
235	crumbled; less friable, many joints	234.3	50	2.5/2.7	0.7/2.7	NA crumbled in sampler, 1, 1	J, PL, P	50, 70	FR	R1-R2	9:20
		237.0	51	5.2/5.3	2.2/5.3	3, 1, 1, 4, 3	J, PL, P; J, PL, R; J, PL, R; J, U, R; J, U, R; J, PL, P; J, PL, R; J, I, R, CL; J, PL, R; J, PL, R; J, PL, K; J, PL, R	75, 80, 70, 60, 45, 55, 35, 55, 55, 55, 55, 55	FR	R1-R2	10:15; core can be broken by hand easily
240		242.3	52	4.[illegible]/4.[illegible]	2.9/[illegible]	1, 4, 1	J, [illegible], R; J, U, R; J, [illegible], SM; J, U, SM; B, PL, [illegible]	55, 50, 45	FR	R1-R2	11:35; Box 19; Box 20

DEPTH SCALE:
DRILLING CONTRACTOR:
LOGGED:
CHECKED:

Golder Associates

RECORD OF DRILLHOLE

Sheet 11 of 1

PROJECT: SRRQ
PROJECT NO.: 1875
LOCATION: U-1A
DRILLING DATE: 29 AUGUST 1991
DRILL RIG: TM LONGYEAR 44
DATUM:
COORDINATES N:
E:
AZIMUTH:
COLLAR ELEV.:
INCLINATION:

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
— CL clay, — CA calcite, — —

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES: WATER LEVELS, INSTRUMENTATION
45	Dark grey shale with abundant calcite veins						3	J, PL, SM, CH J, U, R J, U, R	30 45 45				
			246'										12:35
7	extremely fractured, some sandstone inclusions			53	2'/2'	0/2'	3	J, PL, SM J, I, R J, I, R	30 70 10		R1		
8							NA						
9			249'										13:20
50	Grey-green sandstone with calcite veins (metagreywacke)						2	J, U, R J, PL, R	50 50		R1-R2		
	highly fractured			54	3'/3'	1'/3'	3	J, PL, R J, U, R, CL J, P, R	50 40 30	FR			
							NA						
	LOST CORE - SHALE/SHEA		252'	NC						NC			14:28
	SANDSTONE												14:35 Box 21
	LOST CORE - SHALE/SHEA							S, U, K, R, CL	30 30				
	GREY-GREEN SANDSTONE w/ CALCITE VEINS			55	2'/3'	0/3'	NA	S, U, K, A, CL	50 40	NC	R1		
55	LOST CORE - SHALE/SHEA			NC									
	" " "		255'	NC						N/C			15:10
	CLAY SHEARED SHALE/SHEA												15:25
	GREEN SANDY CLAY							S, U, K, A, CL	50		R1		
	FRESH, GREY/BLACK SANDSTONE & SHALE "SHEAR ZONE"			56	4.2/4.5	0/4.5	NA	S, U, K, A, CL	50 30				
			260'										
	BOTTOM OF HOLE												16:30 Box 21

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED: C. TILLOCK
CHECKED:
DATE: 8-27-91

Golder Associates

FIGURE 1

RECORD OF DRILLHOLE U-2

Sheet 1 of 36

PROJECT: SAN RAFAEL ROCK QUARRY DRILLING DATE: 9/3/91
PROJECT NO.: 1855
LOCATION: SAN RAFAEL, CA DRILL RIG: LONGYEAR 44 Truck Mount
DATUM: MSL
COORDINATES N: E:
COLLAR ELEV.:
AZIMUTH: S34E (146) INCLINATION: -45°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, CL – Clay Infil, CH – Chlorite, CA – Calcite, Go – Gouge

Point load index: ● Axial, ● Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES, WATER LEVELS, INSTRUMENTATION
0–19	FILL												Rotary Drilled with Tricone Bit

DEPTH SCALE: 1 inch = 2.5 feet
DRILLING CONTRACTOR: LONGYEAR
LOGGED: [illegible]
CHECKED:

Golder Associates

RECORD OF DRILLHOLE U-2

Sheet 2 of 36

PROJECT: San Rafael Parking Garage / DRILLING DATE:
PROJECT NO.: 1995
LOCATION: San Rafael, CA
DRILL RIG: Longyear 44; Truck Mounted
DATUM: MSL
COORDINATES N:
E:
COLLAR ELEV.:
AZIMUTH: S31E (146°) INCLINATION: 45°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
Fe – Fe Oxide, Cl – Clay Infil, CH – Chlorite, Ca – Calcite, Ba – Barite

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ◆ Axial ● Diametral	NOTES WATER LEVELS INSTRUMENTATION
20	FILL (continued)												
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													

DEPTH SCALE: 1 inch = 2.5 feet
DRILLING CONTRACTOR: Longyear
DRILLER: Cliff Harrison

LOGGED: John Westling
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

PROJECT: San Rafael Rock Quarry
DRILLING DATE:
DATUM: MSL
COLLAR ELEV.:
PROJECT NO.: 1895
COORDINATES N: E:
LOCATION: San Rafael, CA
DRILL RIG: Longyear 44 Truck Mount
AZIMUTH: S34°E (146°)
INCLINATION: 45°

Discontinuity codes: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, CL – Clay Infil, CH – Chlorite, CA – Calcite, Gr – Grease

Point load: ● Axial, ◆ Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
40	Fill												
41													
42													
43													
44													
45													
46													
47													
48													
49													
50													
51	Fill / Rock NC												
52													
53													
54													
55													
56													
57													
58													
59													
60													

DEPTH SCALE: 1 inch = 2.5 feet
DRILLING CONTRACTOR: LONGYEAR
DRILLER: Bill Harrison
LOGGED: John Wesling
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

Sheet 4 of 5

PROJECT: SKEC
PROJECT NO.: 1895
LOCATION: SAN RAFAEL, CA
DRILLING DATE: 9/4/91
DRILL RIG: Longyear 44; Track Mount
DATUM: MSL
COORDINATES N: E:
COLLAR ELEV.:
AZIMUTH: 534 E (A60) INCLINATION: 45°

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
Fe – Fe Oxide, Cl – Clay Infil, CH – Chlorite, CA – Calcite, Go – Gouge

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (Axial / Diametral)	NOTES, WATER LEVELS, INSTRUMENTATION
60	Slightly weathered; Light olive gray (5Y 5/2) to Olive grey (5Y 3/2) moist medium to coarse grained sandstone (greywacke)			R1	4²/4²	1⁴/4²	3	J, PL, R J, C, SM	15 10				
61							5	F, C, K J, PL, SM	60 80				
62							>10	F, PL, K	20 5	W2	R3		
63							9	J, PL, SM	55 35 30				
64							Crushed		20				
65				R2	4⁵/9⁵	1⁷/4⁵	3	S, PL, K	50 75				
66							8	F, PL, K J, PL, SM	10 20				
67							6	J, C, SM	55 30				
68							7	J, PL, R	45 25				
69							4		55 40 5 90				
70	Light olive Brown (5Y 5/6 m) staining Fe-oxide? (Reduced form of Fe?)			R3	4³/4²	1²/4²	5	J, PL, R, Fe? F, PL, K J, C, R	45 40 55	50	R4		BOX 1
71							5	J, U, R, Fe? F, C, K	60 20 10	70			BOX 2
72							6	J, C, SM, Fe? J, PL, R	50 40	10 25			
73							9	J, PL, SM J, PL, SM F, U, K	35 40 35 20	40			
74							1	J, U, R	40	70			
75	Very slightly weathered Shear fabric in Sandstone; more fines (shaley material?) in this zone			R4	5'/5'	5'/5'	3	S, PL, K J, U, R J, U, R	45		R3		
76							0	J, U, R		W2-W1			
77	Rock becoming fresher in appearance but W2						2		20				
78	Very slightly weathered dark green (5G 4/2) to Grayish Green (5G 5/2); Rock grading to a conglomerate/ Sandstone (greywacke)						5	F, PL, SM	70 40	70 W2-W1			
79				R5	5'/5'	2⁰/5'	0 2	J, C, R J, B, R	50 70				BOX 3
80							5	J, PL, R S, PL, K J, PL, SM	60 25	30			

DEPTH SCALE: 1 inch = 2.5 feet
DRILLING CONTRACTOR: Longyear
DRILLER:
LOGGED: John Wesling
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

Sheet 5 of 36

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: SAN RAFAEL, CA

DRILLING DATE: 9/4/91
DRILL RIG: LONGYEAR 44, TRACK MOUNT

DATUM:
COORDINATES { N:
E:
AZIMUTH: S 31° E (116°) INCLINATION: 45°
COLLAR ELEV.:

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough
Fe – Iron Oxide, CL – Clay, CA – Calcite, SQ – Sugary Silica

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES: WATER LEVELS, INSTRUMENTATION
80	Conglomerate/ Sandstone (greywacke)			R5	5'/5'	2°/5'	8	J, PL, SM, FE J, PL, SM, Fe		W2-W1	R3		
81							5	J, PL, SM, Fe					
82							3	J, ST, R J, ST, R					
83							2	J, C, R J, ST, R					
84							2	J, PL, SM J, C, R					
85	Slightly weathered; Grayish Green (10GY4/2d) shaley Breccia (melange') Pronounced shear fabric below 86' that is oriented at 90° TO core.			R6	5'/5'	1'/5'	6	J, C, R S, U, K					
86							10	J, ST, R J, PL, SM					
87							7	F, PL, K P, PL, K					
88							>10	S, PL, K S, PL, K F, U, K					BOX 3
89							7	F, PL, K					BOX 4
90	Very Slightly weathered; Pale green (5G7/2 d) to Grayish green (5G5/2d); Brecciated Sandstone (greywacke); Sandstone has been brecciated and recemented by calcite.			R7	5'/5'	3°/5'	3	J, U, R J, C, R, Fe		W2-W1			
91							4	J, PL, R, Fe F, PL, K					
92							3	J, C, R J, U, R, Fe					
93							5	J, PL, R					
94	Still very slightly weathered to mostly unweathered. Oxidation Front apparent 1/2 inch either side of some fractures.						8	J, C, R					
95							2	J, C, R J, C, R					
96				R8	5'/5'	1°/5'	4	J, C, R J, K, SM, Fe					
97							>10	J, C, SM, Fe J, PL, SM, Fe		W1			BOX 4
98							4	J, PL, SM; J, ST, SM J, C, SM					BOX 5
99							6	J, C, SM, Fe J, C, SM; Fe					
100							4	J, C, SM J, C, SM					
	Mostly unweathered except near fractures						3	J, ST, R, Fe					
				R9	5°/5°		2	J, C, SM, Fe		W2			
							4	J, PL, SM, Fe J, PL, SM, Fe		W1-W2			

DEPTH SCALE: 1 inch = 2.5 feet
DRILLING CONTRACTOR: LONGYEAR
DRILLER: BILL HUNTER ESTATE

LOGGED: John Wesling
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

PROJECT: SFPQ
PROJECT NO.: 1895
LOCATION: San Rafael, CA
DRILLING DATE: 9/4/91
DRILL RIG: Longyear 44, Truck Mount
DATUM:
COORDINATES N: E:
AZIMUTH: S34E (146°)
COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; CL Clay, CA Calcite, FE Iron, Qz Silica, GO Gouge. Point load: ● Axial, ∗ Diametral

Depth (ft)	Description	Run No.	Core Recovery	RQD	Fractures per foot	Type and Surface Description	Angle	Weathering	Strength	Notes
100–101		R9	5.0/5.0	4.0/5.0	3	J,C,R; J,C,R	30, 15, 60	W1–W2	R3	
101–102					2	J,C,R; J,C,R	50			
102–103					3	J,C,R.	40, 30	60		
103–104					0; 0					
104–105		R10	5.2/5.2	4.4/5.2	0					
105–106					10	J,C,R,Fe; J,C,R,Fe	40, 60, 70	35 W2		
106–107	Siliceous Qtz Sandstone with calcite on joint and fractures (usually 1-2 mm thick). Fresh except near some joints. Generally greenish gray (5G 6/1)				0			W1		Box 5 / Box 6
107–108					0					
108–109					0					
109–110		R11	9.8/9.8	7.8/9.8	1	J,P,S	20			8:00 ORIENTED TO 141.8
110–111					5	J,P,S,Fe; J,P,R,Cl; J,P,S,Cl; J,P,S,Fe	40, 40, 10, 40			
111–112					1					
112–113					2	J,P,K,Fe; J,P,K,Fe; J,P,S,Cl	60, 55			
113–114					8	J,P,K,Cl; J,I,R,Fe; J,I,C,Fe; J,I,R,Fe	50, 50, 40, 25, 40			
114–115	Shear fabric to 116.5 ft.				1	J,P,S,Fe	45			Box 6 / Box 7
115–116					3	J,U,K,Fe; J,P,R,Fe; J,P,R,Fe	45, 55, 35			
116–117					1	J,P,S,Fe	65			
117–118					4	J,P,S,Fe; J,P,S,Qz	55, 45			
118–119					0	S,U,S,Ca	20			
119–120		R12	10.2/10.3	10.0/10.2	1; C	118.6; J,P,S	10		R4	9:00 / 9:15

DEPTH SCALE: 1 inch = 2.5 feet
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hungerford
LOGGED: John Wesling
CHECKED:
DATE:

Golder Associates

FIGURE 1

893-1114 14507.DWG

RECORD OF DRILLHOLE U-2

Sheet 7 of 36

PROJECT: SRPO
PROJECT NO.: 1845
LOCATION: Sonkofaci, CA
DRILLING DATE: 9/5/91
DRILL RIG: Longyear 44 Truck Mount
DATUM: MSL
COORDINATES: N:
E:
AZIMUTH: S 34 E (146°) INCLINATION: 45°
COLLAR ELEV.:

ROCK TYPE

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, SM—Smooth, VR—V. Rough
Fe – Fe Oxide
Cl – Clay In fil
Si – Silica
Ca – Calcite

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	ROD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
120	siliceous Qtz. Sandstone						0			W1	R4		
121				12			0						
122	black shale/mudstone inclusions (up to 3-5 mm) to 128 ft.						0						
123													
124							0						
125							2	J,P,K	50				Box 7
126							1	J,P,K	65				Box 8
127							0	J,P,S,Ca	60				
128							0						
129							0						
								128.8					10:15 am
130	possible shear fabric to 131.5 ft.			13	10.2/10.2	96/10.2	0						10:30 am
131							0						
132							0						
133							1	J,I,R	45				Box 8
134							0						Box 9
135							0						
136							1	J,P,S,Ca	50				
137							1	J,P,S,Ca	50				
138							0						
139							3	J,P,S J,P,S J,P,S	10 45 35				
140				14	2.5/2.0	1.1/2.0	2	J,P,C J,P,S	50 45				

DEPTH SCALE: 1 in. = 2.5 ft.
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hire
LOGGED: Jill Jefferson
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

PROJECT: SKRQ
PROJECT NO.: 1895
LOCATION: San Rafael, CA

DRILLING DATE: 9/5/91
DRILL RIG: Longyear 44 Truck Mount

DATUM: MSL
COORDINATES: N: E:
AZIMUTH: S34E (146°)

COLLAR ELEV.:
INCLINATION: 45°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, Cl – Clay Infil, Ch – Chlorite, Ca – Calcite, Si – Silica, Gc – Gouge

Point Load Index: ● Axial, ● Diametral

Depth (ft)	Rock Type Description	Graphic Log	Elev/Depth (ft)	Run No.	Core Recovery	RQD	Fractures per Foot	Discontinuity Type and Surface Description	Dip	Point Load / Strength	Notes / Water Levels / Instrumentation
140–141	Siliceous Qtz. Sandstone			14			crushed			R4	
141–142							crushed				
142		NC					No core				
			141.8								12:35 141.8 Box NOT ORIENTED TO 149.2
142–143				15	3.2 / 3.2	3.0 / 3.2	1	J, P, S, Ca	35		
143–144							1	J, P, K, Ca	25		
144–145							1	J, U, K, Ca	45		
			145.0								2:15
145–146				16	4.2 / 4.2	4.2 / 4.2	2	J, P, S, Ca	30, 30		2:30
146–147							0				
147–148							2	J, P, S, Ca; J, P, K, Ca	30, 30		
148–149							0				
			149.2						20		2:55 ORIENTED TO 154.2
149–150				17	5.0 / 5.0	4.3 / 5.0	1	J, P, K, Ca; J, P, K	55		
150–151							2	J, P, K; J, P, K	35, 30		Box 10 / Box 11
151–152							1	J, P, K	60		
152–153							2	J, P, S, Ca; J, P, S; J, P, S	35, 40, 40		
153–154	Shear fabric to 157 ft.						4				
			154.2								154.2 Not ORIENTED TO 159.3
154–155				18	5.1 / 5.1	5.1 / 5.1	2	J, P, K, Fe; J, P, K	50, 50		
155–156							1	J, P, C, K, Ca	60		
156–157							1	J, P, U, K, Ca	15		
157–158							1				
158–159							0				
159–160				19			0				159.3 Box ORIENTED TO 176.5 ft.

DEPTH SCALE: 1 in. = 2.5 ft
DRILLING CONTRACTOR: Longyear
DRILLER: [illegible]

LOGGED: Jill Jefferson
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: San Rafael, CA

DRILLING DATE: 9/5/91 - 9/6/91
DRILL RIG: Longyear 44 Truck Mount

DATUM: MSL
COORDINATES N:
E:
AZIMUTH: S34E (148)
INCLINATION: 45°
COLLAR ELEV.:

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe — Fe Oxide, Cl — Clay Infil, Ch — Chlorite, Qz — Silica, Ca — Calcite

Point Load Index: ● Axial, ● Diametral

DEPTH SCALE (FEET)	DESCRIPTION	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY (%)	RQD (%)	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ANGLE	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
	Fresh, greenish gray (5G 6/1)					0			W1	R4	
161			19	5.0/5.0	4.8/5.0		J,P,K,Ca	75			
							J,U,K,Ca	60			
162						2					
						0					
163							J,P,R	35			
						3	J,C,K	45			
164						0	164.3				end of day 9/5/91
165			20	5.0/5.0	4.7/5.0	0	J,P,S	40			
						1					
166							J,P,S,Ca	40			
						2	J,P,S,Ca,Qz	65			
167						1					
168							J,P,S	45			
						2	J,P,S,Ca	55			
							J,P,S	40			
169	grades to grayish green (10G 4/2)					0	169.3				Box 12
						1	J,U,K,Ca	65			07:00 am; 07:45 am Box 13
170											
171			21	5.0/5.0	4.8/5.0	0	J,P,K,Ca	60			
						2	J,P,R	35			
172											
						1					
173	grades to greenish gray (5G 6/1)						J,P,K,Ca	70			
174						0	174.3				07:50; 08:05
175						0					
176			22	5.0/5.0	3.8/5.0	1	J,I,K,Fe	55°			
								85			
177						7	J,J,K,Fe,Cl	90, 70, 40, 20, 50			176 Not ORIENTED to 179.3
178						0					Box 14
179						0					
180						0	179.3				8:35 179.3 ORIENTED TO...
						0					

DEPTH SCALE: 1 in. = 2.5 ft.
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hu... / Fred

LOGGED: Jill Jefferson
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE V-2

Sheet / of

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: San Rafael, CA

DRILLING DATE: 9/6/91
DRILL RIG: Longyear 44 Truck Mount

DATUM:
COORDINATES: N: E:
AZIMUTH: S34E (146°)

COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe – Iron Oxide, CA – Calcite, CL – Clay, Gr – [illegible], Go – [illegible]

Point Load Index: ● Axial ○ Diametral

DEPTH SCALE (FEET)	DESCRIPTION (ROCK TYPE)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG (angles)	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
	Siliceous Qtz. sandstone							W1	R4	
181		23	5.1/5.1	4.8/5.1	0					
182					0					
183					2	J,P,S	55			
184					1	J,P,S	70			
184.4					0					09:20
185		24	4.3/4.3	1.5/4.3	1	J,I,S	35			09:30
186					2	J,P,S; J,I,S,Fe	40; 60			
187					crushed					186.1 Not oriented to 196.6 Box 14
188					crushed					Box 15
188.7					0					
189		25	2.4/2.9	0.8/2.2	2		50, 60			
190					7	J,P,S,Ca	40, 40, 40, 40			
191					4	J,P,S,Ca	60, 60, 30			
191.6					2	J,P,S,Ca	60, 50			
192		26	5.0/5.0	4.1/5.0	0					
193					0					
194					0					
195					0					
196					4	J,P,S,Ca	70, 60, 90, 40			
196.6					0					196.6 Oriented to Box 1? 236.5 ft.
197		27	4.9/4.9	4.6/4.9	0					
198					0					
199	Dark greenish [illegible] (5G 4/1) From 199.? to 199.?				2	J,P,S; J,P,S,Ca	65; 70			
200					0					

DEPTH SCALE: 1-in = 2.5 ft.
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hunnerlund

LOGGED: Jill Jefferson
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE

Sheet 1 of 2

PROJECT: SRLQ
PROJECT NO.: 1895
LOCATION: San Rafael, CA

DRILLING DATE: 9/6/91
DRILL RIG: Longyear 44 Truck Mount

DATUM:
COORDINATES: N:
E:
COLLAR ELEV.:
AZIMUTH: 534E (146°) INCLINATION: 45°

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, VR–V. Rough
Ca – Calcite, Cl – Clay, Si – Silica, Gg – Gouge

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (Axial / Diametral)	NOTES, WATER LEVELS, INSTRUMENTATION
201	Siliceous Siltst. Sandstone						2	J,P,S,Cl	45 AS	W1	R4		
							1	J,P,S,Cl,Ca	60				
								201.5					1:00
202							0						1:30
203							0						
204			28	5.3/5.2	5.3/5.2		1	J,P,S	65				
205							0						Box 16
206							0						Box 17
207							0						
							0						
								206.7					
208			29	4.8/4.8	4.8/4.8		1	J,P,S	80				
209							0						
210							1	J,P,S	55				
211							0						
							0						
212							0						
								211.5					
213			30	5.0/5.0	3.4/5.0		0						
214							0						Box 17
215							1						Box 18
									50				
216							2		50				
							1						
217							0	216.5					
218	Coloring seen here below						0						
219			31	5.0/5.0	4.2/5.0		1		66				
220							1		50				

DEPTH SCALE: 1" = 2.5'
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hunsicker

LOGGED: Jill Jefferson
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

Sheet 1 of 1

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: [illegible]

DRILLING DATE: 9/9/91
DRILL RIG: Longyear 44 Truck Mount

DATUM:
COORDINATES N: E:
AZIMUTH: S34E (Rel)
COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe–Iron Stain, Ca–Calcite, Cl–Clay, Si–Silica, Gr–Gouge. Point load: ● Axial, ● Diametral.

ROCK TYPE DESCRIPTION: (Siliceous Qtz. Sandstone)

DEPTH (FEET)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	TYPE AND SURFACE DESCRIPTION	ANGLE	NOTES / WATER LEVELS / INSTRUMENTATION
220–221				1	J, P, S, Cl, Ca	60	
221				1	J, P, S, Cl	60	
221.5 (run break)				0			
222				0			Box 18 / Box 19
223	32	5.2/5.2	5.0/5.2	0			
224				0			
225				2	J, P, S, Ca; J, P, S, Ca	45; 45	
226				0			
226.7 (run break)				0			
227				0			
228				0			
229	31	5.1/5.1	5.1/5.1	1	J, P, S	65	
230				0			
231				1	J, P, S	60	Box 19 / Box 20
231.8 (run break)				0			
232				0	J, P, S, Ca	50	
233	32	5.2/5.2	4.2/5.2	1			
234				0			
235				0			
236				0			236.0 - 237.0 Not oriented; Oriented to 251.1
237.0 (run break)				1	J, P, S, Ca, Cl	25	
238	33	5.1/5.1	5.1/5.1	0			
239				1	J, P, S, Cl	35	

DEPTH SCALE: 1 in = 1.0 ft
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hungerford

LOGGED: J. Jefferson
CHECKED:
DATE:

Golder Associates

FIGURE 1

99311114\14507.DWG

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895F
LOCATION: [illegible]
DRILLING DATE: 9/9/91
DRILL RIG: Longyear 44 Truck Mount
DATUM:
COORDINATES N: E:
AZIMUTH: S34E(146°)
COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough. Point load: • Axial, • Diametral.

Columns: DEPTH SCALE (FEET) | ROCK TYPE DESCRIPTION | GRAPHIC LOG | ELEV DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION, GRAPHIC LOG | WEATHERING INDEX (W6 W5 W4 W3 W2 W1) | STRENGTH INDEX (R6 R5 R4 R3 R2 R1) | POINT LOAD INDEX (psi) (R6 1500, R5 600, R4 300, R3 150, R2 30, R1) | NOTES WATER LEVELS INSTRUMENTATION

Depth	Description	Elev/Depth	Run No.	Core Recovery	RQD	Fractures per foot	Type and surface description	Discontinuity angle	Weathering	Strength	Notes
240–241	(siliceous Qtz. Sandstone)					0			W1	R4	[illegible]
241–242						1	J, P, S, Cl	40			
242	calcite veins decrs. below	242.2				0					
243–244						0					
244–245			34	$5^2/5^2$	$5^2/5^2$	1	J, P, S	50			
245–246						0					
246–247						0					
247		247.3				0					
248–249						0					
249–250			35	$5^0/5^0$	$4^5/5^0$	0					Box 21 / Box 22
250–251						1	J, P, S, Ca	50			
251–252		251.7				0					
252	slightly weathered to moderately weathered	252.3				crushed		30			
252–253						3		40, 70	W2 to W3	R3	
253–254	254.0 to 254.8		36	$3^1/4^1$	$0^0/4^1$	5	J, P, S	70, 40, 50, 75, 50			Not ORIENTED (core is marked but not cut)
254–255						1		70	W4 to W5	R0	
255		255.1				1		50	W2	R3	
255–256	NO CORE										
256	sl. decr. gr. size below; Grayish bluegreen (5BG 5/2)	256.4				0	J, P, S, Ca, Cl	65	W2	R3	ORIENTED TO 266°
257–258			37	$4^8/4^8$	$4^8/4^8$	1					
258–259						0					
259–260						2	J, P, R, Ca; J, P, S, Ca	50; 55			[illegible]

DEPTH SCALE: 1 in. = 7.5 ft.
DRILLING CONTRACTOR: Longyear
DRILLER: B. Hungerford
LOGGED: J. Jefferson-Grimm
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

PROJECT: SRPO
PROJECT NO.: 1895A
LOCATION: San Rafael, CA
DRILLING DATE: 9/9/91
DRILL RIG: Longyear 44 Truck Mount
DATUM: MSL
COORDINATES N: E:
AZIMUTH: S34E (46°)
COLLAR ELEV.:
INCLINATION: 45°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, Cl – Clay Infil, CA – Calcite, Qz – Silica, Go – Gouge. Point load: ● Axial, ◆ Diametral.

Depth (ft)	Rock type / Description	Run No.	Core Recovery	RQD	Fractures per foot	Discontinuity type and surface description	Angle	Weathering	Strength	Notes
260–261	(Siliceous qtz. sandstone)				1			W2	R3	
261	Calcite in veins is earthy to 271 ft.				0	261.2				
261–262					1	J,C,R,Ca	55, 60			
262–263		38	5.0/5.0	3.4/5.0	5	J,P,K,Ca; J,P,R,Ca; J,P,S,Ca,Cl	25, 40, 60, 45			
263–264					1	J,P,S,Ca,Cl	60			
264–265					0					
265–266					1	J,P,R,Ca	40			
266.2						266.2	40			266.0 Not oriented to 268.1
266–267					1					
267–268	267.6 to 267.85 moderately weathered	39	5.1/5.1	4.3/5.1	0			W3 / W2	R0 / R3	
268–269					1	J,P,R,Ca	50			268.1 ORIENTED to 291.8
269–270					1	J,P,R,Ca	55			Box 23 / Box 24
270–271					1	J,P,R,Ca	55			
271.3					0	271.3				
271–272					0					
272–273		40	5.2/5.2	3.6/5.2	1	J,P,S,Ca	55			
273–274					1 (crushed)					
274–275					0 crushed					
275–276					1		35			
276.5					0	276.5				
276–277					1	J,P,R	70			
277–278		41	5.0/5.0	2.6/5.0	0					
278–279					1	J,U,S,Ca	40			
279–280					3	J,P,S,Ca; J,P,S,Ca; J,P,S	60, 60, 50			

DEPTH SCALE: 1-in = 2.5 ft.
DRILLING CONTRACTOR: Longyear
DRILLER: B. Hun[illegible]
LOGGED: J. Jefferson - Geologist
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

PROJECT: SRRQ
PROJECT NO.: 1899A
LOCATION: San Rafael, CA
DRILLING DATE: 9/9/91
DRILL RIG: Longyear 44 Truck Mount
DATUM: MSL
COORDINATES: N: E:
AZIMUTH: S34E (146°)
COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe – Fe Oxide, Cl – Clay Infil, CA – Calcite, Qz – Silica, Go – Gouge

Rock type: (Siliceous Dk. Sandstone)

Depth (ft)	Run No.	Core Recovery	RQD	Fractures per foot	Discontinuity type and surface description	Angle	Weathering	Strength	Notes
280–281.5				crushed; 1	J,P,S,Ca	45	W2	R3	
281.5					281.5				
281.5–286.7	42	5.2/5.2	5.2/5.2	0, 2, 0, 0, 0, 0	J,P,R; J,P,S,Ca	45, 40			
286.7					286.7				Box 25 / Box 26
286.7–291.8	43	5.1/5.1	3.5/5.1	0, 1, 3, 2, 0, 3	J,P,S,Ca; J,I,R,Ca; J,P,S,Ca,Cl; J,P,R,Cl; J,P,S,Ca; J,P,S,Ca; J,P,R,Cl; J,I,S,Ca,Cl	35, 20, 60, 30, 55, 60, 55, 40			
291.8					291.8				291.8 Not Oriented To 302.0
291.8–297.0	44	5.2/5.2	5.2/5.2	0, 1, 2, 0, 0, 0	J,I,S,Ca,Cl; J,P,S,Ca; J,P,S,Ca; J,P,S,Ca	35, 60, 70, 61			
297.0					297.0				Box 26 / Box 27
297.0–300	45	5.0/5.0	1.8/5.3	0, 0, 0					

DEPTH SCALE: 1 in = 2.5 ft
DRILLING CONTRACTOR: Longyear
DRILLER: B. Hunsaker
LOGGED: J. Jefferson - Geomatrix
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

PROJECT: San Rafael [illegible] Quarry
PROJECT NO.: 1595 A
LOCATION: San Rafael, CA
DRILLING DATE: 9/9/91 – 9/10/91
DRILL RIG: Longyear 44 Truck Mount
DATUM: MSL
COORDINATES: N: E:
AZIMUTH: S34E(146°)
COLLAR ELEV.:
INCLINATION: 45°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Fe – Fe Oxide, Cl – Clay Infil, CA – Calcite, Qz – Silica, Go – Gouge. Point load: ● Axial, ● Diametral.

Depth (ft)	Rock type / Description	Run No.	Core Recovery	RQD	Fractures per foot	Type and surface description	Angle	Weathering index	Strength index	Notes / Water levels / Instrumentation
300–301	(siliceous qtz. sandstone)				2	J,P,S,Ca; J,P,S,Ca	60; 70	W1/W2	R3	
301–302					2	J,P,S,Ca; J,P,S,Ca	60; 60			
302.0						302.0				302.0 ORIENTED TO 327.7
302–307		A6	5.2/5.2	5.2/5.2	0, 0, 0, 0, 0					Box 27 / Box 28
307.2						307.2				
307–312		A7	5.1/5.1	5.1/5.1	0, 0, 0, 0, 0					
312.3					0	312.3				
312–317		A8	5.1/5.1	5.1/5.1	0, 1, 1, 0, 2	J,P,S,Ca; J,P,R; J,I,R; J,I,R	40; 35; 60; 35			Box 28 / Box 29
317.4					0	317.4		W1	R4	
317–320		A9	5.1/5.1	5.1/5.1	0, 1, 0	J,P,S	55			

DEPTH SCALE: 1 in = 2.5 ft
DRILLING CONTRACTOR: Longyear
DRILLER: Bill [illegible]
LOGGED:
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE U-2

PROJECT: [illegible] DRILLING DATE: 9/16/91
PROJECT NO.: [illegible]
LOCATION: [illegible]
DRILL RIG: [illegible]
DATUM: MSL
COORDINATES: N: E:
AZIMUTH: S 34 E (116°)
INCLINATION: 45°
COLLAR ELEV.:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe – Fe Oxide, CL – Clay Infill, CA – Calcite, Qz – Silica, Go – Gouge

Depth (ft)	Description	Elev/Depth	Run No.	Core Recovery	RQD	Fractures per foot	Discontinuity type and surface description	Angle	Weathering	Strength	Notes
320–321	(siliceous cl. Sandstone)					0			W1	R4	
321–322						1	J, I, S	60			
322–323		322.5				0 / 0					
323–324						1	J, P, S, Ca	35			
324–325			50	5.2/5.2	5.2/5.2	1	J, P, R	45			Box 29 / Box 30
325–326						0					
326–327						0					
327–328		327.7				0 / 0					327.7 Not ORIENTED to 338.2
328–329						0					
329–330			51	5.1/5.1	4.4/5.1	0					
330–331	330.3 - 330.5 moderately weathered, extremely weak rock					crushed	330.45 – 330.80		W3 / W2	R0 / R4	
331–332						crushed	331.40 – 331.9				
332–333						1 / 1	J, P, S, Fe; J, P, S, Fe &	60 / 50	W2	R3	
333–334		332.8	52	2.0/2.3	0.0/2.3	crushed / crushed					
334–335						mostly crushed	J, P, R, Fe	50, 50, 50, 50, 50			Box 30 / Box 31
335–338		335.1	53	?/3.1	?/3.1	? / ? / 2	Various natural joints w/ Fe oxide but I can't know which way they go				SAMPLE BLEW OUT OF SAMPLE I CAN'T PIECE IT BACK TOGETHER OR TELL WHICH WAY IS UP/DOWN
338–340		338.2	54	4.6/4.6	3.5/4.6	2 / ?	J, I, R, Fe; J, F, S, Fe; J, F, S, Fe; J, I, S, Fe	45, 45, 45, 45			338.2 ORIENTED TO 342.8

DEPTH SCALE: 1:25 ft
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]
LOGGED: [illegible]
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE N-2

PROJECT: SERP
PROJECT NO.: [illegible]
LOCATION: San Rafael Ca
DRILLING DATE: 9/16/91
DRILL RIG: [illegible]
DATUM:
COORDINATES N: E:
AZIMUTH: [illegible] INCLINATION: [illegible]
COLLAR ELEV.:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe – Iron Oxide, CA – Calcite, CL – Clay, Qz – Silica, GO – Gouge

DEPTH SCALE (FEET)	DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
341	(Siliceous Qtz. Sandstone)				1	J,P,S,Fe (40)	W2	R3	
342					4	mostly crushed (60, 40, 40)			
343					0	342.8			
344		55	0.8/0.8	0.8/0.8	partially crushed 0	343.6	W1	R4	343.6 ORIENTED TO 353.8; box A / box B
345–347		56	5.1/5.1	5.1/5.1	0, 0, 1	J,P,K (35)			
348					0, 0	348.7			
349–352	Shaley inclusions (black) up to 3mm below	57	5.1/5.1	4.4/5.1	0, 0, 0, 1	J,C,S (45)			
353					3	J,P,S,Ca (50); J,P,R (60)			Box 32 / Box 33
354	SHALE: dark gray (N3) to grayish black (N2). 75% shale, 25% silicified sandstone inclusions up to 5cm (generally <1cm)				0	J,I,R (45); 353.8 No match	W2	R3	353.8 Not ORIENTED To 370.7
355–356		58	2.3/3.1	0.4/2.3	1, crushed, crushed	J,I,S,Ca (75); Some Fe oxide staining; 356.1			
357	NO CORE					356.2			
358–359	Siliceous Quartz Sandstone	59	2.1/2.1	0.4/2.1	6 crushed, 3	J,I,R,Fe,Cl (40, 50, 60, 60, 60, 40, 50, 50); 359.0			
360	mod. to highly fractured, extremely [illegible]	60	2.0/2.3	NA/2.0	NA		W3/W4	R0/R1	

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]
LOGGED: J. Jefferson - GeneMatrix
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

Sheet 13 of 36

PROJECT: SREQ
PROJECT NO.: [illegible]
LOCATION: [illegible], CA

DRILLING DATE: 9/10/91 - 9/11/91
DRILL RIG: Longyear [illegible] Truck Mount

DATUM:
COORDINATES{ N: E:
AZIMUTH: [illegible]
COLLAR ELEV.:
INCLINATION: -50

Key: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; FE – Iron Oxide, CA – Calcite, CL – Clay, QZ – Quartz, GO – Gouge

● Axial * Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG (angle)	WEATHERING INDEX	STRENGTH INDEX	NOTES WATER LEVELS INSTRUMENTATION
	mod. Fe oxide staining, some zones are clay (55)					NA					
361	increase in lithic fragments and grain size to 374 ft.	361		NO CORE							
362		361.5	61	4.2 / 4.4	3.0 / 4.2	6			W1	R3	Box 33
						1	J, I, R, Fe	50			
363						3	J, I, R, Fe; J, I, R, Ca	80; 60			Box 34
364						1	J, I, R, Fe, Cl, Ca; J, P, R, Fe	60; 60			
365						0					
366	occ. highly weathered zones to 370 ft.	365.9		NO CORE					W2		
367			62	4.2 / 4.2	3.4 / 4.2	0					
368						3		70; 10; 10			
369						0					
370						1		60			
371	mod. to highly weathered 371-372 ft.	370.1	63	3.5 / 3.5	2.0 / 3.5	crushed			W3 / W4	R0	370.1 ORIENTED To 394.1
372						NA			W1	R3	
373						0					Box 34
374	decr. grain size below	373.6	64	5.2 / 5.2	5.2 / 5.2	0					Box 35
375						1	J, P, S	65			
376						1	J, P, S	55			
377						0					
378						1	J, B, S	30			
379		378.8				0					
380						2	J, P, S, Ca; J, [illegible], Ca	55; 50			

DEPTH SCALE: 1 in. = 2.5 ft.
DRILLING CONTRACTOR: Longyear
DRILLER: [illegible]

LOGGED: J. Jefferson - Gonzalez
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

Sheet 20 of 2_

PROJECT: CRRG
PROJECT NO.: 1645A
LOCATION: San Rafael, CA

DRILLING DATE: 9/11/91
DRILL RIG: [illegible]

DATUM:
COORDINATES N: E:
AZIMUTH: [illegible]
COLLAR ELEV.:
INCLINATION: [illegible]

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe – Iron Stain, Ca – Calcite, CL – Clay, Si – Silica, Gr – Granular

Point Load Index: ● Axial, ✱ Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
	(siliceous qtz. sandstone)						1	J,P,K	40	W1	R3		
381				65	5.0/5.0	4.6/5.0	0						
382							1	J,P,K,Ca	35				Box 35
383	382.9 to 383.3 – moderately weathered, weak rock.						0			W3 / W1	R2 / R3		Box 36
384			383.8				1	J,P,K	30				
385				66	5.2/5.2	4.9/5.2	2	J,P,S,Ca,Fe; J,P,R	50; 50				
386							1	J,I,R,Ca	35				
387							1	J,I,S	30				
388							1	J,P,K	50				
389			389.0				1	J,P,S,Ca	25				
390							0						
391				67	5.1/5.1	5.1/5.1	1	J,P,S,Ca	45				Box 36
392							1						Box 37
393							0	J,P,S,Ca	45				
394			394.1				0				R4		394.1 NOT ORIENTED To 404.0
395							1	J,P,R	60				
396				68	5.0/5.0	5.0/5.0	0						
397							0						
398							1	J,P,S	60				
399			399.[illegible]				0						
400													

DEPTH SCALE: 1 in = 2.5 ft
DRILLING CONTRACTOR: Jergyren
DRILLER: [illegible]

LOGGED: J. Jefferson – Geomatrix
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

Sheet ? of 36

PROJECT: SREP
PROJECT NO.: [illegible]
LOCATION: [illegible]

DRILLING DATE: 9/11/91
DRILL RIG: [illegible]

DATUM:
COORDINATES N:
E:
AZIMUTH: [illegible]
INCLINATION: 45°

COLLAR ELEV.:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Fe – Iron Oxide, Ca – Calcite, Cl – Clay, Si – Silica, Go – Gouge. ● Axial, ● Diametral

Column headings: DEPTH SCALE (FEET) | ROCK TYPE: DESCRIPTION | GRAPHIC LOG | ELEV DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX (W FR, MW, HW, CW, RS) | STRENGTH INDEX (R6, R5, R4, R3, R2, R1) | POINT LOAD INDEX (psi) (R6 1500, R5 600, R4 300, R3 150, R2 30, R1) | NOTES, WATER LEVELS, INSTRUMENTATION

Description: (siliceous qtz. sandstone)

Weathering index: W1; Strength index: R4

Depth (ft)	Run no.	Core recovery	RQD	Fractures per foot	Discontinuity type and surface description	Angle	Notes
400–401	69	4.9/4.9	4.9/4.9	0			Box 37 / Box 38
401–402				0			
402–403				0			
403–404				0			
404–405	70	5.0/5.2	5.0/5.2	2	J,I,S,Fe (404.0); J,P,S	80; 50	LOSE CIRCULATION — 404.0; ORIENTED to 439.8
405–406				1	J,P,S,Ca	60	
406–407				1	J,I,S	50	
407–408				1	J,I,S	40	
408–409				1	J,P,S	50	
409–410	71 (from 409.2)	5.1/5.1	4.7/5.1	0			
410–411				2	J,P,S,Ca; J,P,S,Ca,Fe	35; 30	Box 38 / Box 39
411–412				0			
412–413				0			
413–414				2	J,I,R; J,P,S,Ca	55; 40	
414–415	72 (from 414.1)	5.1/5.1	4.4/5.1	0			
415–416				0			
416–417				1	J,P,K,Fe	40	
417–418				3	J,P,K,Ca; J,P,S; J,P,K,Ca,Fe	55; 45; 25	
418–419				1	J,P,K,Ca	50	
419–420	(from 419.2)			3	J,C,S	60; 90; 45	Box 39 / Box 40

417.1 - 417.6 - moderately weathered, weak rock (W3, R2)

DEPTH SCALE: 1-in = 2.5 ft.
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Flumgo Ford

LOGGED: J. Jefferson-Gelmakix
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

PROJECT: SRRQ
PROJECT NO.: 1895F
LOCATION: [illegible]

DRILLING DATE: 5/11/91
DRILL RIG: [illegible]

DATUM:
COORDINATES N: E:
AZIMUTH: [illegible]
COLLAR ELEV.:
INCLINATION: [illegible]

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Ca – Calcite, Cl – Clay, FE – Iron oxide, Qz – Quartz, Go – Gouge. Point load: Axial, Diametral.

Rock type description: Siliceous Qtz. Sandstone

Depth (ft)	Run No.	Core Recovery	RQD	Fractures per foot	Type and surface description	Angle	Weathering index	Strength index	Notes
420–421	73	5.0/5.0	4.8/5.0	partially crushed	J,I,S; J,I,S	60; 20	W1	R4	
421–422				2	J,P,K,Ca	25			
422–423				2	J,P,S,Cl,Ca	70			
423–424				1	S,P,K,Go	40			Gouge regions as R0, W4 with S4
424–424.2				1		20			
424.2					424.2				
424–425	74	4.8/4.8	4.8/4.8	0		45			
425–426				1	J,P,S,Ca				
426–427				1	J,I,S,Ca	30			
427–428				0					
428–429				1	J,P,S,Ca	90			Box 40 / Box 41
429.0					429.0				
429–430	75	5.0/5.0	5.0/5.0	0					
430–431				0					
431–432				0	J,P,S,Ca	50			
432–433				2	J,I,S,Ca	60			
433–434				0					
434.0					434.0				
434–435	76	5.0/5.0	3.7/5.0	1	J,P,S,Fe,Cl	50			
435–436				3	J,I,S,Fe,Cl; J,I,S,Fe,Cl; J,I,S,Fe,Cl	65, 65, 70, 70, 70			
436–437				4	J,P,S; J,P,S	45; 60			
437–438				0					[illegible]
438–439				4	J,I,S; [illegible], J,P,S	55; 70			[illegible]
439.0					439.0				
439–440				0					439.3 NOT [illegible]

439 – 439.3 – 440.2 crushed

DEPTH SCALE: 1 in = 2.5 ft
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hunnicutt

LOGGED: J.H. Jefferson–Cunningham
CHECKED:
DATE:

Golder Associates

[illegible] 4/1/[illegible]

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

PROJECT: SRPQ
PROJECT NO.: [illegible]
LOCATION: [illegible]

DRILLING DATE: 9/11/91
DRILL RIG: [illegible]

DATUM:
COORDINATES{ N: E:
AZIMUTH: [illegible]

COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; FO–Iron Oxide, CA–Calcite, CL–Clay, QZ–Quartz, GO–Gouge. Point load index: ● Axial, ∗ Diametral.

DEPTH (FEET)	DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG (angle)	WEATHERING INDEX	STRENGTH INDEX	NOTES
441	[illegible] – 441.4 ft. crushed [illegible] mod. to highly weathered and v. weak to weak	77	5.3/5.3	4.0/5.3	crushed, 0, crushed 0, 0, 0, 1	J, P, S, Ca	30	W3/4, W1	R1/2, R4	
444.3		78	4.7/4.7	4.7/4.7	crushed 0, 0, 0, 0, 0, 0					ORIENTED TO 479.4; Box 42 / Box 43
449.0		79	4.7/4.7	4.7/4.7	0, 0, 1, 0, 0, 0	J, P, R	15			
453.7		80	5.3/5.3	5.3/5.3	0, 0, 1, 1, 1	J, P, S, Ca; J, P, S, Ca; J, P, S, Ca, [illegible]	30; 45; 40			Box 43 / Box 44
458.9					1					

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: J. Jeli[illegible]
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE 11-2

PROJECT: [illegible]
PROJECT NO.: [illegible]
LOCATION: [illegible]

DRILLING DATE: 1/17/91
DRILL RIG: [illegible]

DATUM:
COORDINATES{ N: E:
AZIMUTH: [illegible] INCLINATION: 45°

COLLAR ELEV.:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; (Ca) – Calcite, (Cl) – Clay, (Go) – Gouge. Point Load: ● Axial, ∗ Diametral.

DEPTH SCALE (FEET)	ROCK TYPE / DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	TYPE AND SURFACE DESCRIPTION	ANGLES	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
460–461	Siliceous Qtz Sandstone	81	5'/5'	4'/5'	3	J,U,S,Ca; J,P,K,Ca,Go	50, 55, 80, 60	W1	R4	Gouge appears as RO, w/ with S4
462					0					
463					0					
464 (464.0)		82	5.3/5.3	5.3/5.3	1	J,P,K	30			
465					0					Box 44 / Box 45
466					0					
467					0					
468					0					
469 (469.2)		83	5.0/5.0	5.0/5.0	0					
470					1	J,I,S	35			
471					0					
472					1	J,P,S,Ca	30			
473					2	J,P,K; J,P,K	60, 40			
474 (474.2)		84	5.2/5.2	3.4/5.4	0					Box 45 / Box 46
475					2	J,P,S,Ca; J,I,S,Ca	40, 50			
476					1	J,I,S,Ca	55			
477					2	J,P,S,Ca; J,P,S,Ca; J,I,S,Ca	60, 50, 45, 40			
478					3	J,P,S,Ca; J,P,S,Ca	45			
479 (479.4)	greenish gray (5GY 6/1) below				0					479.4 NOT [illegible] To 484.0
480					0					

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE

Sheet 25 of 36

PROJECT:
PROJECT NO.:
LOCATION:
DRILLING DATE: 9/13/01
DRILL RIG:
DATUM:
COORDINATES } N:
AZIMUTH:
COLLAR ELEV.:
E:
INCLINATION:

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
Pl–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Stickensided, Sm–Smooth, R–Rough, VR–V. Rough
Fe – Iron Oxide, CA – Calcite, Cl – Clay, Si – Silica, Gu – Gouge

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ◆ Axial ◆ Diametral	NOTES WATER LEVELS INSTRUMENTATION
481							0	J,P,S,Ca,Fe		W1	R4		
482				85	5"/5"	4"/5"	3	J,P,S,Ca,Fe J,P,S,Ca,Fe J,P,S	40 50 40 50				
483							1						
484							0						Box 46
							0	484.4					Box 47
485							0	J,P,S J,P,S	40 55				484.0 ORIENTED TO 489.4
486							2						
487	gradual, starts about 487			86	6"/5"	5"/5"	0						
488	decrease silica cement content, incr. calcite cement content, incr. gr. size, incr. lithic fragments, Medium gray (N5/5) below						1	J,P,S	40		R3		
489							0						
							0	489.4					489.4 Not oriented
490	at 487.8 – 488.6 ft moderately weathered, weak rock						0						
491							0						
492	has the appearance of being slightly weathered but it may just be the way the rock looks			87	5.3'/5.3'	4.8'/5.3'	1	J,P,R J,I,K	50 50				
493							5	J,P,S J,P,S J,P,K	60 60 40 70				Box 47
494							0						Box 48
							0	494.1					494.1 ORIENTED TO 500.5
495							1	J,P,K J,I,R	50 40				
496							2	J,P,R J,P,S	40 45		R4		
497				88	5"/5"	3.6'/5"	0						
498							4	J,P,S J,P,K J,P,K J,P,R	60 60 60 55				
							0	499.2					

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED:
CHECKED:
DATE:

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FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

PROJECT:
PROJECT NO.:
LOCATION:

DRILLING DATE: 9/12/91
DRILL RIG:

DATUM:
COORDINATES{ N: E:
AZIMUTH:
COLLAR ELEV.:
INCLINATION:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ANGLE	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
500–501		89	5.1/5.1	4.2/5.1	2	J,P,R; J,P,K	50; 50			500.5 NOT ORIENTED TO 509.8
501–502					2	J,P,S; J,P,S	60; 50			
502–503					0					
503–504					1	J,P,S	85			
504–504.8					2	J,P,S; J,P,S	60; 60			Box 48 / Box 49
504.8					0					
505–506		90	5.0/5.0	5.0/5.0	0					
506–507	507.2 – 509.8				1	J,P,S	50			
507–508	v.f.gr. siliceous sandstone and little shale fragments, med. dark gray (N4) to dark gray (N3), brecciated and recemented with calcite (twice)				1		50			CONTACT @ 507.2
508–509					0					
509–509.8					0					
509.8–511	siliceous qtz. sandstone same as at 487 ft.	91	5.2/5.2	5.2/5.2	1	J,P,R; J,P,S,Ce	25; 50			509.8 ORIENTED TO 521.1
511–512					0					Box 49 / Box 50
512–513	512.1 – 512.5 slightly weathered, v. weak to weak rock				0			W3 / W1	R1/R2 / R3	
513–514					1	J,P,R	65			
514–515					0					
515.0–516		92	5.1/5.1	5.1/5.1	0					
516–517	516.2 decr. gr. size to f.gr. to v.f.gr. gradual decr. calcite cement with depth to 518.5				0					
517–518					0					
518–519	518.5 [illegible] calcite [illegible] below [illegible] medium dark gray (N3) below				0			W1	R4	
519–520					0					

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE 91-2

Sheet 1 of 2

PROJECT:
PROJECT NO.:
LOCATION:
DRILLING DATE: 9/3/91 - 9/5/91
DRILL RIG:
DATUM:
COORDINATES { N:
E:
AZIMUTH:
COLLAR ELEV.:
INCLINATION:

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
Pl–Planar, C–Curved, U–Undulating, St–Stepped, I–Irregular
P–Polished, K–Slickensided, R–Rough, VR–V. Rough, Co–Coated

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (● Axial, ○ Diametral)	NOTES, WATER LEVELS, INSTRUMENTATION
521			520.1				0			W1	R4		Box 51
522	522.7 - 523.1 SHALE dark gray (N3)			R3	5.0/5.0	3.9/5.0	2	J,PS J,P,S	55 70				Box 52
523							4	J,P,S J,I,S J,I,S	60 50 60				
524							4	J,I,S,Ca J,I,S J,P,S	50 60 60				
525			525.1				0	J,P,S	50				521.1 NOT ORIENTED TO 534.4
526							0						
527				R4	5.1/5.1	5.0/5.1	1	J,I,S	60				
528							1	J,P,S	4 50				
529							0						
530			530.2				0						
531							0						
532							0						
533				R5	5.3/5.3	5.3/5.3	1	J,P,S	50				
534	534.6 - 534.4 SHALE Greenish Gray (5G 6/1) below 534.2						0						534.4 ORIENTED TO 571°
535			535.2				0						
536							0						
537				R6	5.2/5.2	4.7/5.2	1	J,P,K	70				
538							2	J,P,S J,P,R	60 35				
539							0						Box 53
540							1		75				

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED:
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114) 14503.DWG

RECORD OF DRILLHOLE 1/1-2

Sheet 12 of

PROJECT:
PROJECT NO.: 1P13A
LOCATION:

DRILLING DATE: 2/13/91
DRILL RIG:

DATUM:
COORDINATES { N:
E:
AZIMUTH: INCLINATION:

COLLAR ELEV.:

J—Joint F—Fault S—Shear B—Bedding F—Foliation
PL—Planar C—Curved U—Undulating ST—Stepped I—Irregular
P—Polished K—Slickensided SM—Smooth R—Rough VR—V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (Axial / Diametral)	NOTES WATER LEVELS INSTRUMENTATION
541	Sl. incr. gr. size below						0	540.5	35	WI	R4		
							0	J,P,R					
542							1						
543				97	5'/5'	5'/5'	1	J,P,S	55				
544							1		85				
545							1	J,P,S,Ca	30				
546							0						
547							0						
							1	J,P,R,Ca	30				
548							2	J,P,S,Ca	45				BOX 53
				98	5.3/5.3	5.3/5.3		J,P,S	55				
549							0	J,P,S	35				BOX 54
							1	J,P,S,Ca	40				
550							0						
551								550.9			R4/R5		550.9 - 555.2 All one piece!
552							0						
553				99	5.0/5.0	5.0/5.0	0						
554							0						
555							0						
							0						
556								555.2					Box 55
557							0						555.2 - 561.0 All one piece
558				100	5.1/5.1	5.1/5.1	0						
559							0						
							0						

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED: J. [illegible]
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE

Sheet 29 of

PROJECT:
PROJECT NO.:
LOCATION:
DRILLING DATE:
DRILL RIG:
DATUM:
COORDINATES { N:
E:
COLLAR ELEV.:
AZIMUTH:
INCLINATION:

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ● Axial ● Diametral	NOTES WATER LEVELS INSTRUMENTATION
561							0	561.0		W1	R4/R5		
562							0						
563				101	5.0/5.0	5.0/5.0	0						
564							0						
565							0						
566	S1, decr. gr. size below, elongate particle are oriented at about 90° to core.						0						
							0	566.0					BOX 55
567							1	J,P,K,Ca	1				BOX 56
568							0	J,P,S,Ca	45				
569				102	5.0/5.0	5.0/5.0	1		30				
570							0						
571							0						
							0	571.0					571.0 NOT ORIENTED
572							0						573.9
573	573.7 - 574.9 shale laminations			103	5.0/5.0	5.0/5.0	1		20				
574							0						573.9 ORIENTED TO E/S 6
575							0						
576							0						BOX 56
							0	576.0					BOX 57
577							0						
							2	J,P,S	45				
578				104	4.0/4.0	4.0/4.0		J,P,R,Ca	55				
							1	J,P,R,Ca	40				
579							0						

DEPTH SCALE: 1 in = 2.5 ft
DRILLING CONTRACTOR:
DRILLER:
LOGGED: J. Jefferson
CHECKED:
DATE:

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99311141\14507.DWG

FIGURE 1

RECORD OF DRILLHOLE V-2

Sheet 30 of 36

PROJECT: [illegible]
PROJECT NO.: [illegible]
LOCATION: [illegible]

DRILLING DATE: [illegible] 6/?
DRILL RIG: [illegible]

DATUM:
COORDINATES N: E:
AZIMUTH: [illegible]

COLLAR ELEV.:
INCLINATION: [illegible]

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough. Point load: ● Axial, ◦ Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	NOTES WATER LEVELS INSTRUMENTATION
580					0	580⁹				
581		105	5¹/5¹	5¹/5¹	0					
582					0					
583					0					
584					0					
585					1	J,P,R,Ca	60			Box 57
586					0 / 0	585⁵				Box 58
587	586⁵–587² partially crushed, weak rock, moderately weathered with little v. stiff clay	106	5⁰/5⁰	4⁶/5⁰	partially crushed			WB / W1	R2 / R3	
588					1		40			
589					0					
590					0					
591					0 / 0	590⁵				
592		107	5¹/5¹	3¹/5¹	0	highly fractured & crushed but appears to be mostly from drilling. Breaks easily along fractures when handled.				
593					?					
594					?					
595					0					Box 58 / Box 59
596					0 / crushed	595⁶				595⁶ NOT ORIENTED TO 719⁰ (TD)
597	incr. v.f.-grained lithic shale fragments to about 40%, [illegible] (NE) to 602.9 [illegible]	108	5¹/5¹	5¹/5¹	1	J,U,S	50			
598					0					
599					4	J,P,S / J,P,S,Ca / J,P,S / J,?	30 / 40 / 70 / 40			
600					0					

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

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FIGURE 1

RECORD OF DRILLHOLE U-2

Sheet 3 / of 3

PROJECT: [illegible]
PROJECT NO.: [illegible]
LOCATION: [illegible]

DRILLING DATE: [illegible]
DRILL RIG: [illegible]

DATUM:
COORDINATES { N:
E:
AZIMUTH: [illegible] INCLINATION: [illegible]

COLLAR ELEV.:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Ca – Calcite, Cl – Clay, Si – Silica, Go – Gouge

Point load index: ● Axial, ● Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	ANGLE	WEATHERING INDEX	STRENGTH INDEX	NOTES
						0			W1	R3	(not oriented)
601		600.7				0	J,P,R	60			
						3	J,P,R; J,P,S	50; 40			
602	incr. gr. size to f. gr., decr. lithic shale frags to about 10%, elongate fragments no longer oriented 90° to core, medium gray (N5) below.										
603			109	4.8/4.8	4.3/4.8	1	J,P,S	40			Box 59
604						1	J,P,S	60			Box 60
605						1	J,P,S	40			
		605.5				crushed	J,P,R	50			
606						1	J,P,S	80			
607						1	J,P,R				
608			110	5.3/5.3	3.6/5.3	3	J,P,S,Ca (.05ft); J,P,S	40; 60; 50			
609						1	J,P,S,Ca	70			
610						1	J,P,S,Ca	30			
611		610.8				0					
612						1	J,P,S	60; 60; 80; 90			
613	613.9 – 614.7 moderately weathered weak rock, some stiff to v. stiff clay (S4/S5)		111	4.6/4.6	2.4/4.6	3					Box 60 / Box 61
614						2	J,I,S; J,P,R	40; 50	W3	R2	fractured, crumbles easily when handled
615						1	J,P,R	50	W1	R3	
		615.4				1	J,P,R	50			
616	615.9 SHALE, grayish black (N2), fissile, highly brecciated and recemented with calcite, clay interbeds in more weathered zones, generally slightly to mod. weathered, weak to med. strong					crushed		40			
617			112	2.8/2.8	0.0/2.8	crushed			W2/W3	R2/R3	
618						crushed					
619		618.6				crushed		40			
			113	1.6/1.6	0.0/1.6	1		70			
620						2	J,I,R				
						crushed					

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

Sheet [illegible] of 3[illegible]

PROJECT: [illegible]
PROJECT NO.: [illegible]
LOCATION: [illegible]

DRILLING DATE: 3/[illegible]/91
DRILL RIG: [illegible]

DATUM:
COORDINATES{ N:
E:
AZIMUTH: [illegible] INCLINATION: [illegible]

COLLAR ELEV.:

Legend (discontinuity data): J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

Point load index: ● Axial, ✱ Diametral

DEPTH SCALE (FEET)	ROCK TYPE – DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA – TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES / WATER LEVELS / INSTRUMENTATION
							crushed	620					(not crushed)
621				114	2.2/2.2	0.8/2.2	1	J,P,S	30				
622							0						
623							crushed	622.5 J,P,S; J,P,S	30; 40				
624				115	2.0/2.5	0.0/2.0	1; 1; crushed; 0	624.5					
625					NO CORE			625.3					Box 61 / Box 62
626					1.8/2.5	0.5/2.2	1	J,P,S	55				
627				116			crushed	627.1					
628	628.3 – 629.8, highly weathered very weak rock				NO CORE			627.8					
629				117	2.0/2.3	2.0/2.0	0; 0			WA	R2		breaks apart very easily [illegible]
630					NO CORE			629.8; 630.1		W2/W3	R2/R3		
631							3		80; 50; 50				
632				118	3.8/4.2	0.9/3.8	2		40; 50				
633							3	J,P,S	60; 60; 60				
634					NO CORE		3	633.9; 634.3	60; 60; 60; 60				
635							0						
636				119	2.[illegible]/2.[illegible]	1.[illegible]/2.[illegible]	0						
637					NO CORE		3	636.5; 636.8	50; 40; 40				Box 62
638							2		50; 60				Box 63
639				120			1						
640				121		0.0/1.1		639.[illegible]					

DEPTH SCALE: 1 in = 2.5 ft
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE 11-2

PROJECT: SFF
PROJECT NO.: 1595A
LOCATION: [illegible]

DRILLING DATE: 9/16/91 - 9/17/91
DRILL RIG: Longyear 44

DATUM:
COORDINATES N: E:
AZIMUTH: (346)(166)
COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; FC – [illegible], CA – Calcite, CL – Clay, GT – [illegible], GO – Gouge

Depth scale (feet)	Rock type description	Run no.	Core recovery	RQD	Fractures per foot	Type and surface description	Weathering index	Strength index	Notes
641					2	J,P,S (15); J,P,S (30)			not oriented
642		122	2.0 / 2.5	? / 2.0	0	641.2			
643					crushed				
644			NO CORE		0	643.2 ; 643.7			
645	645.8				partially crushed	J,P,S (50)			Box 63
646	Siliceous Qtz Sandstone medium dark gray (N3), contains Approx. 20% lithic shale fragments brecciated and recemented with calcite	123	4.1 / 4.1	3.0 / 4.1	2	J,P,S (70); J,P,S (50)	W1/W2	R3	Box 64
647					0				
648					0	647.8			
649		124	4.7 / 4.7	4.7 / 4.7	0				
650					0				
651					1	J,P,S (30)			
652	652.0 SHALE (same as above)				1	J,P,S (60); 652.5	W2/3	R2/3	
653		125	2.8 / 2.8	.2 / 2.8	0				
654					crushed				
655					0	655.3			
656	656.7	126	2.9 / 2.9	0.0 / 2.9	1	J,I,S (50) (50) (60)			Box 64 / Box 65
657	Siliceous Qtz. Sandstone up to 40% lithic shale fragments in some zones, occasional 2-3-in. thick shale interbeds, mostly medium dark gray (N4) brecciated and recemented with calcite, v.f.gr.,				2				
658					0	658.2			
659		127	3.9 / 3.9	1.9 / 3.9	1	J,I,R (60); J,P,S (50) (40)			
660					3	(8)			

DEPTH SCALE: 1 in = 2.5 ft
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

Golder Associates

9931114\14507.DWG

FIGURE 1

RECORD OF DRILLHOLE V-2

PROJECT: [illegible]
PROJECT NO.: 1895 A
LOCATION: [illegible]

DRILLING DATE: 9/17/91
DRILL RIG: [illegible]

DATUM:
COORDINATES N:
E:
AZIMUTH: [illegible]
COLLAR ELEV.:
INCLINATION: [illegible]

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Cl — Clay, Si — Silica, Gz — Gouge; ● Axial, ✱ Diametral

Depth (ft)	Rock Type Description	Elev/Depth (ft)	Run No.	Core Recovery	RQD	Fractures per Foot	Discontinuity Data	Weathering Index	Strength Index	Notes
661			127			1	80			(not recovered)
662						partially crushed				
662–663	SHALE: highly brecciated, mod. weathered to highly weathered	662¹				partially crushed		W3/W4	R2	
663–665			128	3⁵/3⁵	NA 3⁵	0, 0, 0				
665		665⁶				crushed				
666	Siliceous Qtz. Sandstone same as above					0		W3/W3	R3	Box 65
667				3⁴/4⁰	1⁸/3⁴	0, 0				Box 66
668	SHALE (same as above) highly brecciated, fragments bonded together with clay 70% rock 30% clay					NA		W3/W4	R2	
669	669⁶ – 670⁴ sandstone	669²				NA				
	NO CORE	669⁶								
670				1³/2⁴	0⁷/2⁴	0, NA				
671		670⁹	130							
672	NO CORE	672⁰								
673	673¹					NA				
674	Siliceous Qtz. Sandstone greenish gray (5GY 6/1), v. f. gr. 673¹ – 675 highly brecciated fragments bound together with clay					NA		WA	R2	
675				5³/5³	2⁰/5³	NA				
676			131			0		W1	R3	
677						0				
		677³				0, 1	J, I, S	6		
678	678⁷		132	4⁴/4⁴	1¹/4³	1	J, I, S 90			Box 66
	SHALE [illegible]							[illegible]	[illegible]	[illegible]

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE

Sheet [illegible] of [illegible]

PROJECT: [illegible]
PROJECT NO.: [illegible]
LOCATION: [illegible]

DRILLING DATE: 9/17/91 - 9/18/91
DRILL RIG: [illegible]

DATUM:
COORDINATES N:
E:
AZIMUTH: [illegible]

COLLAR ELEV.:
INCLINATION: [illegible]

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Ca — calcite, Cl — Clay, Si — Silica, Go — Gouge. Point load index: ● Axial, ▪ Diametral.

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
681–683	[illegible] 70% fragmented rock, 30% clay			132	4.5/4.5	NA/4.8	NA, NA, NA			[illegible]	R2		[illegible]
			683.1										
684–686	685.7 - 686.6 - highly weathered siliceous sandstone, greyish green (5G 5/2), calcite viens, sulfides			133	3.5/4.1	NA/3.5	NA, NA, NA, NA						
			686.6		NO CORE								
			687.2										
688–690				134	3.6/4.3	0.9/3.6	NA, NA, NA, 0						Box 67 / Box 68
			690.8		NO CORE								
			691.5										
692–694				135	3.5/3.5	NA/3.5	NA, NA, NA, NA						
695	inc. clay below to ≥ 50%		695.0										
696–699				136	4.3/4.5	NA/4.3	NA, NA, NA, NA						
			[illegible]										Box 6[illegible]

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible] Jefferson
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U-2

PROJECT: SRRQ
PROJECT NO.: 1895A
LOCATION: [illegible]

DRILLING DATE: 9/18/91
DRILL RIG: [illegible]

DATUM:
COORDINATES: N: E:
AZIMUTH: [illegible]
INCLINATION: 45°
COLLAR ELEV.:

Legend — J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Ca – calcite, Cl – clay, [illegible], Si – silica, Go – Gouge. Point load: ● Axial, ● Diametral.

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
701–705	700.4 [illegible] medium gray [illegible] fractures cemented with calcite, [illegible] shale fragments		137	5.0 / 5.0	3.1 / 5.0	NA, 3, 1, 6, 0, 0, 0	J,[illegible]; J,[illegible]; J,U,S	W1	R3	
705–709	705.3 SHALE: dark gray (N3) brecciated and recemented with calcite. 708: Highly brecciated below, fragments bound together with clay 70% fragments 30% clay	704.3	138	4.3 / 4.3	3.7 / 4.3	0, 0, 0, 0		W2 / W2/W3	R3 / R2	
709–714		708.6	139	5.3 / 5.3	NA / 5.3	NA, NA, NA, NA, NA, NA, NA				Box 69, Box 70
714–719	714.0 – 714.6 siliceous quartz sandstone, [illegible] green (5G 3/2)	713.9	140	5.1 / 5.1	NA / 5.3	NA, NA, NA, NA, NA, NA				
	BOH at 719.0	719.0								[illegible]

DEPTH SCALE: 1 in = 2 ft
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE U3A

PROJECT: S9A4 DRILLING DATE: 9-24-91 DATUM: COLLAR ELEV.:
PROJECT NO.: 1895A COORDINATES{ N: E:
LOCATION: San Rafael DRILL RIG: Longyear, 4" travel mount AZIMUTH: INCLINATION: 60°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; ● Axial, ● Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
0	FILL, LIGHT BROWN RETURN, COARSE SAND CUTTINGS												DRILLED BIT
10													
20	LOST RETURN												
30													
40	SOFT, BAY MUD/SEDIMENTS												
50													
60													
70	HARDER DRILLING WEATHERED ROCK												

DEPTH SCALE: 1" = 10 feet LOGGED: CLT 9-24-91
DRILLING CONTRACTOR: Longyear CHECKED:
DRILLER: K. Longyear

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RECORD OF DRILLHOLE U-3A

Sheet 2 of

PROJECT: SaaQ
PROJECT NO.: 1895A
LOCATION: San Rafael

DRILLING DATE: 9-24-91
DRILL RIG: Longyear

DATUM:
COORDINATES{ N: E:
AZIMUTH:

COLLAR ELEV.:
INCLINATION: 60°

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; Point load: ● Axial, * Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
80–90	HARDER WEATHERED SANDSTONE (?)												Roller Bit
90–92	SLIGHTLY WEATHERED (W2), PALE YELLOWISH BROWN (10YR 6/2) WEAK, SANDSTONE			1	2.0 / 2.8	0	4	JN, FE, P, R 70° 30° 70° 40°; (SOFT) JN, C, U/I, R 30° 40°; JN, FE, R, R 30°		W2/W3	R2/R3		Core 4:40
92	DECOMPOSED S.S. Zone	NR			NO CORE				N/C				
92.8–97			92.8	2	4.2 / 4.2	2.5 / 4.2	2	JN, FE, I, R 60; JN, FE, S, R/VR 20°; JN, FE, P, S/R 40° 50° 50°; (SOFT) JN, C, I, R CLAY 80° 80° 50° 60; JN, FE, I, R 50° 40°		W2/W3	R2/R3		5:15 / 5:20
95.5	SHALE												
97–100			97	3			2 / 2	J, F, SM, CA 30; J, F, R, F... 30; J, F, R ... 50; J, I, R ... 30; J, ... 30					End of day 9.24.91 ↑ check (?) ↓ (?) 9.25.91

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED: CDY
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

Sheet 3 of

PROJECT:
PROJECT NO.:
LOCATION:

DRILLING DATE:
DRILL RIG:

DATUM:
COORDINATES N:
E:
AZIMUTH:

COLLAR ELEV.:
INCLINATION:

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
0.0	Shale, thick bed	3				J, ... 90; J, U, R, Fc 70; J, ... 20			
		4	4.0/5.2	1.2/4.5	2, 3, 2, 4, 5	J, U, R, Fc 50; J, P, R, Fc 68; J, P, SM, Ca 20; J, P, SM, Fc 25, 30; J, U, R, Fc; J, P, SM, Fc 53; J, P, R, Fc 45; J, U, VR, Fc 40; J, C, R, Fc 40, 48; J, C, R, Fc 48; J, U, R, Fc 40; J, U, R, Ca 60	W2	R3	core oriented
0.5									
		5	5.0/5.0	0/5.2	3, 3, 3, >10	J, P, S, Fc 17; J, P, R, Fc 21; J, I, R, Fc 55; J, P, R, Fc 50; J, I, R, Fc 60; J, P, S, Fc 12; CN, U, S, Cl 33; J, P, R, Fc 37; J, U, R, Fc 25; J, P, V, Fc 25	W2	R3	↑ Box 2 ↓ Box 3
1.0	shale mixed with SS, 1/4" thick; very fractured								
	light grey, less weathered	6	5.2/5.2	1.5/5.2	0, 4, 4, 3, 4	35, 15, 45, 20, 45, 65, 43, 30, 70, 70, 40, 60, 75, 70	W1	R3	↑ Box 3 ↓ Box 4
		7				J, P, S, Fc 58; J, U, VR, Fc 38; J, P, C, Fc 59; ...			
2.0									

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

PROJECT:
PROJECT NO.:
LOCATION:
DRILLING DATE:
DRILL RIG:
DATUM:
COORDINATES { N: E:
AZIMUTH:
COLLAR ELEV.:
INCLINATION:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

Point load: ● Axial, ○ Diametral

Weathering index: FR, SW, MW, HW, CW. Strength index: R6, R5, R4, R3, R2, R1, R0. Point load index (psi): 1500, 800, 300, 150, 30.

Depth scale (feet)	Rock type description	Run no.	Core recovery	RQD	Fractures per foot	Discontinuity data: type and surface description	Weathering index	Strength index	Notes / water levels / instrumentation
20	Light gray sandstone, oxidized on fractures, calcite veins. Top 3 ft weathered to yellow-brown	7	5.0/5.0	0/5.0	NA		W2 / W3	R1 / R1	
	Very thin shale stringers parallel to 20° joint	8	5.0/5.2	1.9/5.2	2	J, Pl, R, Fc 50°, 90°			
					1	J, Pl, R, Cl 20°			
25					1	J, U, VR, Fc 55	W2		
	Black shale, some 1/4" sand inclusions, gradual contact at top of bed				3	B, U, R, Fc 70, 70, 90			
					2	J, Pl, R, Cl 90; J, ST, SM 10			↑ Box 4 / ↓ Box 5
		9	3.0/3.0	1.4/3.0	0				Orientation attempt failed
					3	J, Pl, R 60; J, ST, R, Fc 50			
30	Shale and clay inclusions, highly fractured and friable				>10	J, Pl, R, Fe 45; J, Pl, R, Fe 35			
		10	5.2/5.2	2.1/5.3	1	J, Pl, R, Fc 70			
	Highly fractured, mostly shale				1	J, Pl, R, Fc 40			
					7	J, Pl, R, Fc 80; J, Pl, SM, CA 40; J, Pl, R 60; J, Pl, SM, Fc 40; J, Pl, R 85			
					2	J, Pl, R, Fc 25			
	Thin shale stringers parallel to joint				2	S, Pl, K 70; J, Pl, SM 60			Box 5 / Box 4
		11	5.?/5.0	3.8/5.0	1	J, P, S, Ca 30			Orientation attempt failed
					2	J, U, R 75	W1	R2	
					1	J, P, R, [illegible] 32			[illegible]
40						J, [illegible] 42; [illegible]			

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED: [illegible]
CHECKED:
DATE: [illegible]

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RECORD OF DRILLHOLE U3-A

Sheet 5 of

PROJECT:
PROJECT NO.:
LOCATION:

DRILLING DATE:
DRILL RIG:

DATUM:
COORDINATES { N:
E:
AZIMUTH:

COLLAR ELEV.:
INCLINATION:

J—Joint
F—Fault
S—Shear
B—Bedding
F—Foliation

PL—Planar
C—Curved
U—Undulating
ST—Stepped
I—Irregular

P—Polished
K—Slickensided
SM—Smooth
R—Rough
VR—V. Rough

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (Axial / Diametral)	NOTES: WATER LEVELS, INSTRUMENTATION
140	ROCK TYPE												
145													Box 6 / Box 7
150													core cuttings
155													Box 7 / Box 8
160													

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

PROJECT:
PROJECT NO.:
LOCATION:

DRILLING DATE:
DRILL RIG:

DATUM:
COORDINATES{ N:
E:
AZIMUTH:

COLLAR ELEV.:
INCLINATION:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

Column headings: DEPTH SCALE (FEET) | ROCK TYPE: DESCRIPTION | GRAPHIC LOG | ELEV / DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX (FR, SW, MW, HW, CW) | STRENGTH INDEX (R6–R1) | POINT LOAD INDEX (psi) (● Axial, ○ Diametral; R6 1500, R5 800, R4 300, R3 150, R2 30, R1) | NOTES, WATER LEVELS, INSTRUMENTATION

Description	Run No.	Core Recovery	RQD	Fractures per foot	Type and surface description	Weathering	Strength	Notes
	15			1	J, P, SM, CA	W1	R4	
				0				
				0				
Dark grey shale (N3) with sandstone layers / calcite veins / some sandstone lenses to 4" long. Highly fractured.				2	J, P, R 45, 40	W1	R0	Box 8 / Box 9
					CORE			
	14	1½ / 3½	0 / 3½	>10				
NO CORE								
	17	2.0 / 2.8	0 / 2.0	>10				
NO CORE								
	18	1½ / 1½	0 / 1½	>10	J, U, R 30; J, U, R 50; F, P, SM 70			
NO CORE					recovered ... J, P, R 70; 70; F, P, R 70; F, P, R 70; 75, 80; S, P, K, CA 60; J, P, SM 60			Box 9 / Box 10
	19	5½ / 5½	0 / 5½	>10				
					J, P, S 45			
			>10		J, P, SM			

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED:
DATE:

Golder Associates

RECORD OF DRILLHOLE

Sheet — of

PROJECT: IKKW
PROJECT NO.: [illegible]
LOCATION:

DRILLING DATE: 9-26-91
DRILL RIG:

DATUM:
COORDINATES { N:
E:
AZIMUTH:

COLLAR ELEV.:
INCLINATION:

J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation
PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular
P—Polished, K—Slickensided, Sm—Smooth, R—Rough, VR—V. Rough

DEPTH SCALE (FEET)	DESCRIPTION (Rock type, grain size, colour, etc.)	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) (● Axial, ○ Diametral)	NOTES: WATER LEVELS, INSTRUMENTATION
	1-2 inch sandstone bed			20	5"/5"	0/5"	>10	C, P, SM, Cl 45 J, P, R 80 J, P, SM 60 J, U, SM 40		W1	R0		
								F, P, P 30 J, P, R 60					
				21	2'/2'	0/2'	>10						
	breccia 1/4" & smaller pieces with clay		NO		CORE								
	breccia			22	2'/2'	0/2'	>10	S, P, K 50 F, P, P 80					Box 10 Box 11
			NO		CORE								
	foliation clear			23	1'/1'	0/1'	>10	F, U, P 65 F, C, P 40					
			NO		CORE								
				24	1'/1'	0/1'	>10	F, Pl, P 60					
						0/1'	>10	J, I, P 85 F, Pl, P 65 F, Pl, P 60					
				25	1'/3'								
			NO		CORE								
				26	1'/1'	0/1'	>10	J, Pl, P 70 J, Pl, P 85 F, Pl, K 95 F, P 90					

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED:
DATE: 1-26-91

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FIGURE 1

993TTT4\T4507.DWG

RECORD OF DRILLHOLE U3 A

Sheet 9 of

PROJECT: 1895
PROJECT NO.:
LOCATION:

DRILLING DATE: 9-26-91
DRILL RIG: MG - MACHINE

DATUM:
COORDINATES{ N: E:
AZIMUTH:
COLLAR ELEV.:
INCLINATION:

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; VC (Vein), - Tc (Stain), - Cl (Seam), - TF (Tf... Fracture)

Columns: DEPTH SCALE (FEET) | ROCK TYPE DESCRIPTION | GRAPHIC LOG | ELEV DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX (W5 W4 W3 W2 W1) | STRENGTH INDEX (R6 R5 R4 R3 R2 R1) | POINT LOAD INDEX (psi) (• Axial, ○ Diametral; R6 1500, R5 800, R4 300, R3 150, R2 50, R1 30) | NOTES, WATER LEVELS, INSTRUMENTATION

Description	Depth	Run No.	Core Recovery	RQD	Fractures per foot	Discontinuity data
(Dk grey shale continued)		27			>10	J,P,R 55; J,P,P 90; F,P 60; F,P 50
	201.9	28	1.8 / 1.9	.5 / 1.9	5	J,St 50; F,Sm 70; TF
	203.8	NO CORE				F,PL,R 60; TF
Dk grey shale w/ calcite vn; Fol'n is subl to core	204.5	29	1.9 / 1.2	.5 / 1.2		F,St,R 40; F,I,R 50; F,I,R 65; F,St,R 50; F,St,R TF 40
Breccia	205.3	NC				
	206.1	30	.8 / 2.7	.7 / 2.7	>10	TF 05; F,I,R 20; F,I,R 70, 60; J,I,S 20; F,I,R,V 05; TF
Calcite breccia; Fractured in core rather ~ sandier → silst.	206.6					Fo,Pl,Sm 65; Fo,Pl,Sm 90
Fine sand/mud (70/30) laminations		31	2.0 / 2.0	.5 / 2.0	8	J,Pl,Sm,Vc 20; Fo,Pl,Sm 90; J,Pl,Sm,Vc 90
Sandy shale w/ ↓	210.8	NO CORE				Fo,Pl,Sm; Fr,R,Pl
	212.9	32	3.2 / 3.2	.8 / 3.2	7-10	MG; F,St,R 40; (60) J,Pl,S 60; (60) J,St,P 75; (85) F,U,K,V; (65) F,I,R 65; Fr,I,P 65
	216.0	33	1.3 / 1.3	.3 / 1.3	5	Fr,I,R 25; Vc,S,R 30; J,I,R; Vc,I,P,R 80; 55
	217.3	34	1.3 / 1.5	.3 / 1.5		J,Pl,Sm 70; F,Pl,R,I; J,I,R 80; J,I,R; F,Pl,R,V 30; F,Pl,R 70; TF
	218.8	35 NO CORE				
	219.3					MG

Notes: 19.8 ...

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED: 9-27-91
DATE: 9-26-91

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FIGURE 1

9931114\T4507.DWG

RECORD OF DRILLHOLE

Sheet 9 of

PROJECT: SHQ
PROJECT NO.: 1095
LOCATION: U3-A

DRILLING DATE:
DRILL RIG:

DATUM:
COORDINATES { N: E:
AZIMUTH:

COLLAR ELEV.:
INCLINATION:

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough; ● Axial, ○ Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DEPTH (FT)	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION
20	SANDY SHALE Finely laminated	35	2.3 / 1.8	0.3 / 1.0	8		J, Pl, R; F, Pl, R, Vc; Fo, Pl, S; F, Pl, F, V
	NO CORE					221.1 – 221.5	
	SHALE w/ SANDY INTERBEDS, INTERBEDS ARE CONVOLUTED & ANASTOMOSING OF SAND STRINGERS	36	2.0 / 1.5	0 / 1.5	8 / >10		F, Pl, R; Fo, Pl, S; S, Pl, R; J, Pl, R
	NO CORE					223.1 – 223.7	
25		37	3.1 / 2.5	0.6 / 2.5	6 / 8'		Fo, PL, S; Fo, PL, S; F, V, ... ; F, Pl, SM; Fo, Pl, SM
	BLOCK SHALE w/ SANDY INTERBEDS	38	2.5 / 2.5	0 / 2.5	5	226.2	Fo, Pl, SM; F, Pl, R, V; F, Pl, R; F, Pl, SM; F, Pl, F, V; F, Pl, SM, R; F, Pl, SM, V; F, St, R; Fo, Pl, S
30	↓'ng SAND	39	3.6 / 3.6	0.6 / 3.6	5	228.7	F, Pl, R; Fo, Pl, SM; J, Pl, P; J, Pl, SM; F, V, R; Fo, Pl, SM; F, Pl, SM
		40	3.7 / 3.7	1.6 / 3.7	3	232.3	F, Pl, R; F, Pl, P, V; J, Pl, S; Fo, Pl, R; Fo, Pl, R; F, Pl, S; Fo, Pl
	BRECCIATED, Calc. cemented	41	4.0 / 4.0			236.0	TF; J, Pl, F, V; J, Pl, F; F, P, F; F, Pl, F; Fo, P, S; J, I, V, R
40						240.0	

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED: MMA
CHECKED:
DATE: 9/27/91

Golder Associates

FIGURE

9931114\14507.DWG

RECORD OF DRILLHOLE

PROJECT: SERQ
PROJECT NO.: 1315
LOCATION: [illegible]
DRILLING DATE: 9/30/91
DRILL RIG: Longyear 44
DATUM:
COORDINATES { N: E:
AZIMUTH:
COLLAR ELEV.:
INCLINATION:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; – k = calcite

Columns: DEPTH SCALE (FEET) | ROCK TYPE – DESCRIPTION | GRAPHIC LOG | ELEV / DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA – TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX (W5 W4 W3 W2 W1) | STRENGTH INDEX (R6 R5 R4 R3 R2 R1) | POINT LOAD INDEX (Axial / Diametral) | NOTES, WATER LEVELS, INSTRUMENTATION

Depth / Description	Run No.	Core Recovery	RQD	Fractures per foot
Sandy shale; Shear fabric evident 242.5 – 242.5; Melange	42	3.9 / 3.5	1.2 / 2.5	>10; 4; 6; 5
Shale (black)	43	2.1 / 2'	0 / 2'	>10; >10
Calcite cemented fractures; 248.3	44	2.8 / 2.3	0° / 2.3	>10 / >10
	45	1.8 / 2.2	0° / 2.2	>10 / >10
No Recovery; 251.0				
Calcite cemented fractures throughout Run 46; 252.7	46	1.8 / 1.7	0.4 / 1.1	3 / >10
	47	1.2 / 2.2	0° / 2.2	>10
No Recovery; 255.1				
257.?	48	1.1 / 2.1	0° / 2.1	>10 / >10
No Recovery				
260	49	4.5 / 4.3	0.7 / 4.5	8 / >10; 1.8 / >10

Discontinuity data (type and surface description, angle): S, PL, SM 20; J, C, R; F, PL, SM 75; J, I, SM 30; J, I, SM 75; F, C, SM; F, PL, SM; F, I, SM 65; J, ST, SM; F, PL, SM 75; F, PL, SM; F, PL, S/K/S 80; J, PL, SM 90; F, PL, K 60; J, PL, R 80; J, PL, R 70; J, PL, SM 65; F, PL, K 65; F, PL, SM; F, PL, SM; J, PL, SM 60; J, PL, SM, K 55; J, ST, SM 50; J, PL, SM 60; F, ST, SM 60; F, U, SM 30; J, PL, SM 60; S, PL, K 60; F, PL, SM 40; F, PL, K; F, PL, SM; crushed F, PL, SM 40; crushed; F, PL, SM 30; F, PL, K 40; J, ST, SM 43; J, ST, SM; F, U, K; crushed; F, U, SM 75; F, PL, P 55; F, PL, P 65; F, PL, R, K 25; crushed F, U, SM 35; F, U, K, F; F, U, SM 35; F, U, K; J, PL, R, K 90; F, PZ, K 85; F, PL, K; F, PL, K; F, PL, R; F, PL, K 55; F, PL, K 40; F, PL, SM 30; F, PL, K, K 70; F, PL, SM 75; F, PL, K, K 60; F, ST, SM; crush; F, PL, SM 50; F, PL, K 85; J, U, R 75; F, U, P 60; J, U, R 65; F, ST, K; J, PL, SM 65; F, PL, SM; F, PL, SM; F, U, SM; F, U, SM; F, PL, P; F, PL, K

Weathering index: W1 · Strength index: R2

DEPTH SCALE: 1" = [illegible]
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hungerford
LOGGED: [illegible]
CHECKED:
DATE: [illegible]

Golder Associates

FIGURE

9931114\14507.DWG

RECORD OF DRILLHOLE

Sheet 11 of 11

PROJECT: SRRQ
PROJECT NO.: 1895
LOCATION: U3-P

DRILLING DATE: 9/30/91
DRILL RIG: LONGYEAR 44

DATUM: -
COORDINATES{ N: E:
AZIMUTH: -

COLLAR ELEV.:
INCLINATION:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; K = Carbonat, AXFF Fractural, CL = Clay

Column headings: DEPTH SCALE (FEET) | ROCK TYPE DESCRIPTION | GRAPHIC LOG | ELEV DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX | STRENGTH INDEX | POINT LOAD INDEX (psi) (Axial / Diametral) | NOTES WATER LEVELS INSTRUMENTATION

Depth	Description	Depth (ft)	Run No.	Core Recovery	RQD	Fractures per foot	Discontinuity data
260	Sandstone bedset 259.6 & 259.8 (approximately 2 inches thick); 44° dip (apparent). Shale Bedrock	261.7	49				F, U, R; F, PL, K; F, PL, K, K; F, PL, K; F, U, K; J, ST, SM; F, U, SM; F, U, K; F, PL, K, K; F, PL, K; F, PL, K; F, U, K; F, ST, K; F, U, KK; F, U, K
265	Bedding (Sandy) compositional layering dipping 52½° (apparent) at ~264.2; 0.2 thick	266.4	50	5.2/5.2	1.6/5.2	8, 7, 8, 3, 7	F, C, K; F, U, SM; F, U, K; F, U, K, K; F, U, K, K; F, ST, K, K; F, U, K; J, ST, SM, K; F, SM, K; F, U, K; F, SM, K; F, SM, K
		270.0	51	2.6/3.5	0.4/3.5	7, >10, >10	F, U, K 90; F, U, K 70; F, ST, K; F, C, K; F, ST, K; F, U, K; F, U, K; J, U, R; F, U, K; J, U, R; J, U, R; J, U, R
270	No Recovery						
		272.4	52	2.5/2.5	0/0	>10, >10	J, U, R; J, PL, SM; J, PL, SM; J, U, R; F, PL, K; F, U, K, CL; F, U, KK; J, ST, R; F, PL, SM
275	10-1-91: Bullard Piezometer Installation	277.0	53	4/4	0.4/4	4, >10, >10, >10	J, U, SN; J, U, R; F, U, SN; F, U, SN; J, U, R; F, PL, SM; F, U, K; J, U, R; F, PL, SM; F, PL, K; F, ST, K, K; F, ST, K, K; F, U, K; J, PL, R; F, ST, K; F, C, K; F, C, K; F, C, K; F, C, K; F, PL, K, K; F, PL, K

Discontinuity angles (graphic log): 48, 65, 47, 60, 50, 50, 42, 47, 50, 85, 37, 30, 35, 50, 48, 50, 52, 65, 75, 70, 80, 85, 90, 90, 75, 68, 90, 60, 70, 60, 40, 70, 70, 70, 30, 40, 70, 40, 60, 70, 52, 85, 90, 70, 70, 65, 75, 75, 70, 30, 70, 35

T.D.

DEPTH SCALE: 1" = 2½'
DRILLING CONTRACTOR: Longyear
DRILLER: Bill Hungerford

LOGGED: JTW
CHECKED:
DATE: 9/30/91

Golder Associates

FIGURE

9931114\14507.DWG

RECORD OF DRILLHOLE U4A

Sheet 1 of 13

PROJECT: SRRQ
PROJECT NO.: 1373A
LOCATION: San Rafael

DRILLING DATE: 10/3/91
DRILL RIG: Longyear 44' truck

DATUM:
COORDINATES N:
E:
AZIMUTH: 090

COLLAR ELEV.:
INCLINATION: 45°

ROCK TYPE

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

● Axial ● Diametral

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX (FR SW MW HW CW RS)	STRENGTH INDEX (R6 R5 R4 R3 R2 R1)	POINT LOAD INDEX (psi) (R6 1500, R5 800, R4 300, R3 150, R2 30, R1)	NOTES WATER LEVELS INSTRUMENTATION
0													
2	[illegible] silty clay, [illegible] contact [illegible] high plasticity, organic.												7:35 AM
3													[illegible]
													[illegible] 7:50 AM

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE: 10/3/91

Golder Associates

9931114\14507.DWG

FIGURE 1

RECORD OF DRILLHOLE U4-A

PROJECT: SKRQ
PROJECT NO.: 18934
LOCATION:

DRILLING DATE: 10/3/91
DRILL RIG: [illegible]

DATUM:
COORDINATES{ N: E:
AZIMUTH: 090
COLLAR ELEV.:
INCLINATION: 45°

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES / WATER LEVELS / INSTRUMENTATION
	Black shale												1st rock @ 109' 11 AM
													cuttings are 1/16" very angular black shale
	Continued on next page												casing installed to 130'

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough. Point load: ● Axial, ● Diametral.

DEPTH SCALE:
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]
LOGGED:
CHECKED:
DATE:

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9931114\14507.DWG

FIGURE 1

RECORD OF DRILLHOLE U4-A

Sheet 3 of 17

PROJECT: SRRQ
PROJECT NO.: 1895A
LOCATION:

DRILLING DATE: 10/3/91
DRILL RIG: Longyear

DATUM:
COORDINATES N:
E:
AZIMUTH: 090

COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; – Fe

Depth scale (feet)	Rock type description	Graphic log	Elev / Depth (ft)	Run no.	Core recovery	RQD	Fractures per foot	Type and surface description (discontinuity data)	Weathering index	Strength index	Point load index	Notes / water levels / instrumentation
0	Dk grey shale, iron staining on joints; brecciated			1	1⁶/1⁶	0/1⁶	4; NA	J, P, SM, Fe 50; B, U, R Fe 40; J, P, Sm, Fe 65; J, P, SM, Fe 65	R1	W2		Box 1
				2	2⁴/2⁴	0/2⁴	>10	J, P, Sm, Fe 65; J, P, Sm, Fe 50, 80; B, P, Sm, Fe (calcite) 65; Fe, P, Sm; J, Pl, Sm, Cl 40; Fe, P, Sm 50				
5				3	1⁸/2⁰	0⁸/2⁰	2; NA	J, I, Sm, Fe 45; J, Pl, Sm Fe; B, Pl, Sm, Fe 50; J, I, VR 45				
				4	3¹/3⁵	0⁴/3⁵	3; >10; 2	J, Pl, R, Fe 35; J, Pl, Sm, Fe; B, Pl, Sm, Fe 90; [25° J, Pl, Sm, Fe]; J, I, VR, U (vuggy)				10/4/91
				5	1⁷/1⁷	0/1⁷	3; 3	J, Pl, R, Fe 35; B, P, Sm Fe; J, Pl, R, Fe 45; J, Pl, R, Fe, Cl 45; J, Pl, R, Fe 90; J, Pl, P, Fe 45				Box / Box 2
	Increase in calcite veins, highly fractured but some cohesion; Brecciated w/ clay - no cohesion			6	3⁰/5⁰	0/3⁰	>10	Calcite vein; S, Pl, K, Cl 70; B, C, Sm, Cl, Fe; J, Pl, R, Fe 55, 90, 50	R0	W3		
	NO CORE											
				7	2⁰/3⁰	0/2⁰	>10	J, I, R, Fe 0				
	NO CORE											

DEPTH SCALE:
DRILLING CONTRACTOR: Longyear
DRILLER: [illegible]

LOGGED:
CHECKED:
DATE: 10/4/91

Golder Associates

FIGURE 1

9931114\14507.DWG

RECORD OF DRILLHOLE C-4

Sheet 1 of 3

PROJECT: SRRO
PROJECT NO.: 1795.A
LOCATION: [illegible]

DRILLING DATE: 10/4/91
DRILL RIG: [illegible]

DATUM:
COORDINATES N:
E:
AZIMUTH: 090
COLLAR ELEV.:
INCLINATION: 45°

ROCK TYPE

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi) ◆ Axial ◆ Diametral	NOTES: WATER LEVELS, INSTRUMENTATION
0	Dark grey, [illegible]						>10	F, P, SM, Cl 50 J, P, SM 45		W2	R1		
				8	4.5/4	0	>10	30	25				
							>10	J, P, SM 45					Box 2
							>10	J, P, SM, Fe	15				Box 3
25													
							3	J, I, R J, I, R	45 20	W1			
							0	J, P, SM	50				
				9	5.2/5.2	3.4/5.2	2	J, P, SM 50					
							1	J, P, SM, Ca 45	35				
							1	J, P, SM 30					
							0						
							3	J, P, VR 30 30					
				10	5°/5°	3.5/5°	1	J, C, VR, Cl 35					
							1	J, ST, VR 60					Box 3 Box 4
							1	J, ST, R 50 60					
							4	J, P, K, Cl 70 J, P, R, Cl 60 60 J, P, R 40					
							1	J, P, SM 60					
				11	5°/5°	3°/5°	1	J, P, R 60		R2			
							1	Fo, P, SM 20					
							1	S, PI, SM, Cl 30					

DEPTH SCALE:
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED:
CHECKED:
DATE: 10/4/91

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9931114\14507.DWG

FIGURE 1

RECORD OF DRILLHOLE 104

Sheet 5 of 13

PROJECT: SRKQ
PROJECT NO.: 1893A
LOCATION: San Rafael
DRILLING DATE: 10/4/91
DRILL RIG: Longyear
DATUM:
COORDINATES: N:
E:
AZIMUTH: 090
COLLAR ELEV.:
INCLINATION: 45°

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
Pl–Planar, C–Curved, U–Undulating, St–Stepped, I–Irregular
P–Polished, K–Slickensided, Sm–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES: WATER LEVELS, INSTRUMENTATION
70	Dk grey siltstone w/ calcite veins						0			W1	R2		
				12	1'/2.5'	1/1'	3+	S, Pl, K, Cl 50					
								Fo, U, P 30					
			NO		CORE			S, U, I, Cl 20					
							2						
								S, Pl, K, Ca 50					
								J, Pl, P, Cl 55					
								J, I, K, Cl 70					
				13	4'/4.5'	1'/4'	3	S, Pl, K, Ca 50					Box 4
75	4" clay band							S, Pl, K, Cl 50					Box 5
							2	J, Pl, P, Cl 50					
								J, U, P 20					
								Fo, U, Sm 50					
				14	5'/4.6'	4.5'/5'	0						All core recovered
							0						
							1						
							1	S, Pl, K, Ca, Cl 80					
							1	J, U, R 50					
	Some silt and fine sand							J, P, R 45					
							0						Box 5
							1	J, P, R 80					Box 6
				15	5'/5'	4.3'/5'	1	J, P, R, Ca 70					
	Dk grey siltstone w/ calcite veins									R4			
							0						
							1	J, P, Sm 45					
							0						
				16	3'/3'	3'/3'	1	S, [illegible] Ca 65					
							0						

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED:
CHECKED:
DATE: 10/4/91

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9931114\14507.DWG

FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SRRQ
PROJECT NO.: 1895A
LOCATION: [illegible]

DRILLING DATE: 10/?/?
DRILL RIG: [illegible]

DATUM:
COORDINATES N: E:
AZIMUTH: 090

COLLAR ELEV.:
INCLINATION:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Vc – Vein (carbonate), TF – [illegible]

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES WATER LEVELS INSTRUMENTATION
10	MASSIVE/STEEP SLATY CLEAVAGE DK GRY SILTY MDST GETTING HARD NOW (M4) W/ CALCITE VEINS & MINOR FAULTS.			17	5.0 / 5.0	4.4 / 5.0	<1	F,PI,?,Vc ; F,PL,IF,? (60) ; J,IR,R					10/4/? ; 10/?
5	195.6							F,IR,Vc,R (70)					
	198.6 to 199.2 SHEAR CONTACT SILTY MDST TO MED GRAINED MED LT. GREENISH GRAY SS. (5GG/1) 200.6			18	5.0 / 5.0	4.? / 5.0	<1 ; 4	F,IF,R,Vc (85) ; F,IR,R (85) ; F,PL,R,Vc (85) ; CONTACT 70° & 80° ; J,IR,R (60) ; J,IR,R,Vc (35) ; TF (50)		R5			CONTACT
0				19	5.0 / 5.0	4.8 / 5.0	1	F,PL,S ; J,PL,IR (35) ; TF (10)					202.3 ↓ ORIENT'D
	205.6			20	5.0 / 5.0	5.0 / 5.0	<1	J,?,R,Vc (28°)					

DEPTH SCALE:
DRILLING CONTRACTOR: [illegible]
DRILLER: B. [illegible]

LOGGED: 14
CHECKED:
DATE: 10/?

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9931114\14507.DWG

FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SA-9
PROJECT NO.: 1895
LOCATION: [illegible]
DRILLING DATE: 07/OCT/91
DRILL RIG: LONGYEAR-44
DATUM:
COORDINATES: N:
E:
AZIMUTH: 090
COLLAR ELEV.:
INCLINATION:

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough; Vc – Vein (calcite), Tf – Totally fractured, Fc – Iron stain, G – Gouge

Point load index: ● Axial, ● Diametral

Depth Scale (Feet)	Rock Type Description	Elev Depth (ft)	Run No.	Core Recovery	RQD	Fractures per Foot	Discontinuity Data: Type and Surface Description	Notes, Water Levels, Instrumentation
0	BRECCIATED SHEAR ZONE W/SHALE	210.8	20			2-3	F, I, R 75	
			21	5' / 5.0	2.5 / 5.0		J, I, R, Fc 25	LOST ORIENT'N @ 212.4
						>10	Tf, Fc	
15							F, Pl, S, G 50; J, Pl, S, Vc 30	
		216				1		
			22	5' / 5'	3.5 / 5.1	4	J, Pl, S 55; J, Pl, R Vc 30; J, Pl, R, Vc	
0						4	J, I, R, Vc 20	
							J, I, R, Vc 60; F, Pl, SM, K, Vc	
		221						
			23	5' / 5'	5' / 5'	0		
		226.2						
			24	5' / 5'	5' / 5'	0	J, PL, S, Vc 70	

DEPTH SCALE:
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]
LOGGED: [illegible]
CHECKED:
DATE: 7/OCT/91

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FIGURE 1

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RECORD OF DRILLHOLE

Sheet 8 of 12

PROJECT: SARG
PROJECT NO.: 1895
LOCATION: San Rafael D.H.
DRILLING DATE: Oct 8, 1991
DRILL RIG: Longyear 44
DATUM:
COORDINATES: N:
E:
AZIMUTH: 090
COLLAR ELEV.:
INCLINATION: 45°

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, Sm–Smooth, R–Rough, VR–V. Rough
V = Vein (rock), Sd = Sandy, Cl = Clay, G = Gouge

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES, WATER LEVELS, INSTRUMENTATION
	ROCK TYPE											● Axial ○ Diametral	
230													
			233'	1	5'/5'	5'/5'	0						LOST CIRCULATION @ 233'
							0	J, Pl, R, Vc	25				
				2	5'/47'	44'/47'	3	J, Pl, R, Vc	30				
							0						
235			236'										— 0' SLIPPED
													Box 12
				3	4'/3'	3'/3'	0						— 1' SLIPPED
							0	S, Pl, R, Vc 10°					
			241'				2	S, Pl, R, Vc 55					
							1	F, Pl, R, Vc 0					CIRCULATION REGAINED FROM 241'
				4	8°/5°	3°/3°	6						
			244'				1	F, Pl, R, Vc 40°					
							1						
				5	5'/5'	5'/5'		F, Pl, K 55					
								F, Pl, K 45					
													Box 13
								F, Pl, S 45					
								F, Pl, R, Vc 60					
								F, Pl, S, Vc,					
249								F, Pl, S, R, Vc 30					
				6	1'/1'	1'/1'	>1						

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED: TA
CHECKED:
DATE: 2/ROT

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FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SRRW
PROJECT NO.: 1875
LOCATION: D-4

DRILLING DATE: OCT. 8, 1991
DRILL RIG: LONGYEAR 44

DATUM:
COORDINATES{ N: E:
AZIMUTH: 090

COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SH–Smooth, R–Rough, VR–V. Rough

Column headings: DEPTH SCALE (FEET) | ROCK TYPE: DESCRIPTION | GRAPHIC LOG | ELEV / DEPTH (FT) | RUN NO. | CORE RECOVERY | RQD | FRACTURES PER FOOT | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | GRAPHIC LOG | WEATHERING INDEX (W1–W5) | STRENGTH INDEX (R0–R6) | POINT LOAD INDEX (psi) (● Axial, ● Diametral; R6 1500, R5 600, R4 300, R3 150, R2 30, R1) | NOTES: WATER LEVELS, INSTRUMENTATION

Depth scale: 0

Description (rock type):

- SHALE STRINGER ~ 2" THICK 40° TO AXIS
- SHALE ZONE, 30° TO AXIS ~ 2" THICK
- SHALE @ 30° TO AXIS
- SHEARED SHALE
- MASSIVE, FINE GRAINED GRAY SS WITH SHALE STRINGERS AT 30°-50° to CORE AXIS
- CALCITE VEINLETS
- BRECCIATED
- SS-SHALE; BRECCIATED
- SOME "INJECTION" TYPE OF SHALE/CLAY W/ SS CLASTS SUSPENDED IN MATRIX.
- CONTORTED LAMINATIONS
- CALCITE VEINLETS THROUGHOUT CORE.
- ROCK BREAKS EASILY ALONG PREFERRED ORIENTATIONS PARALLEL TO ORIENTED FRACTURES

Runs:

Depth (ft)	Core recovery	RQD
29	5.0 / 5.0	5.0 / 5.0
30	5.1 / 5.1	4.5 / 5.1
31	5.0 / 5.0	5.0 / 5.0
32	5.0 / 5.0	5.0 / 5.0

Fractures per foot (top to bottom): 1, 0, 1, 1, >10, 0, 2, 2, 2, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0

Discontinuity data (type and surface description, with angle to axis):

- FR, C-U, R — 40
- 40
- MB
- F, PL, S; K ⊥ TO AXIS
- SR, PL, S — 45
- SR, U, P - CLAY — 30
- SR, U, P — 40, 40
- FR, P, S - CLAY — MB, 40, 50
- FR, C-PL, R-VR — MB, 40
- FR, C-PL, R — 30
- FR, PL, R — 80
- SR, C-PL, SH-R; CLAY — 35
- S, P, R - CLAY — 30°
- J, P, SH - CLAY — 30
- FR, P, SH - CLAY — 30
- MB
- MB
- 56° — MB

Weathering index: FR (upper), FR (lower)

Strength index: R4 (upper), R4 (lower)

Notes:

- BOX 13
- BOX 14
- 7.5 / 8.0
- BOX 15
- oriented good impression back oriented to 256 S/

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED:
DATE:

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FIGURE 1

RECORD OF DRILLHOLE

PROJECT: [illegible]
PROJECT NO.: [illegible]
LOCATION: U 4

DRILLING DATE: Oct 8 1991
DRILL RIG: LONGYEAR UU

DATUM:
COORDINATES: N:
E:
AZIMUTH: 090

COLLAR ELEV.:
INCLINATION: 45°

Sheet 10 of 1[illegible]

ROCK TYPE

J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation
PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular
P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (Psi)	NOTES: WATER LEVELS, INSTRUMENTATION
70	MASSIVE, GRAY FINE-MED SS, BRECCIATED, CONTORTED CALCITE VEINLETS			33	5'/5'	4'/5'	0	FR, U, R - CALCITE					BOX 15
							0						
							1			MB			
							1	S, P, K		FR	R4		BOX 16
							0			60			LOST ORIENTATION AT 274.1
				34	5'/5'	5'/5'	1	FR, ST, R; CALCITE		40			
							0			MB			
							0						
							0						
							0			MB			
							1	FR, P, R - CALCITE		60			— TRIED TO ORIENT, BAD IMPRESSION
				35	5'/5'	5'/5'	0			MB			BOX 17
							0	F; P, K		55			
							0			50			
							0			MB			
							0			MB			
							0			MB			
							0			MB			
				36	5²/5²	5²/5²	0			MB			
							0			MB			
							1	FR, P-U, R; CALCITE		MB			
							1	F, P, P-K 10° TO AXIS		UD			
										115'			

DEPTH SCALE: [illegible]
DRILLING CONTRACTOR: [illegible]
DRILLER: [illegible]

LOGGED: [illegible]
CHECKED:
DATE:

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FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SARQ
PROJECT NO.: 1895
LOCATION: V. 4

DRILLING DATE:
DRILL RIG: LONGYEAR 44

DATUM:
COORDINATES N: E:
AZIMUTH: 270

Sheet 11 of 1_

COLLAR ELEV.:
INCLINATION:

Legend: J—Joint, F—Fault, S—Shear, B—Bedding, F—Foliation; PL—Planar, C—Curved, U—Undulating, ST—Stepped, I—Irregular; P—Polished, K—Slickensided, SM—Smooth, R—Rough, VR—V. Rough

Point load: ● Axial, ● Diametral

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES / WATER LEVELS / INSTRUMENTATION
10	MASSIVE SS,						>1			MB			Box 17
	ABRUPT CHANGE TO FINE SS TO SILTSTONE MUDSTONE AS IN A BRECCIATED ZONE. CONTACT OFTEN SHARP & ANGULAR			37	5'/5'	4.9/5'	1	FR, PL, R; CaCO3 FR, PL, R FR, C, R FR ALONG CALCITE VEIN		MB 60 65 52 FR	R4		Box 18 2:100 - wire line broke, had to trip rods to retrieve overshot & tube
15				38	5'/5'	5'/5'		FR, C, R FR, C, S; CLAY FR, R, S CALCITE		MB 35 75 60			
	SHALE STRINGER							FF, PL, R; clay		MB 70 MB			
20	SS WITH DENSE CONCENTRATIONS OF CALCITE VEINLETS, SOME SHALE STRINGERS, CONTORTED LAMINAE, ABRUPT CHANGES IN LITHOLOGY ALONG SHARP, ANGULAR CONTACTS - SHALE INJECTION, BRECCIA ZONES			39	5'/5'	5'/5'	0						Box 19
				40	5.0/5.0	5.0/5.0	1 0 2	FR, C, R; CaCO3 FR, PL, SM; CaCO3		20 56 ME			BOX 20

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:

LOGGED:
CHECKED:
DATE:

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FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SKRQ
PROJECT NO.: 1855
LOCATION: U-4

DRILLING DATE: 10-3, 10-9 /91
DRILL RIG:

DATUM:
COORDINATES: N: E:
AZIMUTH: 090
COLLAR ELEV.:
INCLINATION: 45°

Legend: J–Joint, F–Fault, S–Shear, B–Bedding, F–Foliation; PL–Planar, C–Curved, U–Undulating, ST–Stepped, I–Irregular; P–Polished, K–Slickensided, SM–Smooth, R–Rough, VR–V. Rough. Point Load Index: ● Axial, ▪ Diametral

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	NOTES / WATER LEVELS / INSTRUMENTATION
0			40								STOP FOR ... 6:15 (PM)
	SANDSTONE/MUDSTONE		41	5.0 / 5.0	5.0 / 5.0	1	J, P, S, CLAY	50°			Box 20
							J, U, R	20°			
						0					
							J, U, R	55°	FR	R4	
						1	J, U, R, CLAY	55°			
5	SHALEY/MUDSTONE	315.2									7:10 / 7:20
	GRAY N7 DRY, N3 WET					0					
	SANDSTONE W/ MUDSTONE STRINGERS/LAYERS ½ TO 3" THICK, W/ CALCITE VEINS & FILLINGS		42	5.0 / 5.0	4.5 / 5.0				FR	R4	
						3	J, U, R, SHALE	35°			Box 21
							J, U, R	40°			
						2	J, U, S	35			
							J, U, U	30			
		320.2									8:10 / 8:20
						0	J, U, R,	25°			
			43	5.0 / 5.0	5.0 / 5.0	1	J, U, U	10°	FR	R4	
							J, U, R, CLAY	30			
	CLAY SEAM, SOFT					2	J, P, S, CLAY	25	SP	SOFT	CLAY
								15 / 20			
							J, P, S	25			
		325.2									9:05 / 9:15
	BROKEN/FRACTURED MUDSTONE W/ SS. STRINGERS & LAYERS W/ CALCITE VEINS		44	2.9 / 2.9	0.8 / 2.9	1	J, P, K	40			LOST DRILL...
						3	J, P, K	40			Box 22
							J, P, K	30° / 70 / 40			
		328.1					J, P, V	50			10:00 / 10:10
			45	5.1 / 5.1	2.0 / 5.1	2	J, P, K	70			GRIND CORE
						3		50 / 20			

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED:
CHECKED:
DATE:

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FIGURE 1

RECORD OF DRILLHOLE

PROJECT: SA04 | DRILLING DATE: 10-9-91 | Sheet 13 of 13
PROJECT NO.: 1275 | DRILL RIG: | DATUM:
LOCATION: U-1 | COORDINATES N: | COLLAR ELEV.:
E:
AZIMUTH: 090 | INCLINATION: 45

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
Pl-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Stickensided, Sm-Smooth, R-Rough, VR-V. Rough

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	ROD	FRACTURES PER FOOT	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	NOTES: WATER LEVELS, INSTRUMENTATION
330	SANDSTONE w/ MUDSTONE LAYERS (DEFORMED)			45	5.1/5.1	2.0/5.1	1	J/F, P, K, CLAY	30	FA	R4		Casing Code Box 22
			333.2				0						
				48	2.9/3.0	0.9/3.0	1	V.D.K. CLAY	50	FA	R4		11:00
35	CUT FILLED JOINT						3		50				11:10
	SHEAR ZONE FOLIATED MUDSTONE w/ CALCITE VEINS & SOFT CLAY	LC	336.2	47	10/24	0/2.4	>3	V.D.K. CLAY	40		S-1/R3		11:45 / 12:55 Box 23
	w/ SOFT CLAY	LC	338.6	48	12/14	1.5/1.4	>3	J.P. CLAY	45		R2		12:20 / 12:25
0		LC	340.0										12:45 / 12:55
	SANDSTONE w/ CALCITE & SHALE MUDSTONE			49	2.4/3.0	0.6/3.0	>3	J. P, R, CLAY/CA	20	FA	R3/R4		
			343										1:30
	TOTAL DEPTH 343												

DEPTH SCALE:
DRILLING CONTRACTOR:
DRILLER:
LOGGED:
CHECKED:
DATE:

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FIGURE 1

1261.1.001.01

RECORD OF DRILLHOLE # U-5A

SHEET 1 OF 43

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION ~135
DRILLING DATE 10-14-91

DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
0	Fresh, massive, dark greenish gray (5G4/1) and medium bluish gray (5B5/1) m-f, very strong, sandstone (blue ss) some calcite						0→16' logged from cutting and core bit when retrieved by driller.		W1	R4	~0630 begin drilling
2.5											
5											Material highly fractured - drilled having circulation problems surface→16'
7.5											
10											
12.5											
15											
	Same as above		1	0/12	0	>10			W1	R4	Begin coring (16'-17.5') using HQ wireline barrel and diamond bit
17.5				No Core							
	Same as above		2	14/20	0	>10	J,U,R,CL 35 J,C,SM 50 J,ST,R 45		W1	R4	numerous suspected drilling fractures observed
20	Same as above		3	20/20	0	>10	J,C,P,SM,CL 35 J,C,SM,CL 50		W1	R4	
			4	12/20	0	>10	S,C,K 55		W1	R4	changed to NQ size core @ 21.5'
				No Core							
			5	7'/2.5'	0	>10	J,C,R 35 S,PL,SM 40		W1	R4	

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RECORD OF DRILLHOLE # U-5A

STA. U-5A OFFSET L R
PROJECT NO. 9031025
INCLINATION 90 AZIMUTH
ELEVATION -135
DRILLING DATE 10-14-91, 10-15-91
DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
25	Fresh, massive, dark greenish gray (5G 4/1) and medium bluish gray (5B 5/1) m-f, very strong sandstone (blue ss.) some calcite		5	2.6/2.6	0	>10	25.2→26.1 shear zone 45; J,C,R,cl		W1	R4	shear zone, increased calcite
	25.5 same as above with increasing calcite and strong rock strength					1	J,PL,R,cl 20; S,ST,SM 65		W1	R4	
27.5			6	5.0/5.0	2.4/5.0	2	J,PL,SM 30; J,PL,SM 30				
						2	J,I,R,CA 10			R4+R	
30	Fresh, massive, dark greenish gray (5G 4/1) and medium bluish gray (5B 5/1) m-f, very strong sandstone (blue SS) some calcite					3	J,ST,R 40; S,ST,R 20				
						>10	J,PL,R 30; J,U,R 10				
32.5			7	5.0/5.0	3.9/5.0	2	J,PL,SM 40; J,U,R,CA 40; J,C,R 60		W1	R4	
	Same as above					1	J,PL,SM 60				
						0	J,PL,R				
35						0	J,PL,R 30				
						1					
37.5			8	5.0/5.0	4.4/5.0	0					
	Same as above with increasing calcite veinlets, average of 40° to core axis					0			W1	R4	
						0					8 bags mud used driller said he never had full circulation
40						1	J,ST,UR 60				
10-15						0					10-15-91 START CORING @ 0920 and coring to 50
42.5			9	7.2/7.2	4.6/7.2	1	J,C,R 60				
						2	J,ST,UR 60; J,PL,R 60; J,ST,(K,R) 45		W1	R4	
	Same as above					1	J,P,R 45				
						2					
						2	J,P,SM 60; J,P,SM,CA 70				
						0	J,ST,K 20				
						5	J,ST,R 35; J,ST,R 35; J,C,R 45; J,PL,R 45				
50	Same as above		10	1.7/1.7	1.7/1.7	2	J,P,R 60; J,I,R 60				

RECORD OF DRILLHOLE # U-5A

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-15-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
50	Fresh, massive, dark greenish gray (5G4/1) and medium bluish gray (5B3/1) m-f, strong sandstone (blue ss), some calcite, shale (fresh, black (N2) f silt) interbed noted at joint.		10	75/75	50/75	1	J, P, SA — 20		W1	R4	Joint along shale interbed
						0					
52.5						2	J, ST, R — 50; J, P, R — 45				
						2	J, P, SM — 5				Fracture along shale interbed
						0					
55						1	J, P, SA — 60				
							S, C, K (ca) 30; J, P, R 30		W2	R4	Calcite infilling, slickensides. FeO stains on calcite
	56.9 Very thin, Fresh, interbed, black (N2), f silt, weak SHALE.					3	S, C, K 45				Fracture along SHALE interbed.
57.5						0			W1	R4	
				100/100	54/100	0					
60	Same as above		11			0	J, P, sm — 60; J, P, sm — 40				
						3	J, P, sm — 30				
						0				R4	
62.5						1	J, I, R — 60				
						0	J, U, SM 5 CA				Calcite infilling
	65.0 → 65.7 Fresh, dark greenish gray (5G4/1) and medium bluish gray (5B3/1) m-f med strong sandstone (blue ss), some calcite					1					
65						>10	Average ± 50		W1	R3	
						0					
67.5	Fresh, massive, dark greenish gray (5G4/1) and medium bluish gray (5B5/1) m-f, strong sandstone (blue ss) some calcite laminae		12	48/56	22/56	1	J, P, SM, CA 20		W1	R4	Note slickensides on calcite infilling
	69.3 - 69.75 Fresh, breccia, black (N2), m-f crystalline, weak SHALE. Veins of Calcite present.					1					
70						>10	J, I, R - AVE 45; J, I, R — 40; S, C, R 45; S, I, R 35				
						>10					
			No Core								
	Fresh, massive, dark greenish gray (5G4/1) ... (5B3/1) m-f ... calcite laminae		13	14/26	0	>10	J, P, K — 5; J, C, R — 45; J, U, K (K... 60; J, P, R (calcite)				Calcite infilling
			No Core								
			14	27/27	01/27	>10	J, ... 50; J, ST, R 40 45		J, P, R; J, I, R		

RECORD OF DRILLHOLE # U-5A

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-15-91, 10-16-1991

DATUM
DRILL RIG -[illegible] 44

DEPTH SCALE (FEET)	DESCRIPTION	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	WEATHERING	STRENGTH	NOTES / WATER LEVELS / INSTRUMENTATION
75		14	2.7/2.7	0.4/2.7	>10	J,PL,R 60; J,I,VR 51; J,PL,R 25	W1	R4	
	Fresh, massive, dark greenish gray (5G4/1) and medium bluish gray (5B5/1) m-f, strong sandstone, some calcite veining, thin shale interbeds	15	2.8/2.1	0.6/2.8	4	J,C,SM 70; J,PL,SM 50; J,C,R; J,A,R 48			
77.5					3	J,PL,SM 58; J,PL,SM,CA 60; J,U,R 20			Calcite infilling exhibits slickensides
					>10	J,U,R 50; J,PL,SM; J,PL,R 80; J,PL,R 30			
80		16	6.8/6.8	7.8/6.8	1	J,C,R 40; J,I,R 20; S,CIK; J,STK; J,PL,SM; J,STR 30; 10			
					3				
	Same as above				5		W1	R4	
82					3	J,ST,VR 40			
					1	J,PL,SM,CA 25			
85	84.5 to 85.5 zone of calcite veins avg 0.5 in thick, brecciated sandstone observed within calcite zone.				2	J,ST,VR,CA 15			
					0				
	Same as above	17	3.6/3.6	2.2/3.6	2	J,PL,SM,CA 50; J,PL,R 60			
87.5					1	J,ST,R,CA 55; J,ST,R,CA 60	W1	R4	
					2				
					3	J,PL,R,CA 40; J,PL,R,CA 35			1800 END DRILLING
90		18	6.4/6.4	2.4/6.4	3				0700 10-16 Begin Drilling. Driller [illegible]
	91.8 - 92.1. Fresh, very white (N9), c-f crystalline, very weak CALCITE (3mm).				4	J,U,R,CA 45; J,C,R,CA 40; J,U,R,CA 40; J,C,SM,CA			
92.5					2		W1	R4	
					3	J,PL,R,CA 45			
95					3	J,PL,R,CA 40; J,PL,R,CA 35			
					3	J,PL,SM,CA 25			
	same as above	19	4.5/4.5	1.5/4.5		J,ST,R,CA 50; J,PL,R,CA 40	W1	R4	
						J,C,R 25; J,U,R,CA 30; J,C,R,CA 50; J,PL,SM,CA 65			
100									

RECORD OF DRILLHOLE # U-5A

SHEET 5 OF 43

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-16-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
100			19	4.5/4.5							
	101.2 - 102.0. Calcite deposit in joint - possible conduit for groundwater movement.		20	3.5/3.5	[illegible]/3.5	1					
						>10	J, I, DR, CA	16	W1	R4	
102.5	Fresh, massive, dark greenish gray (5G4/1) and medium bluish gray (5B5/1) m-f, strong Sandstone (bluess), calcite veining.						SHEAR ZONE J, C, R, GO 30 {35, 30, 20}				
						>10			W1	R4	
			21	0.5/1.0	0	>1					
105				No Core			J, C, R 45				
			22	5.4/5.4	3.4/5.4	1			W1	R4	
						0					
107.5						0	J, PL, R, CA(K) 30				
							J, PL, K 60				Note slickensides on calcite infilling (108.x)
						3	J, PL, R, CA 20				
							J, PL, SM, CA(K) 30				
110	110.x to 110.x calcite deposit in joint (Appr. 0.1 in. thick)					2	J, PL, R, CA(K) 25	10			Note slickenside on calcite infilling (110.x)
	111.x to 112 calcite in joint slickensided		23	2.8/2.8	0.9/2.8	1	J, C, R, CA 30				
						4	J, PL, K(CA) 20				From 110.x to 113.x colors on core box incorrectly
							J, PL, R 30				
112.5							J, C, VR 30		W1	R3	
	113.x to 113.x Fresh massive, dark greenish gray (5G4) and medium bluish grey (5B5/1) m-f, medium strong Sandstone (bluess) increased calcite (matrix) few calcite veins noted.					>10	J, PL, R 50		W1	R3	
	114.x to 114.x thin shale layer observed at joint. Fractures believed to be predominantly drilling induced.		24	2.5/2.5	0.6/2.5	>10	J, PL, SM, CA(K) 60				
							J, PL, K 45				
115						>10	AG-J, PL, K 60				
	115.x to 115.x thin shale layer 114.x to 116.x sparse shale, calcite noted in joint 116.x to 117.x Increased shale and calcite in matrix - induced fracture at this interval reveals slickensided surface of calcite and shale					2	J, PL, K(CA) 25				
							Mechanical J, PL, K 10				
117.5	117.2 - 121.4 FRESH MASSIVE DARK GREENISH GREY (5G4) AND MEDIUM BLUISH GREY (5B5/1) MED-FINE MEDIUM STRONG SANDSTONE W/ INCREASED CALCITE IN MATRIX SOME CALCITE VEINING [illegible]		25	5.9/5.9	1.5/5.9	1	J, PL, S, CA 10				
						2					
						2	J, PL, S, CA 15				
	121.4 - [illegible] FRESH MASSIVE DARK GREENISH GREY 5G4/1 TO MEDIUM BLUE GREY (5B5/1) MED-FINE MEDIUM TO STRONG SANDSTONE VEINING LESS COMMON					4	J, PL, S, CA 30		W1	R4	THIN CA LAYER IN JOINT POSSIBLE DRILL INDUCED [illegible]
						2	J, PL, S, CA 30				
							J, PL, S 45				
			26	9.2/9.2	8.4/9.2	1	J, PL, R 90				
						0					
	124.5 - 133.7 SEE NEXT SHEET					1	J, PL, S 30 CA [illegible]				

RECORD OF DRILLHOLE # U-5A

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-16-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	WEATHERING	STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
125	124.5 - 133.7 FRESH MASSIVE DARK GREEN GREY (5G 4/1) TO MED BLUE GREY (5B 5/1) MEDIUM TO VERY FINE, STRONG SANDSTONE SPARSE CALCITE VEINS VERY THIN NUMEROUS CLAY/SH FLAKES SIGNIFICANT CALCITE CONTENT IN MATRIX RARE CALC VEIN ≥ 0.2 IN	26	95/95	84/95	0		W1	R3	
					1				
127.5	128-130 SLIGHTLY MORE CALCITE IN MATRIX VOR LESS CLAY				0	J, P, VR, CA 80			PERPENDICULAR TO CALCITE VEIN
					4				
					0	J, P, R, CA 20			THIN UNIFORM CALCITE GROWTH ON JOINT
130					1	J, I, VR, 90			BRECCIATED
	133.7 - 142.8 MASSIVE, FRESH, MEDIUM BLUE GREY (5B 5/1) M-VF SANDSTONE MARKED CALCITE VEINING AT VARIOUS ORIENTATIONS THROUGHOUT SHALE ABSENT FROM THIS INTERVAL LONG CALCITE VEIN IS 0.4 IN, ALL OTHERS LESS THAN 0.1 IN HARD - V. HARD				0				
132.5	133.7 - 134 134 - 134.3	27	85/85	51/85	3	J, P, SM, 30 J, P, C, R-VR 30-90	W1	R3	VERTICAL FRAC - APP DRILL INDUCED
					4				
135	135-135.1 JOINT CA UPPER SURFACE CHL? SH LOWER SURF 135.7				1	J, P, SM, 80 J, P, SM, 50	W1	R4	
	135.9 - 136.4 FRAC ZONE CALC VEIN SLIGHTLY MORE INTENSE AND PARALLEL TO FRAC 137.0 - 137.6 CALCITE FACED FRACTURE				3	J, P, SM-R 45			
137.5	137.8 - 138.8 SLIGHTLY MORE COARSE, MED - FINE W/ V THIN CALC LAMINA AT IRREGULAR ORIENTATION				0	J, P, VR, 20			
					3	J, C, SM, 10 J, P, R 40	W1	R4	90° JOINT - APP TO BE DRILL INDUCED
	139.8 - 139.6 SLIGHTLY FINER LAYER 139.2 - 139.6 JOINT CALC FACED 139.6 - 139.8 SHATTERED ZONE				2	J, P, SM, 10 J, P, SM, 90			FRESH - APP DRILL INDUCED
140	140.3 - 140.4 140.7 - 140.8				2	J, P, C, 70 J, C, C, 70			FRESH FRAC MAY BE DRILL INDUCED
	141.3 THICK CALC VEIN 60° TO CORE								
	141.5 - 142.5 SLIGHTLY COARSER ZONE W/ MORE NUM CALC VEIN 141.8 - 141.9 JOINT	28	57/57	36/57	1	J, P-C, R, 65			
142.5	143 - 148.8 FRESH MASSIVE DARK GREENISH GREY (5G 4/1) TO MED BLK GREY (5B 3/1) FINE SS W NUMEROUS V FINE CALCITE VEINS NO SH				0				
					0				
145	145 - 147 FRESH MASSIVE DARK GREENISH GREY (5G 4/1) FINE SS W/ VERY NUMEROUS V FINE CALCITE VEIN NO REG ORIENTATION OBVIOUS, RUBBLIZED IN CORE BARREL VERY THICK CALC VEIN TO ½ IN 147-147.3 IRREGULAR SHAPED				2	J, P, S, 40 J, C, R, 45			V GOOD FIT, DRILL INDUCED
					0	SLIGHT ...	W1	R4	HI MECHANICAL ORIENTATION TO FRACTURES
		E1	2.0/2.0	0.6/2.0	1				
	147.5 - 152.8 FRESH MASSIVE HARD TO V HARD DARK GREENISH GREY (5G 4/1) TO MED BLUE GREY (5B 5/1) MED TO V FINE SS W/ VERY NUMEROUS VEINS CALC VEIN VERY THIN IN IRREGULAR ORIENTATION RARE PLATY CLAY CLAST TO 1 IN THICK 1 TO CORE ... SH ... TO CALCITE VEINS	30	3.6/3.6	2.0/5.6	0				
150					0				

RECORD OF DRILLHOLE # U-5A

SHEET 7 OF 43

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-17-91

DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
150			30	36/36	20/36	1					End of Drill 0600 Begin Drill
	152.6-152.8 SLIGHTLY COARSER ZONE		31	43/43	12/42	0	J.ST, RR, CA, SH 20				
152.5	152.8-161 FRESH MASSIVE DARK GREENISH GREY (5G 4/1) TO MED BLUE GREY (5B 5/1) MED TO V FINE STRONG TO V STRONG SANDSTONE VERY THIN IRREGULARLY ORIENTED CALCITE VEINS THROUGHOUT GIVING APPEARANCE OF HEALED BRECCIA. DISSEMINATED FLAKES OF SHALE <5% THROUGHOUT CORE					3	J.C, SH VR, CA, SH, 162, 0, 20				FRESH DRILL INDUCED
						2	153.4-155.4 J, C VR, =0				
155						2	J.P.R, CA 90; J.P.R, 40		W1	R3	FRESH DRILL INDUCED
							J.AS-R, CA SH 30				VERY JOINT ENDS IN CALCITE VEIN
						0					
157.5			32	56/56	2/56	2	J.P, BRR, 30; J.AR, CA SH 10-20; J.P.R, CA		W1	R4	
						3	J.P.S, SH-R, CA, 70, 60, 20, 30				ALL JOINTS ALONG CALCITE VEINS 160 TO V 160.0 FT. ALL FRESH DRILL INDUCED AS ABOVE
						3	J.C, VR, CA 45				
160	160-162.8 FRESH MASSIVE DARK GREEN GREY (5G 4/1) TO MED BLU GRY (5B 4/1) MED - V FINE STRONG SS W/NUMEROUS V THIN TO THIN CALCITE VEIN					0	J.P.S, CA/SH 30				POSSIBLY DRILL INDUCED
	162.8-164.6					9			W1	R3	RUBBLEIZED VERY ANGULAR PIECES - 5 CM DRILL INDUCED
162.5	162.8-164.6 AS ABOVE W/SIGNIFICANT BLACK LAMINA & MOD THICK CALC VEIN TO 0.3 IN THICK SH TO 15% BY VOLUME					0	J.P, S, CA, 45; J.P.R, SH, CA, 30				
				10/10	7.5/10	1					
165	164.6-170.2 FRESH MASSIVE DARK GREEN GRY (5G 4/1) TO MED BLUE GRY (5B 4/1) MED - FINE STRONG SANDSTONE MANY V THIN CALCITE VEINS SPARSE SHALE LAMINA		33	10/10	10/10	1	J.P.S, SH W/CA 30				
						3					
						17	J, IR, VR, CA 60				
167.5						6	J.P, VR, CA/SH 20				
						0					
170						0					
	170.2-172.3 FRESH, MASSIVE MED BLU GREY (5B 4/1) FINE SANDSTONE STRONG, W/NUMEROUS SH LAMINA TO 1.2 IN THICK & BRECCIATED SS IN SHALE NUMEROUS CALCITE VEINS FROM V THIN TO 0.2 in thick					2	J.P.VR, SH 60		W1	R4	
	172.3-176.5 FRESH MASSIVE MEDIUM BLUE GREY (5B 4/1) FINE TO VERY FINE SANDSTONE STRONG WITH VERY NUMEROUS CALCITE VEINS IN ANGULAR PATTERN VERY THIN TO 0.3 IN RARE VERY THIN CLAY LAMINA		34	10.2/10.2	8.3/10.2	1					
						2	J.P.S, CA, SH 45				
						2	J, IR, S. 45; J.P, S, 40				POSSIBLY DRILLING INDUCED
						1	J.P, SM, CA 60; J.P, SM CA 45; J.P, R, CA 45				DRILLING INDUCED
172.5											

RECORD OF DRILLHOLE # U-5A

SHEET 8 OF 43

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-17-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
175	FRESH MASSIVE MED BLUE GREY (5B 5/1) M-VF. STR SS SOME CALCITE VEIN W/ OMEOC SHALE LAMINA		34	10.3/10.2	8.3/10.2	1	J,PL,SM,CA 40				
	176.3 FINE SANDSTONE W/ THN CALCITE VEINS CALC ON FRAC PLANE W/ SH UNDER					1	J,PL,SM,CA,SH 46				
	176.6 FINE SS W SH STRINGERS ??? JOINT DISTORTED CALC IN SH										JOINT APP DRILL INDUCED
177.5	177.6 TO 177.8 FINE SS W/ FINE CALC VEINS					1	J,R,R,CA				JT APP DRILL INDUCED
						0					
	179.7 179.8 F-VF SANDSTONE W/ THIN SH LAMINAE V. THIN DISCONTINUOUS CALCITE VEINING					0					
180							J,PL,SM,CA,SH 10				
	181.2-182 FINE SANDSTONE W/ V FINE CALCITE VEINING NUMEROUS INTERSECTING FRACTURES					3	J,PL,R→VR,CA 25,60,70		W1	R3	APP DRILLING INDUCED
182.5			35	10.1/10.1	7.8/10.1	0			W1	R4	
						0					
						0					
185						0					
	186.1-186.3 FINE-VFINE SS W/ SH LAMINAE & THIN CALC VEIN					0	J,R,R 45				
187.5						0	J,PL,SM,CA(K) 85				
	188.8 to 189.1 2 thick calcite veinlets. avg thickness 0.5 in.					1	J,PL,SM 40				
						1	J,PL,SM 60				Appears drilling induced
190						0	J,PL,R,CA 20				
	191.3 to 201.4 core [illegible] - most/all fractures appear to be [illegible] [illegible] along [illegible] of slight [illegible] - avg angle 70° to core axis					3	J,PL,SM,CA 70 (K)		W1	R4	
192.5			36	10.1/10.1	7.7/10.1	0					
						0					
	Fresh, massive, [illegible] [illegible] and medium [illegible] [illegible] [illegible]					1	J,PL,SM,CA 70				Maybe drilling induced
195	195.2-195.5 [illegible] of [illegible] calcite in [illegible]					1	J,R,R,C(K) 60				slight [illegible] surface [illegible] - coated joint @ 194.x - 195.x
						0	J,ST,R,(C) 30				
						1	J,PL,SM,CA,K				197.x - 197.x drilling induced fracture along [illegible] calcite vein
						2	J,ST,[illegible] C(K) 35				appears drilling induced
						1	J,PL,SM,C(K)				[illegible] drilling induced
200											

RECORD OF DRILLHOLE # U-5A

SHEET 9 OF 43

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-17-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
200			36	10'/10'	7.7/10'	0			W1	R4	
						1	J, PL, R(Ca) 90				Appears drilling induced
202.5	202.6 to 202.9 Zone of thin calcite veinlets in sandstone matrix 203 Foliation observed in sandstone matrix		37	10'/10'	8.2/10'	2	J, PL, Sm, Ca 40 J, PL, Sm, Ca 35				Green discoloration in area of calcite infilling
						1	J, U, Sm, CA 85		W1	R4	appears drilling induced appears drilling induced
205						2	J, PL, Sm, CA 85 J, PL, Sm, CA 80				- drilling induced
						0					
207.5						0					
						0					
						2	J, PL, Sm, CA 60 J, PL, Sm, CA 60		W1	R4	209.2 to 209.3 open discoloration of calcite in joint RD discoloration of calcite in joint
210						0					
						0	J, PL, SM, CA 60				
212.5	212.7 Calcite vein approx 0.5 in thick		38	10.2/10.2	9.5/10.2	1			W1	R3	
						1	J, PL, SM, CA 60				
						0					
215						0					
						0					
	217.1 to 217.3 Zone of very thin shale layers					0					
217.5						0			W1	R4	
						0					
						0					
220						0					
						0					
						0					
			39	10'/10'	8.1/10'	0			W1	R4	
						0					
225						0					

RECORD OF DRILLHOLE # U-5A

STA. U-5A OFFSET L R
PROJECT NO. 403-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-17-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
225	225 - 225 fracture with calcite veiny-not broken - FeO staining dissolved on calcite					0			W1	R4	
					8'/6'	2	J,U,K(Ca) 20 / J,P,K(Ca) 20				
227.5			39	10'/10'		0					
						0					
	229 to 229 increase of calcite veins. random orientation					0					
230	229 material change - Slightly weathered, massive, very light gray (N8) to light gray (N7), m-c grained, sandstone, angular grains, no increase in lithics					1	S,PL,K,Ca 25		W2	R3	229 shear exhibits FeO staining on calcite
						0					
232.5						0					
						1	J,U,K 30		W3	R3	
235	234 material change, Fresh, massive, very light gray (N8) to light gray (N7), fine sand, strong sandstone		40	10²/10²	5⁴/10²	1	J,U,K 10		W3	R4	
						0					
						1	J,U,K 15		W1	R4	
237.5						0					
	238 to 238 Increase of calcite and Chlorite(?) in sandstone matrix					0	J,PL,SM(Ca) 90				Calcite infilling shows FeO staining
240						1					
	238 Fresh, massive, dark greenish gray (5G 4/1) and medium bluish gray (5B 5/1) m-f, strong sandstone					0					
						0					
242.5						0	J,PL,SM 40				Thin shale layer
				9'/9'	6'/9'	1					
245			41			1	J,PL,SM Ca 7				
	246 to 247 Fresh, massive, gray (N5), m-c grained, strong sandstone					2	J,PL,SM,Ca 30 / J,C,SM,Ca 85				245 slickensides in part of calcite, open ... of clay
	2?? to 250 Fresh, ... greenish gray (5G 4/1) ... strong sandstone					0					
						0					
250						0					

DEPTH SCALE 1" = 5'

RECORD OF DRILLHOLE # U-5A

STA. U-5A OFFSET L R
PROJECT NO. 403-1025
INCLINATION 90 AZIMUTH

ELEVATION - 135
DRILLING DATE 10-18-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
250	250.8 to 251.4 Fresh, massive, light gray (N7), m-c grain, [illegible] Sandstone. Increase of calcite in matrix,		41	9'/9'	6.5'/9'		J, I, R, CA 30; BRECCIATED; J, I, R, CA 30		W1	R2	BRECCIATED
			42	2.3/2.3	0	>10; >10	J, I, C-VR 10; J, P, S, 40; J, P, S, 45; J, P, S, 45; J, P, R, 60		W1	R3	
252.5	253.2 to 254.4 material brecciated										
255			43	2.6/2.6	0	>10; >10					BRECCIATED
257.5			44	2.9/2.9	0	>10; >10	J, P, R, 30; J, P, VR 45; J, P, VR 45; J, P, R, 60				BRECCIATED
260	Fresh, massive, dark greenish gray (5G 4/1) and medium bluish gray (5B 5/1) m-f, strong sandstone (blue ss), calcite veining.		45	4.1/4.1	1.6/4'	1; 2; 1; 2	J, I, VR, CA; J, PL, K (Ca) 30; J, PL, SM (Ca) 40; J, PL, SM (CaK) 40; J, PL, R (CaK) 50; J, I, R (CaK) 20		W1	R4	green discoloration of calcite infilling; green discoloration of calcite infilling; green discoloration of calcite; green discoloration of
	261.3 to 262.4 zone of calcite filled vugs										
262.5	262.5 to 262.7 drilling induced fracture along calcite vein, slight area of slickensides observed; 262.8 to 263.0 slight increase in sand grain size.										
265	Fresh, massive, dark greenish gray (5G 4/1) and medium bluish gray (5B 5/1) m-f strong sandstone; thin calcite veining.		46	10'/10'	6.3/10'	0; 0; 1; 0; 0; 0	J, I, VR (Ca) 30; J, ST, VR (Ca)		W1	R4	Radial pattern noted in infilling, green discoloration in area
267.5											
270						1; 0; 1; 0; 0; 2	J, U, VR (CaK); J, U, K; J, ST, K; [illegible]				[illegible]

RECORD OF DRILLHOLE # U-5A

SHEET 12 OF 43

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90° AZIMUTH
ELEVATION -135
DRILLING DATE 10-18-91
DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
75						2	J, Pl, R J, Pl, R-40 J, Pl, sm 20	10	W1	R1	calcite infilling calcite with clastic infilling
77.5	277' to 277.6' zone of thin shale interbeds		47	10/10	8.4/10	0					
80	280.6 to 281' FeO staining noted in calcite infilling					0					
82.5						0					
85	Fresh, massive, dk greenish gray (5G 4/1) and medium bluish gray (5B 5/1) m-f, stony substone, calcite veining		48	10'/10'	10'/10'	0					
87.5						0					
90						0					
92.5						0					
	295.2 to 296.6' zone of increased igneous segregations, increased calcite infilling, angular to subangular substone		49	10/10	7.3/10	0					
	296.6' Fresh, massive dk greenish gray (5G 4/1) and medium dk gray (5B 4/1), m-f, stony [illegible]					0					
						0					
						0					
						0					
						0					
						2	J, Pl, sm 30				

RECORD OF DRILLHOLE # U-5A

SHEET 13 OF 43

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION ~135
DRILLING DATE 10-18-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
300	Same as above 301[7] to 301[4] Zone of very thin shale laminae		49	10[0]/10[0]	7[3]/10[0]	0 0			W1	R4	
302.5	302[0] to 303[4] Rock fractures at an average angle of 30° along calcite veins when struck 303[4] to 304[0] Calcite vein along axis of core					1 0	J, PL, R 30 J, PL, SM, (460)				
305			50	3[2]/3[2]	0[8]/10[0]	2 3 1	J, PL, SM 60 J, PL, SM, CA 60 J, PL, SM 60 J, PL, R 35 J, PL, R, CA 35		W1	R4	Chlorite(?) discoloration in calcite infilling Calcite infilling not slickensided Calcite infilling FeO. Ob coloration
307.5				8[2]/8[2]	6[6]/8[2]	0 2 0	J, ST, SM 40 J, PL, K 90				
310			51			0 0			W1	R4	
312.5	312[9] to 313[8] Zone of thin shale laminae 313[8] to 314[0] shale zone 314[4] to 315[2] Zone of very thin shale laminae					0 0					
315	316[9] to 317[0] very thin shale laminae, 30° to core axis (average).					0 1	J, ST, R 30				
317.5	318[5] to 319[1] sandstone slightly brecciated (angular) with thin calcite infilling		52	6[4]/6[4]	3[4]/6[4]	0 0 0			W1	R4	
320	321[0] to 321[6] Calcite filled fracture parallel to axis; "soft calcite" @ 321[0], chlorite(?)					1 0	J, I, R (CaK) 60				
322.5	322[5] to 323[0] Zone of thin shale laminae		53	10[1]/10[1]	8[2]/10[1]	0 1 0	J, PL, SM 50				Fracture in shale ... shale ...
325											

RECORD OF DRILLHOLE # U-5A

SHEET 14 OF 43

STA. OFFSET L R
PROJECT NO. 403-1025
INCLINATION 90 AZIMUTH
ELEVATION -135
DRILLING DATE 10-18-91
DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
325						0					
	Fresh, massive, dark greenish gray (5G4/1) and medium bluish gray (5B5/1) m-f, strong sandstone, calcite veins (random to 30° directions from core axis).		53	10/10	8.5/10	0			W1	R4	
327.5						0					
						0					
						0					
330						0					
						0					
332.5	332.8 to 332.9 Slight increase in grain size, slight increase of calcite in ss matrix,		54	6.5/6.5	1.7/6.5	1	J, PL, SM, Ca(k) 20		W1	R4	
						0	J, ST, SM, Ca 30				
335						2	J, PL, SM 50				
	336.5 to 337.7 calcite vein along axis of core, core broken along length of vein					1	J, PL, K, Ca 30				calcite & chlorite (?) infilling
337.5						0					
						0	J, PL, SM, Ca 40				
						2	J, PL, SM, Ca 30		W1	R4	
340	Fresh, massive, dark greenish gray (5G4/1) and medium bluish gray (5B5/1) m-f, strong sandstone, calcite veins.		55	7.8/7.8	4.1/7.8	0					
						1	J, PL, SM Ca				341.5 sand clay thin ...
						0					
342.5						1	J, PL, SM 45				
						0					
				7.0			15				Fracture ... induced
	Same ...		56	7.0/7.0	3.6/7.0		J, PL, K 20				Fracture ... induced
	348.2 to 348.3 calcite ...						J, PL, SM, Ca 50				
350							J, PL, SM, Ca 40				

RECORD OF DRILLHOLE # U5A

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH
ELEVATION −135
DRILLING DATE 10-18-91 10-21-91
DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES / WATER LEVELS / INSTRUMENTATION
350	350 to 350 zone of slightly larger grain size.		56	7.0/7.0	3.8/7.0	6	J,PL,SM,Ca 20; J,PL,SM,Ca 45; J,PL,SM; J,PL,SM		W1	R4	Fractures angular average 40°
	Fresh, massive, dark greenish gray (5G 4/1) to medium bluish gray (5B 5/1) m-f, very strong sandstone, calcite veins.					0					
352.5						0					
						0					
355	355 to 357 calcite vein along axis of core					1	J,PL,R,K,Ca 35				
	357 to 362 increase of very thin calcite veinlets		57	10.0/10.0	5.2/10.0	1	J,R,K,Ca 40				Cemented sand hole adjacent to calcite veinlet
357.5						1	J,PL,K (Ca) 60				Chlorite(?) coloration in calcite
						0			W1	R4	
						0					
360						0	J,PL,R 50				Fracture along shale interbed
						1					
						0					
362.5	362 to 362 zone of very thin shale laminae					0					
	Fresh, massive, dark greenish gray (5G 4/1) to medium bluish gray (5B 5/1) m-f, strong sandstone, thin calcite veins.					0					
365						3	J,PL,SM 55; J,PL,SM; J,PL,SM 65				along thin shale
			58	9.1/9.1	5.5/9.1	1	J,ST,R 30; J,PL,R (Ca) 70		W1	R4	
367.5						1	J,I,K,Ca 30				367 to 368 fracture calcite vein
						1					368 to 369 fracture calcite vein [illegible] 0.75
						0					
370	370 to 370 zone of [illegible] shale laminae					0					370 fracture [illegible] shale interbed
						2	J,ST,R 45; J,PL,SM 22				[illegible]
						0					
372.5	Fresh, massive, dark greenish gray [illegible] to [illegible] [illegible] sandstone, [illegible]		59	10.0/10.0	5.1/10.0	0			W1	R4	
						1	J,[illegible] 45				
375						0					

RECORD OF DRILLHOLE # U5A

SHEET 16 OF 43

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH
ELEVATION -135
DRILLING DATE
DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
375	Fresh, massive, dark greenish gray (5G 4/1) to medium bluish gray (5B 5/1), m-f, strong sandstone; thin calcite veins ≤ average ∠ of 40°		59	10.2/10.2	5.9/10.2	0					
						0					
377.5						1	J, R, R 55		W1	R4	
						1	J, PL, SM 40				
380	380.1 to 380.7 Zone of very thin shale laminae and calcite veins average ∠ 60°					0					
						2	J, R, R 60; J, PL, R 80				fracture along shale intersected @ both fr[illegible]
382.5						0					
						1	J, PL, SM 50				
385	Fresh, massive, dark greenish gray (5G 4/1) to medium bluish gray (5B 5/1), m-f, medium strong sandstone, thin calcite veins no distinct directions.		60	10.1/10.1	6.8/10.1	3	J, I, R 80; J, PL, K 65; J, PL, SM 30		W1	R3	fracture along shale intersected
	386.0 to 387.9 Calcite vein parallel to core axis thickness 0.20 inches, FeO and chlorite (?) discoloration noted.					0	J, PL, SM, K 40				fracture along shale intersected
387.5						1					
						0					
						1	J, ST, K 65				
390	389.8 to 391.0 zone of brecciated sandstone increase of calcite filling, shale laminae					0					
						0					
						0					
392.5						0					
	393.[illegible] [illegible] 30° and 5° to core axis					1	J, PL, K 40				
395	395.[illegible] to 395.[illegible] Zone of [illegible] shale laminae		61	10.3/10.3	4.9/10.3	0					
						0					
	396.9 to 397.9 Zone of brecciated, angular SS with calcite infilling					2	J, C, R, Ca 60; J, PL, K, Ca 15				Soft calcite filling; [illegible] breccia [illegible] soft calcite
						0					
	[illegible] to 39[illegible] Zone of undulating shale laminae					2	J, PL, SM 50; J, ST, SM, Ca, G 10				fracture along shale lam[illegible]
	39[illegible] to 39[illegible] Zone of [illegible] shale laminae						J, PL, [illegible] 30				[illegible]
400	39[illegible] to 400.[illegible] Zone of [illegible] to subangular breccia [illegible]					4	J, PL, SM 60; [illegible] 25				fracture along shale [illegible]

RECORD OF DRILLHOLE # U5A

SHEET 17 OF 43

STA. OFFSET L R

PROJECT NO. 903-1025

INCLINATION 90 AZIMUTH

ELEVATION -135

DRILLING DATE 10-21-91

DATUM

DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES / WATER LEVELS / INSTRUMENTATION
400	397.9 to 400.0 Zone of thin shale laminae					1	J, PL, SM 50; J, ST, SM, CG(K) 10; J, PL, SM 30				Fracture along shale contact
	Fresh massive, dark greenish gray (5G4) to medium bluish gray (5B5) sandstone, thin calcite veins, m-f strong		61	10.2 / 10.2	4.9 / 10.2	2					
402.5						0			W1	R4	
	(403)					1					
	403.0 to 406.2 Zone of shale, thin calcite veins		62	3.4 / 3.4	0.5 / 3.4	>10	J, PL, SM 40; J, PL, K 50		W4	R3	highly fractured shale, believed to be mechanically induced
405						>10	Two Angle 50				
	406.? contact, shale, calcite [illegible] @ 50° [illegible] (5G4) to medium bluish gray					1	J, PL, SM 50				Fracture along shale
407.5	407.0 to 408.2 Fresh, massive, dark greenish gray (5G4) to medium bluish gray (5B5) m-f strong ss thin calcite veins		(40)	(7)		1	J, PL, SM 45		W1	R?	Fracture along shale, infilled
	408.5 to 408.7 Zone of shale laminae, calcite, contact ∡90° to core axis					0					408.9 to 409.4 thin bedded shale
410	408.7 Fresh, massive, dark greenish gray (5G4) to medium bluish gray (5B5), m-f strong ss, thin calcite veins at avg ∡50° to core axis, sparse shale laminae		63	10.0 / 10.0	8.7 / 10.0	0					
						0					
412.5						0					
						0					
						0					
415						1	J, PL, SM 80				
	415.4 to 416.7 (0.20 thick) Calcite veins subparallel to core axis, two stringers cross cut calcite veins in ss at avg 60° to core axis -					0					
417.5						0					
	Faulted shale laminae, 60° to core axis; 418.0 faulted shale laminae 60° contact, 90° layering to CA, residual calcite veins from layered shale			10.0 / 10.0	8.5 / 10.0	2	J, ST, R 50; J, PL, K 50				Fracture at shale layer
	[illegible]		64			0					
420	[illegible]					2	J, PL, SM 70; J, PL, SM 70				Fracture at shale; Fracture at shale
						0					
						0					423.? to 423.? [illegible]
	427.7 material change (60° contact ∡) Fresh, massive, [illegible] 5B5 [illegible]					0					
	[illegible] sparse calcite [illegible] subparallel										

* 430[3] to 430[4] undulating layers of sandstone and shale @ avg. 80° to core axis.

RECORD OF DRILLHOLE # U5A

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH
ELEVATION -135
DRILLING DATE 10-27-91
DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
425	425[5] to 426[0] Zone of brecciated sandstone, very thin shale laminae, and calcite veining.		64	10.0/10.0	8.5/10.0	0					
	426[0] to 428[6] Fresh, massive, grayish blue green (5BG5/2) to dark greenish gray (5G4/1) m-c, very strong sandstone, shale and/or lithic fragments, increase in chlorite(?) in matrix, sparse shale laminae @ 60°.					0			W1	R5	10-21-91 / 10-22-91 @0600
427.5						1	J, U, SM, 40				Fracture along shale interbed
	428[6] contact. Faulted shale, to 428[7]. 428[7] SS - same as above. (428.6)					0					
430	429[5] to 429[8] Calcite & shale laminae (avg 60°), shale with rounded SS fragments grading to SS c̄ shale laminae. 429[8] to 4[?] Zone of shale and calcite layers 85° to core axis. *		65	10.0/10.0	7.0/10.0	2	J, ST, R, 85; J, PL, R, Ca 80		W1	R3	Fracture along shale
	431[5] to 431[7] Zone of shale c̄ brecciated (sub-angular to rounded) sandstone, fractured, 30° to core axis.					1	J, PL, SM, Ca				
432.5	432[2] Change to Fresh, massive, grayish black (W2) and dark gray (W3), medium strong SHALE, sub angular to rounded SS frags between shale laminae. Contact ~90° to core axis. Calcite sparse, [illegible]					2	J, PL, R 10 / 90				Fracture in shale
						1	J, PL, K 45				
						0	J, PL, SM 50				Fracture in shale
435	434[2] to 436[3] (brecciated (angular) sandstone in shale)					2	J, PL, SM 5[?]				Fracture in shale
	43[?] [illegible]					0			W1	R3	
	[illegible] SHALE, [illegible]					0					
437.5	[illegible]					0					
			66	10.0/10.0	9.0/10.0	0					
440						0					
						0	J, PL, SM 52				
442.5	442[3] Contact shale/SS ~70° to core axis					1			W1	R5	
	Fresh, massive grayish blue green (5BG5/2) to dark greenish gray (5G4/1) [illegible] strong SS, sparse [illegible] (70-90° [illegible]) and calcite [illegible]					1	J, C, SM 50				
445						0	J, [illegible] 70				
							J, PL, SM, Ca 30				
			67	1[?]/1[?]	[illegible]	1					
	448[5] to 44[?] [illegible]					0					
450	4[?] [illegible] 80° [illegible]					0					

RECORD OF DRILLHOLE # U5A

SHEET 19 OF 43

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH
ELEVATION -135
DRILLING DATE 10-27-91
DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
450	sandstone and calcite (451.2) 451² to 451⁶ pinched shale zone - [illegible] 451⁶ to 458⁶ Fresh, thinly bedded, (undulatory) grayish black (N2) and dark gray (N3), medium strong SHALE, calcite veiny undulatory, "Rare sandy" Shale "laminae" observed.		67	10⁰/10⁰	6⁶/10⁰	<10, B, 0, 0, B	J.R.Sm 85; J,R,Sm 50; J,PL,Sm 40; JI,UR; J,R,Sm 60; J,PL,Sm 60		W1	R3	along shale; along shale; Area appears mechanically induced - shown as representative ∡'s.
452.5											
455									W1	R2	
457.5	458⁶ material change to grayish black (N2) clay/shaley clay c̄ gypsum crystals (~1.0in), breccia of sandstone fragments, Contact ∡ 40°, calcite vein subparallel to axis of core - 461² Fused calcite veins noted		68	3⁸/4⁰	0⁵/4⁰	B, B, A, A	Calcite veins ∡ 80°; calcite veins ∡ 70°.				Mechanically induced fractures
460	461² to 461⁶ Shear zone, Sandstone breccia in clay/shaley clay matrix		69	4⁰/4¹	1³/4¹	B, A, B, 10			W1	R2	mechanically induced fractures
462.5	462⁶ calcite veins c̄ 80° to core axis. 462⁶ to 467.7 Fresh, thin bedding (trace), grayish black (N2) and dark grey (N3), weak SHALE, calcite veiny (465² to 467⁷ appears tectonically fractured?)										
465			70	3⁶/3⁶	0	≥10, >10, >10, 5	Fracture pattern averages 30°, [illegible] calcite veining		W1	R2	Highly fractured - mechanically induced
467.5	467.7 - 470.8 FRESH GRAYISH BLK (N2) CLAY-SHALE MASSIVE W/RARE LAMINAE SANDSTONE TO 0.2 in NUMEROUS VERY THIN CALCITE VEINS		71	2.1/3.4	0	B, B, B	CALC VEIN ORIENTED 45° FROM CORE DOMINANT FRACTURE ORIENTATION 45°		W1	R2	HIGHLY FRACTURED
470	470.8 — 472.3 FRESH GREYISH BLACK (N2) MASSIVE CLAYSTONE/SHALE WITH SPARSE THIN CALCITE VEINING FIRM - HARD REMNANT SANDSTONE LAMINAE VERY RARE & HIGHLY DISTORTED	No Core									
	472.3 - 473.5 FRESH GREYISH BLK (N2) MASSIVE CLAYSTONE FIRM - SOFT WITH MODERATE THIN HIGHLY DISTORTED CALCITE VEINING BRECCIATED W/ CALCITIC CLAY MATRIX		72	3⁴/3¹	0	5, A	J.P.R. 90; J.P.R. 70; J.R. 30; J.P.R. 90		W1	R2	VERY HIGHLY BRECCIATED OUT IN TACT
	473.5 - 476.4 FRESH GREYISH BLK (N2) MASSIVE TO FAINTLY BEDDED FIRM CLAYSTONE/SHALE BEDDING 30° FROM CORE ORIENTATION SPARSE CALC VEIN THIN HIGHLY DISTORTED JOINTING OF NUMEROUS VEINS - MOD THICK AT 74.7	No Core				A?	J.P.R. 80				MISSING SECTION ASSUMED TO BE SAME
475			73	2¹/2¹	0	A	CALC VEIN 60°		W1	R[illegible]	[illegible] SAME [illegible] FILLED AT [illegible]

RECORD OF DRILLHOLE #U5A

SHEET 20 OF 93

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-22-91

DATUM TOP OF HOLE
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
475	↑ SEE PREVIOUS PAGE (476.4)		73	23/24	0	B			W1	R2	
	No Core										
	476.4 - 480.0 FRESH GRAYISH BLK (W2) MASSIVE FIRM-HARD (FUNCTION OF WETNESS) CLAYSTONE POSSIBLE GHOSTS OF HIGHLY DISTORTED BEDDING MODERATE TO NUMEROUS CALCITE VEIN THIN HIGHLY DISTORTED TO THICK SUB-PLANAR THICK (0.7 in). Siltstone Symbol (15)		74	36/36	0	A, >10	CLAY FILLED 2, CLAY BRECCIA; J, IR, R-VR 10°; J, P-C, R 60-2; J, P, R, 40-2; CALCITE VEIN 20°				10-22-91; 10-23-91 @0630; PARALLEL FRACTURES CLAY FILLED
477.5											
480	480.0 - 481.1 FRESH GREYISH BLK (W2) MASSIVE W/ TRACE GHOST BEDDING HARD CLAYSTONE/SHALE NUMEROUS IRREGULAR THIN CALCITE VEIN HIGHLY DISTORTED W/ BASE TREND 45° TO CORE		75	36/36	3	A, 3	J, W?, R, 90; J, CE, 70; J, P, S, 90, 70		W1	R2	- MECH INDUCED CALCITE VEIN
	481.1 - 481.5 LITHOLOGY AS ABOVE VERY HIGHLY FRACTURED ZONE RUBBLE IN CORE BARREL						RUBBLED ZONE				
	481.5 - 483.6 LITHOLOGY AS ABOVE NOT FRACTURED					B					
482.5	483.6 - 483.7 LITHOLOGY AS ABOVE W/ VERY SIGNIFICANT CALCITE VEINING					5	J, P, R, 45, 60				FRAC ALONG VEIN
	483.7 - 486.4 FRESH GREYISH BLK (W2) MASSIVE FIRM TO HARD CLAYSTONE W/ VERY NUMEROUS CALCITE VEINS, TO .3 in. VEINS HIGHLY CONTORTED DOMINANT TREND SUB PARALLEL TO CORE; 485.4 - 485.9 ½ CORE/ONE SIDE OF CALC VEIN IS CLAY BRECCIA IN CLAY MATRIX SPARSE MOST IF BEDDING & RARE SILTY ZONES		76	22/27	1	B, D, A, B	J, P, R, 45		W1	R2	RUBBLE
485											
	486.4 - 486.9 FRESH GRAY BLK (W2) MASSIVE HARD CLAYSTONE W/ RARE VERY THIN CALCITE VEINS SLIGHTLY DISTORT 45° TO CORE		77	43/43	3	3	CALC VEIN 45		W1	R2	
487.5	486.9 - 487.8 FRESH GRY BLK (W2) BEDDED HARD SHALE W/ VERY NUMEROUS CALCITE VEINS TO 0.2 in THICK 45° FROM CORE WITH THIN (0.2 in) SILTY - SANDY SUB-PARALLEL BEDS HIGHLY DEFORMED						J, P, S, 45; J, P, S, 60				JOINT ALONG PRIMARY CALCITE VEIN
	487.8 - 489.9 FRESH MASSIVE GRY BLK HARD CLAYSTONE WITH RARE THIN CALCITE VEIN MODERATELY BUT IRREGULARLY FRACTURED DID NOT PART DURING DRILLING						J, P, R, 20				JOINT 90° DRILL INDUCED ALONG CALCITE VEINS
490	489.9 - 490.7 LITHOLOGY AS ABOVE VERY HIGHLY FRACTURED					D	RUBBLED				DRILL INDUCED
	490.7 - 493.0 FRESH GRY BLK (W2) MASSIVE FIRM CLAYSTONE WITH SPARSE THIN & RARE MEDIUM CALCITE VEINS (493)			MISSING / MISSING			MISSING SECTION SAMPLE? RUBBLED?				
			77	39/39	3	4	J, P, S, 60; J, P, R, 45; J, P, R, 60; CALC VEIN 70		W1	R2	
492.5							J, P, R, 45; J, P, S 70, 40; J, P, S, 45; J, P, S, 90, 60; J, R, R 45				
	493 - 494¹ FRESH GRY BLK (W2) TO MEDIUM BLUE GREY (5B 5/1) BEDDED MED → FINE SANDSTONE W/ TRACE CALCITE CEMENT UPPER 3 in VEIN ABSENT. 4 in DISTORTED INTERCALATED/BRECCIATED SANDSTONE/SHALE LOWER 9 in SANDSTONE SOMEWHAT BRECCIATED W/ CALCITE CEMENT & MODERATE CALCITE VEINS TO 0.3 in ‖ TO BEDDING FABRIC 1.2 in OF SHALE IN SHALE?						CALC VEIN 45			R3 R4	
495	494¹ - 497⁵ FRESH GRY BLK (W2) TO MEDIUM BLUE GREY (5B 5/1) INTERCALATED FINE SANDSTONE AND SHALE BEDDING 45° TO CORE NUMEROUS VERY FINE CALCITE VEINS CORE SHOWS HEALED BRECCIATION W/ CLAY & CALCITE AS MATRIX & MINOR HEALED VERTICAL FAULT W/ .2 in OFFSET VERY MINOR CALCITE CEMENT IN RK MATRIX OF SANDSTONE NO MATRIX CALCITE IN SHALE OVERALL COMPOSITION 75% SANDSTONE 25% SHALE <1% CALCITE SHALE % DECREASES SOMEWHAT W/ DEPTH		78	34/34	0	B			W1	R1 R3	CORE SHATTERED DOMINANT TREND 45° FROM CORE AXIS MINOR TRENDS 60° & 90° ON FRAC ⊥ TO CORE
	497⁵ - 498⁹ FRESH GRY BLK (W2) TO MED BLUE GRY (5B 5/1) INTERCALATED FINE GRAINED HARD SANDSTONE AND FIRM - HARD SHALES WITH NUMEROUS CALCITE VEIN (VCG?) HIGHLY DEFORMED 497⁵ - 498⁴ ALSO BRECCIATED IN CLAY MATRIX SAND CONTENT 60%		79	35/35	5	B	J, P, S, 54, 60 BRECCIA; J, P, S, 54, U		W1	R1/R3	
500	498⁹ - 500 FRESH BEDDED GRY BLK (W2) HARDISH W/ SPARSE CALCITE VEIN					? SEE MASS					SEVERAL BEDPLANE FAILURES DUE TO DRILLING

RECORD OF DRILLHOLE # U5A

SHEET 21 OF 43

STA. OFFSET L R

PROJECT NO. 903-1025

INCLINATION 90 AZIMUTH

ELEVATION -135

DRILLING DATE

DATUM

DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
500	500.0 - 500.8 FRESH BEDDED FINE HARD SANDSTONE BEDDING DEFINED BY CLAY RICH LAMINAE BEDDING 45° TO CORE MODERATELY DEFORMED W/ RARE CALCITE VEIN		79	(500.8)		3	J, P, Sm, 45		W1	R3	
	500.8 503.0 FRESH BEDDED GRY BLK (W2) TO MED BLU GRY (5B 5/1) HARD TO FIRM SHALE WITH SPARSE BEDS (1/4") OF FINE SANDSTONE WITH SOME THIN CALCITE VEIN ... TO BEDDING X-BEDDING VISIBLE LITTLE BED ... VEIN DISTORTION						J, P, Sm, 45			R1 / R3	
502.5	503.0 - 505.2 FRESH BED GRY BLK (W2) HARD SH W/ RARE SANDSTONE BEDS SPARSE CALCITE VEINING ONE CALCITE VEIN 90° ... 3 IN THICK						J, F, Sm, 50 / J, P, Sm, 50, 80, 45, 60				3 SAND BED BETWEEN ...
			80	2.2 / 2.2	0	B					SHATTERED IN DRILL
505	505.2 - 506.9 FRESH BED GRY BLK (W2) TO MED BLU GRY (5B 5/1) HARD TO FIRM SH W/ SOME SS BEDS & BRECCIA FRAGMENTS SPARSE THIN CALCITE VEINING LOWER .5 FT BEDDED SH ON ONE SIDE OF VERT CALC VEIN & BRECCIA ON OTHER DOM. BEDDING ORIENTATION 45° FROM CORE AXIS										DOMINANT TREND 45-60° FROM CORE AXIS ⊥ TO BEDDING
			81	1.7 / 1.7	0	A	CALCITE VEIN 0°		W1	R1	SHATTERED BRECCIATED ZONES SH & SS IN CLAY MATRIX. VERT CALC FRAC FILLING. DOM FRACTREND 45° (⊥ TO BEDDING)
507.5	506.9 509.8 FRESH BEDDED & BRECCIATED GRY BLK (W2) TO MED BLU GRY (5B 4/1) HARD TO FIRM SANDSTONE & SHALE W/ OBVIOUS THIN TO VERY THIN HIGHLY DISTORTED CALCITE VEIN		82	2.1 / 2.1	0	10 / A	J, P, S, CA, 45 ONE @ 60 / JP, SS, 45		W	R1	2 IN SH BRECCIA W/ CP AROUND ...
510	509.8 - 511.2 FRESH BEDDED GRY BLK (W2) TO MED BLU GRY (5B 5/1) HARD FINE SANDSTONE & SHALE W/ SPARSE THIN CALCITE VEIN		83	2.1 / 2.1	1	A	MISSING		W1	R2	RUBBLIZED BRECCIA ZONE
	511.2 - 512.7 FRESH BEDDED GRY BLK (W2) HARD SH W/ RARE CALCITE VEIN SUB PARALLEL TO BEDDING. SOME PERPENDICULAR & DISTORTED BEDDING 60° TO CORE					3	J, P, S, Sm, 60 / J, R, R, Sm, 90				DRILL INDUCED
512.5						A	J, R, R, 90				BRECCIA ZONE?
	512.7 - 514.1 FRESH BEDDED GRY BLK (W2) TO MED BLU GRY (5B 5/1) HARD SHALE (80%) AND FINE SANDSTONE (20%) W/ RARE THIN CALCITE VEIN BEDDING 45° ... ENTIRE INTERVAL BRECCIATED		84	1.4 / 1.4	0	A	DOM FRACTREND 20° ... (40°)		W	R2	BRECCIATED & CRUSHED IN DRILLING
515	514.1 - 515.2 FRESH BEDDED GRY BLK (W2) HARD SHALE W/ RARE THIN CALCITE VEIN MOST ⊥ TO BEDDING ...		85	1.2 / 1.2	0	4 / B	J, P, S, SH 45 / J, P, S, CA, 45		W1	R2	DOMINANT TREND 45°
	Fresh bedded gry blk (W2) hard shale, rare thin calcite veins 20° to core axis		86	1.0 / 2.0	0	B / B			W1	R2	
517.5			No	Core							
	Same as above with sh/ss laminae in 1.5± ...		87	1.6 / 1.6	0	B / A&B	J, M, Sm, ...		W1	R2	10-23-91 / 10-24-91
520	...		N	Core							
	520.5 - 523.5 FRESH BEDDED (CONTORTED) GRY BLK (W2) AND MED BLU GRY (5B 5/1) HARD SHALE AND FINE SANDSTONE BEDDING 60° FROM CORE AXIS CALCITE VEINS RARE AND PERPENDICULAR TO BEDDING. PYRITE MINERALIZATION ... ONE FRACTURE 80% ...		88	3.0 / 3.0	0	>10 / B	JOINT SURFACES SMOOTH SHALE OR SHALE ON ONE FACE CALCITE ON OTHER		W1	R2	DRILLING INDUCED BUT FAILURE ALONG BEDDING OR CALCITE VEINING
	523.5 - 524.8 FRESH BEDDED GRY BLK (W2) HARD SHALE ... RARE CALCITE ... SAND LAMINAE					A	FULVERIZED ...				
			89	1.3 / 1.3	0	B					
525	524.9 → SEE NEXT SHEET										

RECORD OF DRILLHOLE # USA

SHEET 22 OF 43

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-23/24

DATUM
DRILL RIG

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
525	524 - 526 FRESH INTERBEDDED GRY BLK (W2) TO MED BLU GRY (5B 5/1) HARD FINE SANDSTONE AND SHALE CONTORTED BEDDING RARE CALCITE VEINING NO CORE IN SHOE		90	15/15	0	A			W1	R3	JOINT/FRACTURE SEEMS RANDOM
	526 - 529 FRESH BEDDED AND INTERBEDDED GRY BLK (W2) HARD SHALE AND MED BLUE GRAY HARD FINE-VERY FINE SANDSTONE. RARE THIN CALCITE VEINS 527-527 PARTIC- ULARLY SANDY OVERALL (ASSUMING LOST CORE IS SHALE) 65% SH 35% SS SS SHOW MINOR DEFORMATION & BEDDING SPACING IN PULVERIZED AREA MODERATELY PLASTIC W/ SOME SILT / SAND					NO RECOVERY	CORE LOST				
527.5			91	22/18	0	A	SEVERAL PARTIALLY JOINTS PARTIALLY HEALED W/ CALCITE		W1	R3	DOMINANT FRACTURE TREND ⊥ TO BEDDING 45°
	529 - 531 - 0.4 FT FAIRLY GOOD CONDITION REST OF CORE BARELY RECOVERED - AS ABOVE ON VERTICAL CALCITE VEIN & 2 IN THICK ON CLAY FILLED FRACTURE REST OF SECTION UNDESCRIBABLE					NO RECOVERY	CORE LOST				
530			92	22/12	0	B, A	(MISSING CORE / NO RECOVERY)		W1	R2	
	531 - 529 - AS ABOVE 531 - 532 SOMEWHAT MORE COMPETENT FRESH BEDDED GRY BLK (W2) HARD SHALE W/ SPARSE VERY THIN TO THIN CALCITE VEIN SOME LAMINA SILTY W/ TRACE SAND?		93	23/12	0	B	MISSING SECTION NOT RECOVERY		W1	R1	GENERAL FRACTURE PATTERN 45° 60° SUBSET X-CUTTING NEAR 30°
532.5											
	10 AM TRIP FOR BIT										
535	534 - 536 FRESH BEDDED GREY BLK (W2) HARD SHALE AND MED BLUGREY HARD FINE-VERY FINE SANDSTONE W/ SOME CALCITE VEINING PREDOMINATELY IN SANDSTONE GRADATIONAL INTERBEDDING SHALE - SS CONTACT 60% SS 40% SH		94	18/18	2	3	J.I.R. SM 45 J.P. SM 45 VERTICAL VEIN		W1	R3	TRIP FOR BIT
	536 - 539 FRESH INTERBEDDED GRY BLK (W2) HARD SHALE AND MED BLUE GRY HARD VERY FINE-FINE SANDSTONE W/ TRACE ... VERY RARE CALCITE VEINS PULVERIZED ZONE SOFT CLAY SANDSTONE BEDS INTERNALLY DISTORTED 80% SS 20% SH VERY RARE PYRITE ... FRACTURES		95	24/20	1	B, 2	J.P.S. 80 J.P.S. 60		W1	R2-R3	JOINT ⊥ TO BEDDING JOINT ∥ TO BEDDING
537.5						B, A					DOMINANT TREND 60° ON SMOOTH VERT FRAC CONTAINED PYRITE
							NO RECOVERY				
	539 - 543 FRESH BEDDED GRY BLK (W2) HARD - FIRM SHALE WITH SPARSE MED BLUGRY HARD FINE-VERY FINE SANDSTONE BEDS AT 30° TO CORE SOME FINE TO MEDIUM CALCITE VEINS TENDING TO BE GROUPED IN SWARMS - SHALE BEDS TO 1.2 IN W/ SIGNIFICANT (20%)? SAND CONTENT NO SAND BED EXCEEDS 2 IN SHALE 70-80% SS 20-30% PULVERIZED ZONES CONSIST OF SHALE CLASTS IN CLAY MATRIX		96	42/41	2	3	J.P.S. 60		W1	R1	⊥ TO BEDDING
540						6	J.P.S. CA 30 J.F.R. 45 J.P. S.P. 90 J.C.R. 90 (J.F.R. CA 30)				⊥ TO BEDDING P = PASTE CALCITE ON JOINT FACE
						6	CRUSHED ZONE				
542.5	543 - 545 FRESH BEDDED GRY BLK (W2) HARD SHALE W/ SPARSE MED BLU GRY HARD VERY FINE TO FINE SANDSTONE BEDS VERY NEARLY PARALLEL TO CORE (20°) 20% SS 80% SHALE RARE CALCITE VEINING CONCENTRATED IN SHEARED ZONES SHALE CLASTS IN CLAY MATRIX					>10	SHATTERED				PULVERIZED ZONE SHATTERING BETWEEN PULV. ZONES DUE TO DRILLING?
			97	21/14	1	B, A	NO RECOVERY PRESUMED SHEARED ZONE		W1	R1	PULVERIZED?
545	545 - 547 AS ABOVE ENTIRE CORE SHATTERED - BRECCIATED ON ZONES BUT DID NOT SEPARATE IN CORING										
	547 - 550		98	12/12	0	B	SHATTERED		W1	R1 R2	
	FRESH BEDDED GRY BLK (W2) HARD SHALE W/ SOME MED BLUGRY HARD VERY FINE - FINE SANDSTONE BEDDING 45° TO CORE SPARSE THIN - MODERATE (1.3 in) CALCITE VEINING ... RANDOM ORIENTATIONS BUT DOMINANT ⊥ TO BEDDING		99	22/22	0	D	J.P.R. 60 J.P.S. 45 J.P.S. 80, 30, 60 J.P.S. 45		W1	R1	
550											

DEPTH SCALE 1" = 2 FT

RECORD OF DRILLHOLE # 05A

SHEET 23 OF 43

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-24

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA – TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES – WATER LEVELS – INSTRUMENTATION
550	550¹ → 552³ FRESH BEDDED/X-BEDDED GRY BLK(W2) TO MED BLU GRY (5B 5/1) HARD SHALE AND FINE SANDSTONE W/ SPARSE CALCITE VEIN DOMINANTLY ∥ TO BEDDING SUB SET ∥ TO CORE (VERTICAL) 3 IN SAND BED - X BEDDED W/ TRACE FRACTURES? & VERTICAL CALCITE VEIN AT 551²		100	2²/2²	0	A, 7	J,P,S 45; J,P,S, CA 60; J,P,S, ≠ 60; J,P,S, 80		W	R2-R3	∥ TO BEDDING; SAND/SHAL CONTACT
552.5	552³ [illegible] AS ABOVE SHALE; 553⁰-553² SANDSTONE AS ABOVE; 553²-555³ INTERBEDDED SHALE/SANDSTONE FRESH BEDDED/INTERBEDDED GY BLK (W2) TO MED BLUE GRY (5B 5/1) HARD TO FIRM SANDSTONE AND SHALE W/ NUMEROUS CALCITE VEINS CONFINED TO SHALE LAYERS BEDS 60-20° TO CORE		101	2³/2³	0	A, A	J,P,S 45 CA; J,P,S, 45		W1	R2-R3	
555	555³-557⁸ FRESH BEDDED GRY BLK (W2) HARD TO FIRM SHALE WITH SOME LAMINA/BEDS MED BLUE GRY (5B 5/1) HARD SANDSTONE MOST OF CORE HEALED BRECCIA MIXED WITH CLAY & CALCITE CMT		102	2⁶/2⁶	0	A	BRECCIA ZONE PARTIALLY CLAY MATRIX PARTIALLY CALCITE MATRIX		W	R2	FRAC/JOINTS 45°/60° W/ BEDDING 0°
557.5	557⁸-561² MASSIVE GRY BLK (W2) FIRM TO HARD CLAYSTONE W/ VERY RARE SILTY LAMINA TRACES OF BEDDING? AT 30° TO CORE SPARSE CALCITE VEINS ∥ TO SUB ∥ TO BEDDING TO 1/3 IN THICK		103	4⁵/4⁵	2	5, 2	J,P,R, CA 80; J,P,R, CA 55; J,P,R 80; J,P,S, 80		W1	R1	
560	561³ → 562³ BEDDED/CONTORTED MEDIUM BLU GRY (5B 5/1) HARD MEDIUM TO COARSE SANDSTONE SLUMPED OR BRECCIATED INTO CLAY MATRIX W/ NUMEROUS CONTORTED CALCITE VEINS					B, 2	CRUSHED			R2	BRECCIA?
562.5	562³-563¹ BRECCIATED GRY BLK (W2) FIRM SHALE IN CLAY MATRIX - FRAC FILLING WITH NUMEROUS CALCITE VEINS; 563¹-564² BEDDED/CONTORTED MEDIUM BLU GRY (5B 5/1) HARD MEDIUM SANDSTONE SLUMPED/FOLDED BASIC BEDDING 30° TO CORE WITH MODERATE IRREGULAR CALCITE VEINING - TRACE PYRITE ON BEDDING FRACTURE (ROSES) CALCITE ALSO ON VERT FRACS.		104	3⁵/3⁵		A, >10, A	IRREGULAR BASIC TRENDS 45°; J,A,B,M, FES, 20-0		W	R1	BRECCIA
565	564²-566 AS ABOVE INTERBEDDED W/ ONLY MINOR DISTORTIONS					8	J,P,S CA 45; J,P,S, 80				BRECCIA; J,P,R, 90
						NO RECOVERY					
567.5	566⁷-566⁴ SANDSTONE AS ABOVE MEDIUM - COARSE; 566⁴-567⁴ AA INTERBEDDED SHALE 80% SS 20%; 567⁴-567⁸ SANDSTONE AA; 567⁸-568⁶ SHALE AA HIGHLY BRECCIATED IN CALCITE MATRIX SINGLE TERMINATE CALCITE VEIN 1/4 IN		105	2⁴/2⁸	0	5, 7/0, B	J,R,R, 80; J,C,R, 60; J,P,S, 45; J 60° W/ 1 SPOSET		W1	R2	RECOV PART OF PREV. CORE; SHATTERED
570	568⁶-571⁴ BEDDED MEDIUM BLU GRY (5B 5/1) HARD FINE-MEDIUM SANDSTONE W/ SPARSE CLAY LAMINA & CALCITE VEINING PYRITE ROSES COMMON ON FRACTURE FACES ON RE & CALCITE		106	2⁸/2⁸	2	7/0, 2	J,P,R, CA 45; J,P,R, CA 80; J,C,R, CA 45		W	R2	SHATTERED
572.5	571⁴-572² BEDDED HARD MED-FINE SS. AS ABOVE ONE MAJOR CALCITE VEIN TR PYRITE; 572²-575⁴ BEDDED GRY BLK (W2) FIRM-HARD SHALE W/ CALCITE VEINS SHATTERED & BRECCIA ZONE - MINOR INTERBEDS OF MEDIUM BLU GRY (5B 5/1) FINE-VERY FINE SANDSTONE TO SILTSTONE MINOR PYRITE & CALCITE LINING FRACTURES DISPLACEMENT OF BEDDING ACROSS FRACTURES COMMON		107	4⁰/4¹	1	7/8, 1, 10	J,P,S, SH 60; J,R,R, SH 45; J,P,P CA 0		W	R2	SHATTERED; CONTACT W/ SHA
575						A	CRUSHED				BRECCIA?

DEPTH SCALE 1" = 2.5'

RECORD OF DRILLHOLE #U5A

SHEET 24 OF 43

STA. U5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-25, 10-28, 91

DATUM
DRILL RIG

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
575	575¹-577⁶ MASSIVE BRECCIATED GRY BLK (W2) HARD SHALE W/ FRAGMENTS & DISTORTED GRABS OF VERY FINE-FINE SANDSTONE VERY NUMEROUS VERY THIN TO THICK, 4in CALCITE VEINING INTER FRAGMENTAL CLAY ~~BEARING~~ MATRIX		107 / 108	2² / 2²	0	A / B			W1	R2	MAJOR FRAC TREND 30° TO CORE
577.5	577⁶-580² MASSIVE W/ MINOR BEDDING GRY BLK (W2) HARD-FIRM SHALE W/ BROWN LOCALLY. PYRITE ROSES COMMON ON FRACTURE FACES SPARSE CALCITE IN RANDOM ORIENTATIONS RARE DISSEMINATED PYRITE RHOMBS. ~~BOTTOM~~		109			A / B			W1	R1, R2	NO MAJOR FRACTURE TREND DISCERNABLE
580	580²-582¹ BEDDED/CONTORTED/FAULTED GRY BLK (W2) HARD-FIRM SHALE W/ MINOR SS NUMEROUS VERY FINE TO FINE CALCITE VEINS PYRITE ROSES COMMON ON FRACTURE FACES RARE DISSEMINATED RHOMBS BEDDING NEAR ⊥ TO CORE		110	2⁶ / 2⁶	1	B / B	S, P, VR, P/CA 45				BOTTOM 2IN CLAY MUSH; 45° TREND; PYRITE VEG. (?) OF FRACTURE FACES
582.5	582⁴-585² AS ABOVE WITH SOME MORE BEDDED MEDIUM BLU GRY (5B 5/1) VERY FINE CONTORTED SS		111	2⁴ / 2⁴	0	A / B / B	J, P, S, 60; J, P, S, 30				MUSH
585	585⁰-587⁶ AS ABOVE 80% SHALE 20% SANDSTONE MINIMAL CALCITE BEDDING SOMEWHAT MORE CONTORTED		112	2⁶ / 2⁶	0	>10 / B	J, J-P, VR, S-R, CALCITE & PYRITE				MUSH A
587.5	587⁶-589⁷ AS ABOVE		113	2⁸ / 2¹	0	B / B					
590	589⁷ to 594⁴ Massive, brecciated gray black (W2) strong shale, very thin calcite veining. 591² to 591⁷ Zone of angular brecciated shale, numerous calcite veinlets. Sections of calcite veins noted through out core section of rock ~½ inch. Material pulverized, (brecciated shale fragments) and clay		114	4⁶ / 4⁹	1⁹ / 4⁶	1 / 1 / 1 / H / A	J, I, R 50; J, St, R 30; J, I, ve 50		W1	R4	Fractures appear mechanically induced
595	594⁴ to 596⁰ massive gray, black (W2) m. strong [illegible] ... @ 60° [illegible] ... wind, SS increasing. 596⁰ contact to SS. 596⁰ to 598⁵ zone of SS & shale. Zone about ⅓ of core. Shale zone exhibits angular to subangular SS fragments. Calcite zone observed @ 597³ to 597⁷ with shale zone very fine shale breccia / calcite [illegible] in this zone. 597⁷ to 598⁵ [illegible] of shale, SS [illegible] with shale zone. Contact @ 598⁵ shale / SS ~25°	NO CORE	115 / 116	2² / 2² ; 5² / 5²	0 / 5² / 5²	B / B / B / B	S, R, K; J, I, R 60; J, R, 30; S, R, K; J, I, R; J, R, R 30; J, I, R 20; J, M, K(ca) 30; J, M, S(ca) 30		W1	R3	Fractures [illegible], calcite [illegible] [illegible] fractures [illegible]; calcite infilled [illegible] shale fragments
600											

DEPTH SCALE 1" = 2.5'

RECORD OF DRILLHOLE # U5A

SHEET 25 OF 43

STA. U5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-28-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES / WATER LEVELS / INSTRUMENTATION
	598° ss - massive, medium gray (N5) to med dark gray (N4) m-c grain, strong ss, intermittent calcite veining non-oriented to veins @ 60° to CA										
600			116	5.8/5.8	2.5/5.8	B	J, PL, SM (CA)		W1	R4	
						1	J, PL, R 90; Zone of mech. induced fractures - avg 2 of 30° to CA; 95				Appears mechanically induced
602.5	602° to 607² massive, medium gray (N5) to med dark gray (N4) m-c grain, strong ss, calcite veining @ avg 60° to core axis, increase of calcite veins from 604° trend of run. calcite veins of 1/10 inch to 604°, 604² to 607² veins not typed.					1	J, PL, SM; J, PL, K (CA) 60				Appears mechanically induced
			117	5.2/5.2	4.9/5.2	0			W1	R4	
605						1	J, ST, R (CA) 85				Chlorite (?) coating of calcite infilling. Fracture along calcite layer
						0					
						0					
607.5	607½ to 608 zone of ss c fine to med grain ss, calcite veining does not cross sandstone, fine grained ss boundaries. 607² to 608° fine grain ss c shale laminae. Course grained ss adjacent is angularly fractured.					0					
			118	5.2/5.2	3.8/5.2	1	J, PL, SM (CA) changing to 30; J, I, R.		W1	R4	
610	608² to 612⁴ sandstone - same as noted above.					1	J, PL, K 90 changing to J, I, R 30; J, PL, SM				
						1					
612.5	612⁴ to 617⁵ same as above c					0					
						1	J, PL, SM 70				Fracture along calcite vein
			119	5.1/5.1	3.2/5.1	0			W1	R4	
615	616° to 617⁵ mechanically crushed, fracture angle 5° to 10° to core axis, slight increase of grain size.					0	J, U, K (CA) 20				
						B	J, I, VR 30				
617.5						B	J, PL, SM (K) 40				
	Same as above		120	5.2/5.2	1.4/5.2	1			W1	R4	
						0					
620	620° to 621² Fracture along axis of core R to ... crystalline (...) appeared.					B	J, PL, R (CA); parallel K 20; J, PL, R; J, R, K (CA); J, I, VR; Crystalline (needle) infilling; J, R, K				Pyrite noted in calcite infilling, crystalline (...) filling in vug of calcite
						B					Crystalline infilling - clear to yellowish-brown
						B	40				
	622² to 623² shale fragments. At this interval - 50% SH, 50% SS, fracture along shale @ 623²					B	J, PL, SM (CA); J, I, VR				
	Same as above		121	3.2/3.2	0	B	J, U, SM 60; J, R, SM (CA); J, R, SM (CA) 70		W1	R4	
625						B	J, PL, SM (CA) 70				Fine to coarse-grained druse of calcite

DEPTH SCALE

RECORD OF DRILLHOLE # U5A

STA. U-5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-28-91

DATUM [redacted]
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
625	massive, medium gray (N5) to med. dark gray (N4) m-c grain, medium strong SS, intermittent calcite vein at 30° to random orientation.		121	3 1/3 1	0	B			WI	RB	Fractures healed ⊥ to core axis
						0	J, ST, R	25°			
627.5	628 2 to 629 1 Zone of fine grained ss and shale, dark gray (N3) with undulating shale laminae, contact K'd with ss ~40° on each end.		122	5 2/5 2	2 5/5 2	1	J, PL, SM, CA	20	WI	R3	Mechanically induced
						0	J, R, Ca	0°, ⊥			
630	massive, medium gray (N5) to med dark gray (N4) m-c grain, medium strong ss, intermittent calcite vein at 30° to random orientation					1					
						0	J, PL, SM				
	Same as above with ... shale laminae @ 15° to core axis					B	J, PL, SM (Ca)	30			gray (calcite?) infilling (K)↑
632.5			123	5 1/5 1	1 7/5 1	B	J, PL, SM (Ca) ... fractured	30			gray infilling material clayey / calcite (gouge?)
						B	J, U, R (K?) mechanically induced	15°			633 3 to 633 6 increase Chlorite(?) in matrix
635						0					
	Fresh, massive, med. gray (N5) to olive gray (5Y 4/2), m-coarse grained, medium strong SS, rare fragmented calcite veins, occasionally @ 85° to core axis.					0					
637.5						0	J, PL, SM, CA	25°	WI	R3	along calcite vein MI
	638 4 - ss w/ shale laminae - thickness to max of 1 inch.		124	5 3/5 2	2 0/5 3	3	J, PL, SM / J, PL, K / J, R, K	20, 25, 30			
	639 0 thin shale laminae; 639 1 to 640 2 mechanically broken, coarse-grain SS					B	J, PL, SM (K)	40			
640						B	J, U, R, (K) Ca / J, PL, SM	40			possible fracture along shale laminae
						B	J, PL, SM	40			Foliation of shale ...
642.5						1	J, ST, R, Ca				
	Same as above, calcite veining @ 60° to axis (average), strong ss,		125	5 1/5 1	2 1/5 1	2	J, PL, SM, CA / J, PL, SM, Ca	40, 00	WI	R3	
						0	J, PL, SM, Ca / J, ...				
						?					
						0					647 ...
	647 5 to 64? Zone of ... coarse ss, 647 5 to 64? clay ... (fragments ... 1/5 inch) ... at angle of 20° to core axis, ...						J, PL, SM, Ca ...	10	WI		
			126	5 2/5 3	2 5/5 2	2	... J, R, R	25			
						B	J, R, K, Ca	70	WI	R4	
650						1	J, ...	20			

RECORD OF DRILLHOLE # U5A

SHEET 27 OF 43

STA. U5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-28, 10-29, 1991

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
650	Fresh, massive, med gray (N5) to olive gray (5Y 3/2), m-coarse grained, strong SS, rare fragmented calcite @ 60° to core axis		126	5.3/5.3	2.5/5.3	0, 0			W1	R4	
652.5						0, 1			W1	R4	653.3 Zone of thin calcite veins @ 60° to core axis
655	same as above		127	5.0/5.0	2.7/5.0	2, 2, B	J, PL, K, Ca; J, PL, SM; J, PL, SM, Ca; J, PL, SM, Ca; J, PL, SM, Ca	30, 30, 50, 40, 60			Fracture along shale lamina
657.5	same as above 654.2 to 659.8 zone of SS and angular fragments of shaly/SS, very fine grain SS, grayish black (N2) to olive gray (5Y 4/1) 659.8 to 660' zone of very fine SS, shaly SS, grayish black (N2) to olive gray (5Y 4/1). at angle of 40° to CA. Slight increase of calcite veinlets, random orientation		128	4.0/4.0	0.9/5.0	B, B, B	J, PL, SM, Ca; S, PL, K, Ca; J, PL, SM, Ca; J, I, R, Ca; J, PL, SM, Ca	70, 30, 40, 50			Chlorite(?) and calcite; Fracture along 659.3 (?)
660	660.2 return to coarse grain SS as above					B	J, ST, K, Ca; SHALE/Gneiss MI fractures	60			
662.5	same as above with increase of calcite veins 40° to CA, sub-veining series @ 60° to CA, fractures along calcite veins		129	3.4/3.4	0	B, B, B	J, PL, SM; J, PL, K, Ca; J, PL, SM; J, PL, SM, Ca; J, PL, SM, Ca	50, 40, 60, 60, 60	W1	R	Fracture along shale lamina; Chlorite(?) and calcite
665	same as above		130	3.3/3.3	0	B, B, B	J, PL, SM, Ca; J, PL, SM, Ca 70; K on contact joint; J, PL, SM, Ca with chlorite; J, PL, SM, Ca; J, PL, SM; J, PL, K, Ca 60	40, 50			Chlorite(?) coloration of calcite; J, PL, SM; Fracture along lamina shale/SS.
667.5	667.2 Contact to shale @ 40° to core axis 668.0 to 668.8 mechanically crushed - dominant fracture angle is 30° to core axis. Material - fresh, massive to generally thinly bedded, grayish black (N2), minimal fine sand, strong SHALE. sparse calcite banding @ 65° to core axis. laminae of SS/shale @ 20° to core axis approx 669.2 to 669.8. 671.2 change of bedding laminae from ~85° to core axis to 50° to core axis.		131	5.3/5.3	2.9/5.3	B, 0, 0, B, 0	Ave 60; J, I, R	50	W1	R4	
675	same as above with [illegible] laminae of SS/shale (like bedding?) @ 30° to core axis, sparse pyrite		132	5.1/5.1	2.3/5.1	2, B	J, I [illegible]; Mechanical [illegible]	60			

DEPTH SCALE 1" = 2.5'

RECORD OF DRILLHOLE #U5A

STA. U5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH
ELEVATION -135
DRILLING DATE 10-24-91
DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION
675	675.2 Material change to sandstone @ 50° to core axis. Fresh, massive, red gray (N5) to olive gray (5Y 4/2) m-c grained, strong SANDSTONE; calcite veining sparse @ 40° to core axis. 675.1 to 675.5 shale lamina @ 70° to core axis.
677.5	675.5 to 678.1 SANDSTONE as described above, rare thin shale lamina @ 60° to core axis.
	Fresh, massive, red gray (N5) to olive gray (5Y 3/2), m-c grained, strong to very strong SANDSTONE. Calcite veins rare, calcite randomly in "pods" approx ½ inch length and width, "ghost" calcite banding at 60° to core.
680	
682.5	same as above. 682.9 ¼" thick vein of quartz(?) and calcite. 683.0 to 683.3 zone of quartz(?) and calcite. 683.8 change to fine to med grain SANDSTONE, contact at ~50° to core axis, some calcite veining at 60° to core axis, [illegible] offset only 1/10 inch, to obscured, fewer lithics.
685	686.4 material change to m-c grain SANDSTONE, random calcite veinlet orientation, increase of lithic fragments.
687.5	687.1 to 687.9 zone of fine ss and shaley lamina, calcite veins not faulted @ boundary. 688.5 to 688.7 thin shale lamina.
690	690.2 to 690.7 zone of increased (quartz?) and calcite
	691.7 material change to fine grained ss, some shale, and breccia of angular shaley sandstone fragments in sandstone matrix.
692.5	692.8 return to sandstone material - Fresh, massive, red gray (N5) to olive gray (5Y 3/2) m-c grained, strong to very strong SANDSTONE, [illegible] calcite/(quartz?) [illegible] @ [illegible] to core axis.
695	
	697.5 color change to medium [illegible] gray (5B 5/1) to dark [illegible] gray (5Y 4/1).
700	

RUN NO.	RECOVERY	R.Q.D.	WEATHERING	STRENGTH
132	5.1/5.1	2.6/5.1	W1	R4
133	4/4	3.?/4.1	W1	R4
134	5.1/5.1	5.0/5.1	W1	R4
135	5.2/5.2	4.6/5.3		
136	5.2/5.2	3.0/5.2	W1	R4
137	5.3/5.2	5.1/5.?	W1	R4

FRACTURE INDEX PER FT. (top to bottom): 2, 0, 8, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 1, 0, 0, 0, 6, 0, 0

DISCONTINUITY DATA – TYPE AND SURFACE DESCRIPTION:
- J, R, Sy – 50
- J, R, Sm – 70
- No 60°
- J, I, R, Ca (K) – 30°
- S, R, Sy – 20

NOTES – WATER LEVELS – INSTRUMENTATION:
- Fracture along shale lamina
- Fractures in shale la[mina] MI
- 687.3 to 687.4 quartz(?) and calcite vein

DEPTH SCALE 1" = 2.5'

RECORD OF DRILLHOLE # U5A

STA. U5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-29-91, 10-30-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
700 – 702.5	Fresh, massive, medium bluish gray (5B 5/1) to dark greenish gray (5GY 4/1), bottom sandstone, intermittent calcite/quartz(?) veins at 60° to core axis.		137	5.2/5.2	5.1/5.2	0, 0, 0			W1	R5	
702.5 – 707.5	Same as above		138	5.2/5.2	4.1/5.2	0, 0, 0, 0, 0		T5	W1	R5	Calcite vein 1/20" inst thick
707.5 – 712.5	Same as above		139	5.2/5.2	3.0/5.2	0, 0, 0, 1, 0	J, I, ve, Ca poss. W K	20	W1	R5	709± thin zone of shale laminae, fine grained SS.
712.5 – 717.5	Same as above		140	4.2/4.2	4.2/4.2	0, 0, 0, 0			W1	R5	
717.5 – 722.5	721.0 to 72?± ... of fine sand, silt, ... color change to red gray (10S), ... of fine calcite veinlets		141	5.0/5.0	1.6/5.0	B, B, 1, 0, 0	J, I, R, Ca(k) 50; J, R, Sm, Ca; J, U, R, Ca; J, I, ve, Ca	10	W1	R5	Approx. ... induced
722.5 – 725	Same as above		142	5.2/5.2	5.0/5.2	0			W1	R5	

RECORD OF DRILLHOLE # USA

STA. USA OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 10-30-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
725	Fresh, massive, medium bluish grey (5B5/1) to dark greenish gray (5G4/1), very strong SANDSTONE, intermittent calcite/quartz veins @ 60° to core axis		142	5.0/5.0	5.0/5.0	0, 0, 0			W1	R5	
727.5											
730	Same as above		143	5.1/5.1	3.9/5.1	0, 1, 0, 1, 0	J,ST,R,Ca	40	W1	R5	Fracture along calcite vein
732.5							J,PL,SM	20	W1	R4	
735	735.0 to 736.8 slight increase of calcite in matrix, change to strong SANDSTONE.		144	3.5/3.5	1.7/3.5	0, 1, 2	J,PL,SM,Ca	30			"soft" calcite infilling -
							J,PL,SM,Ca	20			"soft" calcite infilling
							J,PL,SM	20			slight increase of shale along fracture surface
737.5	736.8 to 742.0 very strong SANDSTONE, 738.5 to 738.6 thin shale laminae		145	5.3/5.2	5.0/5.2	1, 0, 0, 0, 0	J,PL,SM,Ca	30	W1	R5	
740											
742.5	Same as above										
	744.9 change to slightly finer-grained sandstone, same as above otherwise		146	5.0/5.0	4.8/5.0	0, 0, 0, 0, 0			W1	R5	
745											
	Same as above		147	5.1/5.1	5.1/5.1	0, 0, 1	J,PL,SM,Ca		W1	R5	fracture along calcite vein
750											

DEPTH SCALE 1" = 2.5'

RECORD OF DRILLHOLE # USA

SHEET 31 OF 43

STA. USA OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH
ELEVATION -135
DRILLING DATE 10-30-91, 10-31-91
DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
750	Fresh, massive, medium bluish gray (5B5/1) to dark greenish gray (5G4/1), very strong SANDSTONE, intermittent calcite veins @ 60° to core axis.		147	5.2/5.2	5.1/5.2	1, 0, 0			W1	R5	
752.5	same as above 753.1 to 753.3 sparse angular calcite fragments 756.7 calcite laminae @ 60° to core axis		148	5.1/5.1	4.?/5.1	1, 0, B, 0, 0	J, PL, SM, Ca MI J, PL, SM, Ca	70 20 40 90	W1	R5	Fracture along calcite vein 755.1 calcite vein 3/10 inch thick 755.4 1/5 inch thick calcite vein with chlorite (?)
757.5	Same as above 758.5 to 758.7 shale/fine SS rich angular pod, [illegible] in core 760.1 fracture offset of shale rich / fine SS pod of 7/10 inch noted. 761.4 to 761.6 thin shale laminae		149	5.2/5.2	3.8/5.2	0, 0, 0, 3, B	J, PL, SM, Ca J, PL, K, Ca J, PL, K, Ca F, I, R, Ca	40 50 30 30	W1	R5	Fracture along calcite vein Fracture along calcite, MI, material from coarse-grained
762.5	Same as above 763.1 "pod" of shaly (lens @ 50° to core axis) thins to disappear max thickness 1/2 inch		150	5.1/5.1	3.8/5.1	0, 1, 0, 0, 2, 1	J, PL, SM J, PL, SM, Ca J, PL, SM, Ca J, PL, SM, Ca Clay (gray?)	50 25 30 ?0	W1	R5	Fracture along calcite vein
767.5	Same as above		151	5.1/5.1	3.1/5.1	0, 1, 1, B	J, PL, SM J, PL, SM Crushed calcite vein, ?enored	60 50 ??	W1	R5	
772.?	Marked change to shale @ 60° to core axis, fine shale laminae, laminae offset by faulting ~ 1 inch, 773.1 to 773.3 zone of undulating shale and [illegible]		152	4.2/4.2	2.2/4.2	3, 3	J, PL, R J, PL, SM, Ca J, ST, SM J, PL, SM J, ST, SM	30 40 60 ? 70	W1	R4	774.2 - 774.? thin laminated shale and [illegible] @ 60° to core axis
775											

(772?)

DEPTH SCALE: 1" = 5' MI = mechanically [illegible] LOGGED BY

RECORD OF DRILLHOLE # U5A

SHEET 32 OF 43

STA. U5A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90° AZIMUTH

ELEVATION -135
DRILLING DATE 10-31-91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
775	Fresh, massive, grayish black (N2), med. strong SHALE. Laminae of fine grained SS/shale observed thickness from 1.5 inches to fine laminae downcore, minimal calcite veining ∥ to laminations. 777⁴ to 777⁹ undulating, convolute sandy laminae ⊥ to "bedding" 777⁹ to 779⁰ alternating layers of shale and fine grained SS/shale @ 70° to core axis		152	4.2/4.2	2.3/4.2	2, 1	J,PL,SM 80; J,PL,SM 70; J,PL,CA 40		W1	R4	Appears MI. 775⁸ contact @ 60°. Massive, grayish black (N2) shale, no calcite veining observed
777.5						4	J,ST,RK 70; J,PL,SM 70; J,PL,SM	60			J,PL,SM
	779⁰ change to SANDSTONE @ ~70° to core axis. Fresh, massive medium bluish gray (5B5/1) to dark greenish gray (5G4/1), very strong SANDSTONE, calcite veining @ 30° to core axis. (781)		153	4.9/4.9	3.0/4.9	0			W1	R5	779² to 779⁵ alternating sandstone / shaly SS
780						0, 2	J,PL,SM 80				
	781⁰ change to predominately shale & fine grained shaly SS laminae – "bedding" @ 70° to core axis					2	J,I,R; J,PL,CA; J,R,CA 70; J,PL,U,R 30		J,PL,SM		
782.5				5.2/5.2	3.7/5.2	2					Ca
	782⁸ Marked change to SANDSTONE, contact @ 70° to CA. Fresh, massive, medium bluish gray (5B5/1) to dark greenish gray (5G4/1) m-coarse grained SANDSTONE, calcite/quartz(?) veining @ 30° to core axis, increase of lithic size		154			0			W1	R5	785² to 785⁵ present increase of quartz(?)/calcite in sandstone
785						0, 1	J,ST,R 30				Chlorite(?) coating on fracture
						0					
787.5	Same as above. 788² to 788⁵ zone of increased quartz(?)/calcite and small brecciated (angular) SANDSTONE, small calcite veins ∥ to core axis observed from 788⁰ to 790° (intermittently). Offset other calcite/quartz veins by ~1/10 inch.		155	5.0/5.0	3.2/5.0	0, 1	J,U,R,Ca		W1	R5	Fracture along calcite vein
790						0, 0	J,PL,SM 40; J,U,R,Ca 40				
						B	Coarse, angular sandstone				Average fracture in crushed zone 40°
792.5	793⁸ to 794⁵ zone of increased shale, fine-grained SS – gradational. 795⁰ to 794⁵ zone of increased calcite (quartz(?)) vein thickness (to 2/5 inch) @ 45° to core axis.		156	5.1/5.1	4.2/5.1	0, 1	J,I,R,Ca (x) 45		W1	R5	
795						0, 0, 1	J,PL,SM 20				
	Same as above		157	5.1/5.1	4.5/5.1	1, 0	J,PL,SM,Ca 30				
800						1	J,PL,SM,Ca 45				799⁵ to 799⁷ – ? (position of ? @ ? angle)

RECORD OF DRILLHOLE # USA

SHEET 33 OF 43

STA. USA OFFSET L R
ELEVATION -135
DATUM
PROJECT NO. 905-W25
DRILLING DATE 10-31-91
DRILL RIG
INCLINATION AZIMUTH

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
800	Fresh, massive, medium bluish gray (5B5/1) to dark greenish gray (5G 4/1) m-coarse grained SANDSTONE, calcite/quartz(?) veins e		157	5'/5'	4'/5'	0			W1	R5	
802.5						0					
	BOSE material change to fresh, massive, bluish gray (5B5/1) to dark greenish gray (5G 4/1) f-m grain SANDSTONE, lithics decrease in size. Extremely thin shale laminae @ 60° to core axis 804' to 805' thin shale laminae between angular to subangular brecciated SANDSTONE.		158	5'/5'	4'/5'	0					
						2	F, PL, SM	80			Joint clay shale lam
							F, PL, SM	60			
805						1			W1	R4	
						0	FR, SM	60			804' to 805' zone of coarse sd, shale, calcite
807.5						1	F, U, SM	60			
	807' material change @ 30° to core axis, only slight change, increase of calcite in matrix, slight increase of lithic size, sparse calcite veins @ 30° to core axis		159	5'/5'	2'/5'	0					
						1	J, ST, RG	10	W1	R5	
810						0					
						1	J, PL, SM	80			
						0					Fresh clay calcite vein
812.5						0					814' to 815' increase of calcite due to core angle calcite veins
	Same as above		160	5'/5'	5'/5'	0					
815						0			W1	C5	
						6					
817.5						0					
	Same as above		161	5'/5'	5'/5'	0			W1	C5	
820						0					
						0					
						0					
						0					
	Same as above		162	5'/5'	5'/5'	0			W1	R5	
825						0					

RECORD OF DRILLHOLE # USA

SHEET 34 OF 43

STA. USA OFFSET L R
PROJECT NO. 903 1025
INCLINATION 90 AZIMUTH
ELEVATION -135 DATUM
DRILLING DATE 10-31-91 DRILL RIG
11-1-91

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
825	Fnd. massive, dusk gray (5B5/1) to dark greenish gray (5G4/1) m-c grain had sandstone, Intermittent calcite veins @ 30° to core axis.		167	5'/5'	5'/5'	0			W1	R5	
827.5						0					
830	Same as above 830' to 831' calcite vein ⊥ to core axis		163	5'/5'	5'/5'	0 0 0 0			W1	R5	
832.5	832'-838' FRESH MASSIVE WITH BEDDING GHOSTS BLUISH GREY (5B5/1) TO DARK GREENISH GREY (5G4/1) MEDIUM TO COARSE GRAINED HARD SANDSTONE, WITH SPARSE CALCITE VEINS & IRREGULAR SHAPED INCLUSIONS .2-.7IN LENTICULAR SHAPED PARALLEL TO BEDDING? 45-60° FROM CORE AXIS		164	5'/5'	5'/5'	0			W1	R5	
835											
837.5	838'-843' AS ABOVE - CALCITE SOMEWHAT MORE PREVALENT & LITHIC FRAGMENTS SOMEWHAT LESS COMMON		165	5'/5'	5'/5'	0			W1	R5	
840											
842.5	843'-848' FRESH MASSIVE (VERY SUBTLE BEDDING APPARENT ONLY WHEN CORE IS BROKEN) BLUISH GREY (5B5/1) TO DARK GREENISH GREY 5G4/1 COARSE QUARTZ SANDSTONE WITH NUMEROUS LITHIC GRAINS (10%) & TRACE INTERGRANULAR CLAY PLATES. VERY NUMEROUS VERY FINE JOINTS? CALCITE VEINS? 30° TO CORE AXIS 360° ORIENTATION DO NOT AFFECT ROCK STRENGTH - CORE BREAKS AT 90° WHEN STRUCK		166	5'/5'	5'/5'	0			W1	R5	
845											
847.5	848'-853' ROCK LITHOLOGY AS ABOVE LITHIC GRAINS MORE NUMEROUS & LARGER TO .1IN VERY NUMEROUS CALCITE VEINS 30° TO CORE (CONT'D ON NEXT)		167	5'/5'	4	6	J, P, S, 90, 30, 20, 30 J, P, R, 30, 90		W1	R4	CALCITE LINED 30-CALCITE LINED-BLUE? NO-MAY BE DRILL INDUCED

RECORD OF DRILLHOLE

SHEET 35 OF 43

STA. USA OFFSET L R
PROJECT NO. 903 1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE
11-1-91 → 11-1-91

DATUM MSL
DRILL RIG
LONG YEAR

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
850	VERY NUMEROUS CALCITE VEINS FROM VERY THIN TO 0.8 IN DOMINANT TREND 20° TO CORE AXIS SOME VERY FINE TERMINATED XLS? NEEDLE XLS IN PLANE OF FRAC CALCITE? BROWN STAIN IN LOWEST VEINS IRON?		167			4			W1	R4	
						2	2) J, P, S, 20				BOTH CALCITE LINED PERPENDICULAR TO EACH OTHER
852.5	853 - 858⁶ FRESH BEDDED BLUISH GREY (5B 5/1) TO DARK GREENISH GREY (5G 4/1) MEDIUM TO COARSE XTL SANDSTONE W/ NUMEROUS 60% LITHIC GRAINS. BEDS RANGE IN DARKNESS W/ MINERAL. SHALE PARTING AT 854⁵ .2 IN. 3 BRECCIA AT 858 ADJ TO .2 IN CALCITE VEIN. CALCITE MATRIX. BROWN STAIN IN CALCITE VEINS - IRON?					7 10	FRACT SWARM J, P, S, 20 / J, P, R, 0				ALL CALCITE LINED SLKNS.? FE STAIN
			168	5² / 5²		2	J, P, S, 20 CALC J, S, S, 80		W1	R4	
855						0					
						0					
						1	J, P, S, 30				
857.5						3	2) J, P, S 30				MUTUALLY PERPENDICULAR
						6	J, PR, R, 60 J, P, P, 30+				SLICKENSIDES SHOWN AT 20°
	858⁶ - 860⁰ AS ABOVE W/O CALCITE VEINING BEDDING VERY SUBTLE		169	1⁶ / 1⁶	1⁶ / 1⁶	0			W1	R5	
860	PROJECTED TD DRILL ADD 200 FT										
	860⁰ - 865² FRESH MASSIVE (BEDDING GHOSTS?) BLUISH GREY (5B 5/1) TO DARK GREENISH GREY (5G 4/1) COARSE SANDSTONE/GRAY WACKE LITHIC FRAGMENTS 15% CALCITE VEINS THIN 20°-30° FROM CORE AXIS FE? STAINS IN VEIN		170	5² / 5²	5² / 5²	0			W1	R5	
862.5											
865	865² - 870⁴ AS ABOVE - NO VISIBLE STAINING IN VEINS BEDDING? GHOSTS A RESULT OF GRAIN SIZE VARIATION W/ DEPTH &/OR % LITHIC FRAGMENTS		171	5³ / 5³		0	J, P, S, 20 CALC		W1	R5	
						2	2× J, P, S, 20 CALC				
867.5						8					
						0					
870						≥1					SHATTERED ABOVE OUT DURING REMOVAL
	870⁴ - 875⁶ AS ABOVE CALCITE VEINS MINOR TREND PARALLEL CORE AXIS SEVERAL THIN CLAY PARTINGS		172	5² / 5²		1	J, P, S, 40 CALCITE		W1	R5	
						0					
						0					
						0					
875						3	J, P, S, 90 J, P, S, 90, 25				

DEPTH SCALE 1"=2.5'

RECORD OF DRILLHOLE

SHEET 36 OF 43

STA. U5A OFFSET L R

PROJECT NO. 903-1025

INCLINATION 90 AZIMUTH

ELEVATION -135

DRILLING DATE 11-1-91, 11-4-91

DATUM MSL

DRILL RIG

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
875			172						WI	R5	
	875⁶-880⁰ AS ABOVE		173	5³/5³	5³/5³	0			WI	R5	
77⁵											
880	880⁰ — 885⁸ AS ABOVE w/ SOME BROWN STAINING ON CALCITE VEINS ~~DIFFIC~~ 2 SETS OF VEIN 30° TO CORE AXIS & MUTUALLY PERPENDICULAR					0					
			174	5⁸/5⁸	5⁸/5¹	0			WI	R4	DIFFICULTY REMAINING CORE FROM BARREL ALL FRACTURES MECHANICALLY INDUCED
82⁵											
85	885⁸-891⁰					0					
	Same as above		175	5³/5³		<1			WI	R6	
87⁵							2 JC, S, 30				
890											
			176	10¹/10¹	10⁰/10⁰	0					
92⁵	Same as above										
95						1	Jnt. K, 55°		WI	R	
900											

DEPTH SCALE 1:30

LOGGED BY IMSTHC

RECORD OF DRILLHOLE # U57

STA. U57 OFFSET L R
PROJECT NO. 903 - 1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 11-4-91

DATUM MSL
DRILL RIG Conveyjet 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
900	Fresh, massive, bluish grey (5B5/1) to dark greenish grey (5G4/1), very strong sandstone, sparse calcite veins @ 30° to core axis,		176	10'/10'	10'/10'	0			W1	R5	
						0					
902.5				10'/10'	10'/10'	↓					
			177								
905									W1	R5	
	Same as above										
907.5											
910											
912.5						0					
				10'/10'	7.9/10'	0					
						0	J, PL, SM, Ca	50			
915			178			1					
	same as above					2	J, PL, SM, Ca; J, PL, K	35; 50	W1	R5	Fracture along calcite vein
917.5						0					
						1	J, PL, SM, Ca	60			
						0	J, I, R, K, Ca	60			[illegible] (?) Calcite [illegible] in calcite
	920.0 to 920.3 thin [illegible] ... [illegible] offset from 40° to core axis to 60° to core axis					1					
						0					
			179	10'/10'	6'/10'	0	J, PL, SM, K; J, PL, SM, Ca	15; 50			pyrite stained along fracture
	923.0 to 925.0 [illegible] ... calcite stringers surrounding [illegible] ... brecciated [illegible]					2			W1	R5	
						0					

RECORD OF DRILLHOLE # USA

SHEET 38 OF 43

STA. USA OFFSET L R

PROJECT NO. 953-1055

INCLINATION 90 AZIMUTH

ELEVATION -135

DRILLING DATE 11-4-91

DATUM MSL

DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
925			179	10.0/10.0	6.1/10.0	0, 0			W1	R5	Note - gray, clayey material in core from drilling (cuttings)
927.5	928.3 contact to highly mechanically induced fracturing. Average fracture ∢ 40° to CA, minor fractures @ 80° to core axis. Increase of grain size to coarse quartz ss. Medium bluish gray (5B 5/1) to Dark greenish gray (5G 4/1), angular grained ss.					0, B			W1	R4	
930						B, B			W1	R5	
932.5						0, 2	J, PL, SM, ca 30°; J, R, SM 60°				Fracture along calcite vein; Fracture along calcite vein - brown (FeOx) staining
935			180	10.2/10.2	9.0/10.3	0, 0, 0			W1	R5	
937.5	Material change @ 937.7 @ 50° to core axis along shale laminae - change to thin, thinly bedded, light olive gray (5Y 6/1) to medium gray (N5), weak SANDSTONE. Still coarse grained c̄ increase of calcite and laminated shale observed in fresh breaks of the core. Thin shale laminae throughout zone.					0, 1	J, R, SM 80°		W1	R2	938.± to 938.8 shale zone; Fracture along shale lamina
940						B, B, B	Mechanically induced, irregular with K calcite, and ss observed 10° 30°		W1	R2	939.± to 939.± zone of weak, clayey material (gouge?)
	942.3 material change to Thin massive, bluish gray (5B 5/1) to dark greenish gray (5G 4/1) sandstone c̄ intermittent calcite veins @ 45° to core axis		181	10.1/10.1	7.4/10.1	0, 0, 0			W1	R4	
						0, 0, 0, 0	J, R, SM 40				
						0, 0					

DEPTH SCALE

RECORD OF DRILLHOLE # U57A

STA. U57A OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH

ELEVATION -155
DRILLING DATE 1-4-91, 1-5-91

DATUM MSL
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
950	950± Marked change to Fresh, massive, light olive gray (5Y6/1) to medium gray(N5) coarse to very coarse grained SANDSTONE. discontinuous shale laminae and sub-angular sandstone breccia noted.		181	10'/10'		2	Mechanically induced fracture PL, sm	60 / 60	W1	R2	gray, clayey material from drilling on core
952.5						0	J,R, sm,ca	30			Fracture along calcite vein
	951.8 Marked gradation to Fresh massive, bluish gray (5B5/1) to dark greenish gray (5G4/1), m-C, SANDSTONE. Intermittent calcite veining @ 35° to CA.			10'/10'	37/10'	2	J,I,R,Ca	50 / 30			954± to 954.9 zone layers 1/2" angular subangular breccia sandstone and fragments, @ 40°
955			182			1	J,C,SM,Ca				
						1	J,R,SM,Ca	40			
	956.7 to 957.5 grain change to very coarse angular, quartz sand.					0	J,R,SM / Fracture along calcite vein	30	W1	R4	955.4 shale laminae @ CA
957.5						B	J,R,K,Ca	50 / Z			Fractures MI- avg 4 50°
	958.0 to 958.3 slight increase of shale/lithics in sandstone matrix, angular, serrated contacts to surrounding SS					0					959± to 960± core broken during removal from tube, avg 4 50°
						B					
960	960.0 to 961± slight increase of shale/lithics in sandstone matrix, angular, serrated contacts to surrounding SS.					0					
						0					
962.5						0					
	Fresh, massive, bluish gray (5B5/1) to dark greenish gray (5G4/1), m-C, strong, SANDSTONE.			10'/10'	9.7/10'						
	964.3 to 964.5 zone of calcite stringers with angular, brecciated sandstone.										
965	965.3 to 965.8 pinched zone of calcite stringers & angular, brecciated SS.		183						W	R4	
							J,I,R,Ca	50			
967.5						0					
970											
				10'/1[illegible]		0					
975	974± [illegible]										

RECORD OF DRILLHOLE # U5A

SHEET 40 OF 43

STA. U5A   OFFSET   L   R
PROJECT NO. 902 1025
INCLINATION 90   AZIMUTH

ELEVATION
DRILLING DATE 1-5-91

DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES, WATER LEVELS, INSTRUMENTATION
975											
977.5	976.7 to 977.6 Increase grain size, very coarse, increase calcite stringers, decrease of shale. Calcite stringers predominantly random, some @ 30° to CA		184	10.2/10.2	10.1/10.1	0			W1	R4	
	977.5 to 978.7 Fresh, massive, bluish gray (5B 5/1) to dark greenish gray (5G 4/1), m-C, strong SS. Some shale laminae 50° to core axis					1	J, R, Sm	50	W1	R4	Fracture along calcite vein - thickness ~ 1/2 inch to CA
980	978.7 - 980.0 Fresh, massive to thinly bedded, light olive gray (5Y 6/1) to medium gray (N5), coarse - very coarse, strong, SANDSTONE.					0					
982.5	Fresh, massive, bluish gray (5B 5/1) to dark greenish gray (5G 4/1), m-C, strong, SANDSTONE. Intermittent calcite veining @ 40° to CA. Intermittent shale laminae @ 60° to CA - pyrite observed in most of shale laminae		185	10.1/10.1	10.0/10.0	0			W1	R4	
985											
987.5											
990											
	991.0 grain size increases to coarse, very coarse, strength decreases to medium strong, color same.					B	All fractures appear mechanically induced -				calcite vein - 1/2 inch thick
	992.0 to 993.6 Fresh, massive, bluish gray (5B 5/1) to dark greenish gray (5G 4/1), coarse to very coarse, medium strong, sandstone. Calcite [illegible]		186	7.3/7.3	0.8/7.3	B	J, I, R / J, J, R	80	W1	R3	[illegible] to fracture [illegible]
	[illegible] laminated sandstone					B					
	[illegible] same as above [illegible] [illegible] fracture [illegible] 20° to core axis					B	J, [illegible] / J, R, R	30			
	994.8 / [illegible] of calcite, grain [illegible]					B					
						1					
						B					

RECORD OF DRILLHOLE # USA

STA. USA OFFSET L R
PROJECT NO. 9?? 1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 11-5-91

DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
1000	Fresh, massive, light olive gray (5Y 6/1) to med. light gray (N6), coarse to very coarse, med. strong, SANDSTONE. 1002± slight possible gradation to finer-grained sandstone.		187	4.9/4.9	0	B	Entire run mechanically fractured. Dry fracture @ 40° to core axis		W1	R3	
1002.5						B					
						B					
						B	J, PL, Sm				Core primarily shattered but intact – crumbles when handled.
1005	Same as above c̄ some intermittent small (< 1 inch sq.) pods of shale-rich ss. Calcite veining @ 50° to CA		188	4.6/4.6	0	1	J, PL, Sm		W1	R3	
						B	Several irregular fault surfaces				
						B					
1007.5						B	J, PL, Sm	0			
	1008.5 gradual change to fresh, massive, bluish gray (5B 5/1) to dark greenish gray (5G 4/1) m-c grained, med-strong, SANDSTONE. Minor angular brecciated ss fragments noted @ 1010.4 to 1010.7					1	J, PL, Sm	40			Fracture along calcite vein
1010			189	4.7/4.7	0.6/4.7	2	J, I, R; J, I, Sm	30; 60	W1	R3	
						B					
						B	J, U, Sm				Fracture along calcite vein
1012.5	1013 natural change to fresh, massive, grayish black (N2) strong, SHALE. Calcite vein @ ?° to CA						J, PL, Sm	70	W1	R4	Fracture in shale
	1014 – natural change to fresh, massive, olive black (5Y 2/1) and light olive gray (5Y 6/1), very strong SANDSTONE, shale laminae (to 0.5 in thick max) offset ~ 3 inches. Fault trace (?) appears @ 20° to core axis.								W1	R5	1015 Calcite vein to CA terminated calcite/shale lam. at 40° to contact
1015			190	10.0/10.0	9.7/10.0		J, U, Sm, Ca	30			Possible fracture along calcite vein.
											1016± to 1016.2 two shale laminae, contact c̄ SANDSTONE angular brecciated.
1017.5	1016.4 natural change to fresh, massive to "ghost bedding" (zones of increased shale in ss matrix) dark gray (N3) to medium bluish gray (5B 5/1) c̄ minor greenish gray (5G 6/1), medium grained, very strong SANDSTONE. Calcite veining @ 30° to CA. Rare angular shale pods to ½ inch.								W1	R5	
1020							J, PL, Sm	30			Fracture along calcite vein
	Fresh, massive, ? gray (5B ?) to medium ? gray ? very strong SS. ? ? @ ? to core axis [illegible]					1	J, P?	30			Fracture along calcite [illegible]
						0					

RECORD OF DRILLHOLE # U5A

STA. U5A OFFSET L R
PROJECT NO. [illegible]
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
1025	Fresh, massive, dark grey (N3) to medium bluish gray (5B5/1) c̄ minor greenish gray (5GY 6/1), m-c grained, very strong SS. Some lithic fragments, so calcite veins @ 30° to CA. SANDSTONE c̄ slight shale in matrix.		R1	10.2/10.2	8.5/10.2	0			W1	R5	
1027.5											1029.1 to 1029.2 calcite veins and angular brecciated
1030						1	J, PL, SM, Ca	45			FeO staining on calcite
1032.5											
	1034.2 to 1034.6 shale zone (several shale layers in SS matrix) contact @ 90° top, and 30° downhole to CA					1	J, PL, SM Ca	60			Fracture along shale lamina
1035			R2	10.0/10.0	9.5/10.0	0					1035.3 thin shale laminae
						0					
						0					
1037.5						1			W1	R5	
	1038.9 to 1039.0 calcite vein c̄ rounded shale fragments, contact to shaley SS @ 60° to core axis, grades to SS as seen in previous core. 1039.1 to 1039.2 shale layers @ 60° to core axis					1	J, PL, K J, PL, SM 60	20			Fracture along calcite vein Fracture along calcite/shale zone
1040						0					
	1041.3 to 1041.5 shale zone - contact @ 40° to CA (top), 70 to CA (downhole)					1	J, PL, SM	40			Fracture along shale
1042.5	1041.5 to 1042.1 - Shale lamina fragments in SS matrix - @ ~60 to CA.					1	J, PL, SM Ca	60			
	1043 to 1043.5 Material change - Fresh, massive, grayish black (N2) SHALE. Jagged, irregular contact					B		40			
	1042.4 - Fresh massive, med dark gray (N4), med. bluish gray (5B5/1), dark greenish gray (5G4/1), m-c, SANDSTONE. Calcite vein @ 60° to core axis.		R3	7.1/7.1	5.5/7.1	0			W1	R5	1043.5 to 1050.1 material parted during drilling
							J, PL, SM, Ca	30			
						B					
	1044.2 Contact to white - [illegible] grayish black (N2) SHALE [illegible] @ 60° to core axis										70°

DEPTH SCALE 1" = 2.5'

RECORD OF DRILLHOLE # USA

STA. USA OFFSET L R
PROJECT NO. 903 1025
INCLINATION 90 AZIMUTH

ELEVATION -135
DRILLING DATE 11-6-91

SHEET 43 OF 43
DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
1050	Fresh, massive, grayish black (N2) strong; SHALE,		193	7.7/7.7	5.8/7.7	B			W1	eS	
	1050.5 Material change to SANDSTONE @ 30° to CA Fresh, massive, red light gray (N6), coarse to v. coarse Strong; SANDSTONE					B	J, I, R — 50; J, Pl, SM, Ca — 45; J, I, VR — 20	50; 45; 20			Fracture along shale banding; Fractures mechanically induced
1052.5	1052 Material change to SANDSTONE with abundant calcite veins - SANDSTONE brecciated (sub-angular) calcite veins non-directional core (~60% SS, 40% calcite)		194	5.7/5.7	3.0/5.7	↓	J, I, R, Ca — 10; Calcite vein ½" thick - brecciated SS frags noted in calcite vein	10	W1	eS	1052 to 1052.3 calcite vein
1055	1054.4 Material change to SS/shale matrix severely brecciated (rounded) c̄ abundant calcite veins (~70% SS/sh, 30% calcite), some dolomite (?) [illegible] of calcite						J, I, VR, Ca — 40	40			Dolomite(?) discolor of calcite
1056	End of Hole @ 1056' bgs										1056' - EOH @ 08 11-6-91
1057.5											

DEPTH SCALE 1" = 2.5'

36
41

RECORD OF DRILLHOLE # 46

SHEET 1 OF 10

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90°
AZIMUTH

ELEVATION
DRILLING DATE NOV 91

DATUM
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
00.0	0-6 SEVERELY WEATHERED YELLOWISH GREY (5Y 7/2) TO MODERATE YELLOWISH BROWN (10YR 5/4) MASSIVE? MED-COARSE SANDSTONE VERY HIGHLY FRACTURED W/ DEEP Fe STAINING ON JOINT PLANE		1	1.3 / 6.0	0	>10	PLANAR SMOOTH BUT HIGHLY WEATHERED		W4	R2	SHATTERED APPEARING NO DOMINANT TREND
2.5											
5.0											
7.5	6-10± HIGHLY WEATHERED BEDDED YELLOW GREY (5Y 7/2) MODERATE YELLOW BROWN (10YR 5/4) TO [illegible] (N7) MEDIUM CLEAN SANDSTONE [illegible] JOINTS ALL STAINED (10YR 5/4) BEDDING INDISTINCT - SUBTLE [illegible] OF GRAIN SIZE AT A VARIETY [illegible] ORIENTATIONS TO AX. BLK SHALE? BRECCIA 3" THICK AT TOP OF CORE		2	4.8 / 4.8	1	>10, 4, 5, >10	SHATTERED 45±10°; J.P.S 60/45; J.P.S 90; J.R.S 0°; J.P.S 70		W4, W3	R2	DOMINANT TREND 60° TO CORE AXIS
10.0	10.8-14.4 MODERATELY TO HIGHLY WEATHERED MASSIVE? YELLOW GREY (5Y 7/2) TO VERY LIGHT GREY (N7) W/ STAINS OF MOD. YEL. BRN (10 YR 5/4) MEDIUM SANDSTONE BRECCIATED? STAINS ON ALL SURFACES		3	5.2 / 5.2	0	>10, >10, 7, 4	SHATTERED; J.P.S. 70; SHATTERED; J.P.S. 30; J. IR R. 45		W4, W3	R1, R2	CONJUGATE 45° W/ MINOR TREND AT 30 & SOME VERTICAL
12.5	14.4-15' MODERATELY WEATHERED BEDDED (DISTORTED DRK GRY (N3) SHALE										
15.0	15'-16 LIGHT-MOD WEATHERED MASSIVE MED GRY FINE TO MEDIUM SANDSTN Fe STAINING ON JOINTS NOT PENETRATING RK & SOME QUARTZ VEINING (APP. GREYWACKE)					6, >10	J. IR R. 45; J.P. S-R. 45; SHATTERED		W3		
17.5	16.0-21.1 LIGHT TO MODERATELY WEATHERED MASSIVE MEDIUM GREY (N5) VERY FINE? TO FINE W/ MEDIUM SANDSTONE TO GREYWACKE DARK Fe STAINED JOINT SURFACES RARE QUARTZ VIENS		4	5.1 / 5.1	0	>10	SHATTERED		W3	R2	ONE VERT FRAC DOWN AXIS OF CORE CONJUGATE SETS AT 45° & DOMINANT SET A 60 TO CORE AXIS
20.0											
22.5	21.1-26.0 MODERATELY WEATHERED LIGHT GREY (N8)/MED LITE GREY (N7) TO YELLOWISH GRY (5Y 7/2) MASSIVE SANDSTN MOD-HIGHLY FRACTURED W/ STAINS ON ALL FRAC SURFACES. SLICKENS. on 2 FRACS PROBABLY DRILL INDUCED		5	4.9 / 4.9	0	7, >10, 6, >10	J. P. S-R 60° ±10°; J.P.S 60 (45); SHATTERED P, S-R 90±0°		W3 → W2	R2 → R3	
25.0											

DEPTH SCALE 1:30

Golder Associates

LOGGED BY JMS

RECORD OF DRILLHOLE # 46

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90 AZIMUTH
ELEVATION
DRILLING DATE 7 NOV 91
DATUM
DRILL RIG LONGYEAR

DEPTH SCALE (FEET)	DESCRIPTION	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA – TYPE AND SURFACE DESCRIPTION	WEATHERING	STRENGTH	NOTES / WATER LEVELS / INSTRUMENTATION
25.0		5							
	26⁰–29⁸ MODERATELY TO LIGHTLY WEATHERED MEDIUM LIGHT GREY (N7) TO YELLOWISH GREY (5Y 7/2) MASSIVE FINE-MED SANDSTONE W/ SOME RARE COARSE GRAINS? QUARTZ VEINING & OCHRE STAINS ON JOINT SURFACES	6	5.2/5.2	1	3	J.P.S.30	W3	R2–R3	SHEAR OR CLAY
27.5	29⁸ TO 31² AS ABOVE WITH COLOR/WEATHERING CHANGE TO MEDIUM GREY. CHG AT 30' SHEAR 1/2 IN SHALE AT TOP OF CORE?				7	J.P.R.60; J.I.R.R.0°; S.P.R.70			
					7	F.R.R.80; J.P.S.40			
30.0					6	J.R.R.10; J.P.S.30	W2	R2–R3	
					6	SHATTERED @ 45°			
	31²–36⁴ LIGHTLY TO FRESH MEDIUM GREY (N5) TO LIGHT OLIVE GREY (5Y 5/2) MASSIVE FINE-MEDIUM DIRTY SANDSTONE WITH RARE QUARTZ AND NUMEROUS CALCITE VEINS (VERY FINE TO 0.2 IN) WEATHERED ZONES (BY COLOR) 2–2.5 IN IN EACH SIDE OF BROWN STAINED FRACTURE FACES. MOST FACES IRON STAINED WITH MINOR AMOUNTS OF CLAY	7	5.2/5.2	5	4	J.P.S.45 FE STAINED	W2–W1	R2–R3	
32.5					3	J.P.R.45 LIGHTLY STAINED			
					2				
					2	J.P.R.45 SOME STAINING			
					0				
	36⁴–41⁵ FRESH MEDIUM GREY (N5) MASSIVE FINE-MED W/ TRACE COARSE DIRTY SANDSTONE 5% LITHIC GRAINS NUMEROUS CALCITE/DOLOMITE VEINS RANDOMLY ORIENTED VERY FINE TO 0.5 IN STAINING ON MOST JOINT/FRACTURE SURFACES PENETRATION INTO ROCK 0–0.2 IN.	8	5.1/5.1	5	0	J.P.S.30	W1	R3–R4	
37.5					10	FRAC ZONE 35			
					5	J.C.R.45			
40.0					4	J.C.R.30			
					6	J.C.R.30			
	41⁵–45² FRESH TO LIGHTLY WEATHERED MASSIVE? MEDIUM RARE COARSE GRAINED SANDSTONE (QTZ) W/ <10% LITHIC GRAINS SPARSE FINE CALCITE VEINS UPPER 4 IN FRESH; LOWEST 6 IN FRESH ALL JOINT SURFACES IRON STAINED W/ CLAY MATERIAL	9	3.2/3.2	1	4	J.R.R.30; J.I.R.VR.30–40	W1–W2	R3–R4	
42.5					1	J.I.R.R.30–60			
					3	J.P.S.30–[illegible]			
45.0					7	J.P.S.45			
	45²–47³ FRESH – EXCEPT AT JOINTS – MEDIUM GREY (N5) INTERBEDDED FINE & COARSE SANDSTONES. 0.5 IN Fe stained on each side of joints brown clay materials in plane numerous very thin calcite veins CONJUGATE SETS 45° TO CORE AXIS 10 FT CUT REST LEFT IN HOLE	10		2	1	J.P.S.60	W1	R1	
					6	J.R.R.45–60; J.P.VR.60; J.I.R.R. CALCITE			
					10	J.P.S.60 CALCITE			
	47³–50 AS ABOVE RUN 11 TO PICK UP CORE – NO RECOVERY	11		1	1	J.I.R.R.60	W1	R1	
50.0					3	J.I.R.R.60			

RECORD OF DRILLHOLE #46

SHEET 3 OF 10

STA. OFFSET L R ELEVATION DATUM

PROJECT NO. 903-1025 DRILLING DATE 8 NOV 91 DRILL RIG LONGYEAR

INCLINATION 90° AZIMUTH

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
50.0	NO RECOVERY CORE LOST 49½ → 55°										
52.5											
55.0	— 55° — FRESH TO VERY LIGHTLY WEATHERED MASSIVE TO BEDDED (DISTORTED) MEDIUM GREY (N5) TO GREYISH GREEN (1.5G 6/1) FINE TO COARSE SANDSTONE WITH NUMEROUS THIN NON-ORIENTED CALCITE VEINS AND DK LITHIC GRAINS SPARSE VERY THIN CLAY LAMINAE MOST JOINTS STAINED RED BROWN ± HAVE THIN CLAY DEPOSITS (DRILLING MUD?) SOME STAINING WITHIN CALCITE VEINS INTERCLASTIC CALCITE & PORE SPACE CAST. RARE THIN BRECCIAS SINGLY TERMINATING VEIN VUGULAR POROSITY 1-IN HIGHLY WEATHERED ZONE AT BASE OF CORE WEATHING RIND 1-2 IN ONE EACH SIDE OF JOINTS		12	9⅔ / 9½	8	0			W1	R1	≈50 DT JAM RIG STUCK - NOT STUCK
57.5						2	J, C, R, 10 J, V, R, 90				
						2	J, P, R, 90 CALC				
						1	J, P, S, 30 CAL				
60.0						1	J, C, R, 90 CALC				
						0	J, P, R, 20 ε				DRILL INDUCED
62.5						2	J, P, S, CALC 30 STAIN				
						3	J, P, R, 30				
						>10	J, IR, R, 60				
	64½ - 74½ FRESH TO LIGHTLY WEATHERED BEDDED MEDIUM GREY (N5) & GREYISH GREEN (1.5G, 6/1) TO YELLOWISH GREY (5Y 7/2) FINE TO COARSE SANDSTONE W/ RARE THIN CLAY LAMINA TO 0.4 IN AND NUMEROUS THIN CALCITE VEINS VERY FEINT RIPPLE x-BEDDING, -DISTORTED BLK CLAY LAMINA & 3 IN CLAY BRECCIA IN SANDSTONE MATRIX, SOME CALCITE VEINS TINTED GREEN FROM CHLORITE? BEDDING ≈30° TO CORE AXIS UPPER 2 FT STAYS WET MUCH LONGER THAN REST OF CORE - POROSITY MUCH GREATER IN WEATHERED ZONES - VERY HARD SILICA CEMENT IN LOWER SOLID SECTION		13	10² / 10²		>10	SHATTERED ZONE		W1 → W3	R1 → R3	SHATTERED SHATTERED ZONE RELATED TO CLAY BRECCIA
65.0						>10	J, C, R, 20° CLAY & Fe STAINED				
67.5						9	J, P, >, 90° AT TIP OF CLAY LAMINA				
						1					
						0					
70.0						0					SOLID
						6					
						0					
						0					
						0					
75	SEE NEXT SHEET					0					

DEPTH SCALE 1:30

Golder Associates

LOGGED BY

RECORD OF DRILLHOLE # U6

SHEET 4 OF 10

STA. OFFSET L R
PROJECT NO. 903-1025
INCLINATION 90°
AZIMUTH
ELEVATION
DRILLING DATE 8 NOV 91
DATUM
DRILL RIG LONGYEAR

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
75.0	74½ – 77½ FRESH GREYISH GREEN (15GY 4/1) HIGHLY DISTORTED BEDDING FINE – CRS DIRTY SANDSTONE WITH NUMEROUS CALCITE VEINS TO 4 MM LITHIC GRAINS 10% CALCITE VEINS NOT ORIENTED		4	10½/10½	6	0			W1	R1	
						0					
77.5	77½ – 81½ FRESH GREYISH GREEN (15GY 4/1) TO MEDIUM GRY MASSIVE W/ BEDDED & CONGLOM ZONES SANDSTONE GY WITH 1 & 3 CM SHALE DARK GRY RED SANDSTONE FINE TO COARSE VERY SIGNIFICANT LITHIC GRAINS & CLAY CONTENT FOR 1.0 FT BRECCIA ZONE OF CALCITE? LIGHT GREEN & DARK GREEN RK FRAGMENTS AND DARK GRAY CLAY FRAGMENTS TO .25 IN BOTTOM .5 FT AGAIN SIGNIFICANT CLAY CONTENT (INTERBED)					3	J, P, S, 45 & CLAY WRP				
						1	J, P, S, 60 CLAY				
80.0						8					
						1	J, P, S, 45				
	81½ – 81⅝ BROWN DARK GRY BLK (N2) SHALE					A	J, P, S, 45				A SHALE BED CLAY BROKEN MANY RECENT INDUCED FRACTURES
82.5	81⅝ – 84½ FROM GRY GRN (5G 5/1) MASSIVE SANDST W/ 15% GRAINS OF CLAY FRAGS (ANGULAR) ENTIRE CORE HAS NUMEROUS CALCITE VEIN DOMINANT TREND 30° TO AXIS					1					
						0					
	84° – 85½ AS ABOVE CONTACT AT 30° TO CORE AXIS										
85.0	85½ – 86½ FROM MED GRY BEDDED SAND/STONE VF SAND IN CLAY MATRIX CONTACT AT 60° TO CORE AXIS		15	10½/10½	7	1	J, P, S, 30		W1	R1	
	86½ – 90° FRESH GRYGRN (5GY 4/1) WITHIN BEDDED CONTORTED FINE TO MED SANDSTONE RARE FINE CALCITE VEINS SPARSE BLK SHALE LAMINA 5% LITHIC GRAINS MOST BEFORE DISTURBANCE & CALCITE CMT IN ZONES NEAR SHALE					4	J, P, S, 90				CONTACT SS/SH IN SHALE BED
87.5						0					
						0					
90.0						0					
						0					
	90½ – 92° FRESH GRY GRN (5GY 4/1) TO DRK GRY BLK (N2) INTERBEDDED FINE SANDSTONE AND SHALE BEDDING CONTORTED & OFFSET BY VERTICAL (1P) TO CORE AXIS FAULTS FILLED W/ CALCITE					1	J, P, S, 80				SS/SH CONTACT
92.5						0	J, P, S, 90 SH SURF				
	92° – 94° SANDSTONE AS ABOVE					0					
95.0	94½ to 96° 94½ SHALE AS ABOVE					0					
	95½ [illegible]		16	[illegible]		[illegible]					[illegible]
97.5	96° to 96½ [illegible]										
	[illegible]										
100.0	GRY RED [illegible]										

DEPTH SCALE 1:30

Golder Associates

LOGGED BY JMS, AC

RECORD OF DRILLHOLE #U6

SHEET 5 OF 10

STA. OFFSET L R
PROJECT NO. 903 1025
INCLINATION 90 AZIMUTH

ELEVATION
DRILLING DATE 11-11-91

DATUM
DRILL RIG LONGYEAR

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
100	Fresh, massive, light gray (N7) to light olive gray (5Y 6/1) and Greenish gray (5GY 6/1), m-C, SANDSTONE, some lithic fragments, calcite veining sparse and at 60° to core axis.		16	10²/10²	9.8/10²	0			W1	R4	100² to 102² calcite without FeO cover
102.5	103² SANDSTONE AS ABOVE slightly weathered(?) calcite infilling with FeO weathering discoloration. Infill @ 30° to CA - Discoloration (dark yellowish orange (10YR 6/6)).						Zone of calcite infilling.	30	W2	R5	103 to 104 calcite infilling. Slightly weathered FeO discoloration
105.0							J, I, UR, ca	40	W1	R4	Some veg. calcite ½ inch ⊥ to core axis
	106² Return to fresh material, shale lamina @ 60° to CA		17	10⁰/10⁰	6.4/10²	1	MI-85				
107.5						0	J, I, R, (MI)	60			
	108² to 110 slight increase of calcite in SANDSTONE matrix,					1			W1	R4	
						0					
110						1	J, I, R, ca	30			
	110² to 111² Zone of shale and shale/ss interbeds					5	J, R, sm, FeO(?) staining	~70			Fractured along shale lamina
	111² Fresh, massive, dark greenish gray (5GY 4/1) m-f grain, strong SANDSTONE, sparse calcite veinlets @ 60° to CA, decrease in calcite in matrix [illegible]					0			W1	R4	
112.5						1	J, R, sm	80			Fracture along shale lamina
	113⁸ Slight decrease to medium strong - amount of calcite in matrix decreases.					B	J, R, sm, ca — Dominant fracture angle @ 50 to core axis —	35			
115	115² Fresh, massive, medium (light gray 50%) to dark greenish gray (5G 4/1) [illegible] grained SANDSTONE. Some calcite [illegible] @ 30 and 10° to CA.					B			W1	R3	113² to 115² material mechanically crushed ?
			18	10⁰/10⁰	10⁰/10⁰	0					
117.5	117⁴ [illegible] changes to 60° to [illegible]								W1	R5	
120											
	[illegible]										
122.5											
125											

DEPTH SCALE 1:30

RECORD OF DRILLHOLE # U6

SHEET 6 OF 10

STA. OFFSET L R
PROJECT NO. 903 1525
INCLINATION 90 AZIMUTH

ELEVATION
DRILLING DATE [illegible]-91

DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
125	Fresh, massive, medium bluish gray (5B5/1) to dark greenish gray (5G4/1), m. f grain, strong SANDSTONE. Some calcite veining @ 60° to core axis; rare veining @ 10° to CA.					6			W1	R4	
						1	J, PL, R, Ca, FeO				
127.5			19	9.5/9.5	4.4/9.5	0					
						3	J, ST, SM, Ca, FeO; J, PL, SM, Ca, FeO; J, PL, SM, Ca, FeO	50, 10, 60			
130						3	J, PL, SM, Ca, FeO	15			
						4	J, W, R, Ca, FeO; J, PL, SM, Ca, FeO (60)	5, 15			
						0	J, PL, SM, Ca, FeO; J, PL, SM, Ca	25			
132.5						5	J, ST, R, Ca, FeO; J, PL, SM, Ca; J, PL, SM, Ca; J, ST, SM, Ca, FeO; J, ST, K, Ca (40)	30, 15, 40, 10			
						1	J, R, SM, Ca; J, R, SM, Ca, FeO	30, 40			
135	135.5 to 137.4 calcite and shale laminae ∥ to core axis (along fracture)					1	J, PL, R, Ca, FeO				
			20	5.5/5.5	0	2	J, U, UR, Ca, FeO (~10); J, PL, SM, FeO, Ca	30			
137.5						6	J, PL, SM, Ca, FeO		W1	R4	
						1		15			
						1	J, PL, SM, Ca, FeO	15			
140						0					"Soft" calcite
							J, PL, SM, Ca, FeO	30			141.0 to 141.4 zone of weathered shale or [illegible] @ 60° to CA
						1	J, ST, [illegible], FeO	30			
142.5	same as above		21	4.5/4.5	3.5/4.5	0			W1	R4	
						1	J, PL, SM, Ca				
145						5					
			22	[illegible]	[illegible]	0					
147.5											
150											

RECORD OF DRILLHOLE # U6

STA. OFFSET L R
PROJECT NO. 903 1025
INCLINATION 90 AZIMUTH
ELEVATION
DRILLING DATE 11-11-91
DATUM MSL
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
150	Fresh, massive, medium bluish gray (5B5/1) to dark greenish gray (5G4/1), n-f, v. strong SANDSTONE, intermittent calcite veins @ 50° to core axis to random orientation. Ghost shale laminae throughout section, ~60° to core axis.		22	10.2/10.2	10.2/10.2	0			M	R5	
152.5											
155											
157.5	Same as above.		23	10.0/10.0	10.0/10.0	0			M	R5	
160											
162.5											
165	165± some increase of SHALE in matrix in localized pod										
167.5	Same as above		24	9.3/9.3	9.3/9.3	0					
170	[illegible] (contd)					1	[illegible]		W1	R5	[illegible]
						0					[illegible] shale [illegible] of [illegible]
172.5	[illegible]										
175	[illegible]										

DEPTH SCALE 1" = 2.5'

Golder Associates

LOGGED BY

RECORD OF DRILLHOLE # U6

SHEET 8 OF 10

STA. OFFSET L R
PROJECT NO. 903 1025
INCLINATION 90 AZIMUTH

ELEVATION
DRILLING DATE 11-12-91

DATUM
DRILL RIG Longyear 44

DEPTH SCALE (FEET)	DESCRIPTION	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING	STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
175										
	177.0 to 177.7 shaly SS @ 70° to CA. predominant calcite vein @ 40° to CA grading to 40° to CA @ 180 → 181.4. Minor calcite stringers ⊥ to core throughout run	25	10.0/10.0	8/10.0	0, 0, 1, 0, 0	J, PL, SM, K	20	W1	R5	
177.5										
180										
	181.3 to 183.0 slightly more weathered material. [181.3 to 182.0 FeO staining, weak, mechanically fractured material] VERY soft calcite (platy) & angular brecciated calcite & sandstone fragments				B, B	J, I, UR; J, PL, SM, Ca; Calcite appears weathering; J.PL, SM fracture along calcite	20, 30, 40	W2	R3	FeO discoloration — not on calcite ... orange/rust color dark yellowish o... (10YR 4/6) black on FeO
182.5	182.2 to 182.7 Zone of increased calcite in matrix				0, 0			W1	R4	182.0 prominent calcite vein @ 40° to CA
185	183.0 color change of material to light bluish gray (5B 7/1) and light olive gray (5Y 6/1). Thin calcite vein @ 30° to CA.				0					185.2 to 185.5 Zone calcite
187.5	187.0 to 189.0 color gradation to bluish gray (5B 5/1) / dark greenish gray (5G 4/1).	26	10.0/10.0	10.0/10.0	↓			W1	R4	
190					1	J.PL.SM, Ca	20			
192.5	192.0 gradation in color change to bluish gray (5B 5/1) / dark greenish gray (5G 4/1).				0 ↓					
195					1	J.P... Ca	30			
	196.0 grades to light bluish gray (5B 7/1) and light olive gray (5Y 6/1). Abundant calcite veining @ angle 60° to core axis, secondary ... @ 30° to CA.	27	6.0/6.0	4.8/6.0	1, 2, 0, 1	J, PL, SM Ca; J, R, SM Ca; J, R, SM Ca; J... Ca	20, 30, 30, 40	W1	R4	
200										

DEPTH SCALE 1" = 2.5'

Golder Associates

LOGGED BY

RECORD OF DRILLHOLE # 06

SHEET 9 OF 10

STA. OFFSET L R ELEVATION DATUM MSL

PROJECT NO. 903 1025 DRILLING DATE DRILL RIG LONGYEAR 44

INCLINATION 90 AZIMUTH

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES — WATER LEVELS — INSTRUMENTATION
200	Natural change @ 200 to more weathered (?) SS core - light bluish gray (5B 7/1) and light gray (N7) possible light olive gray (5Y 6/1)		17	6" / 6"	4" / 6"	3	J, I, R J, I, R J, PL, SM, Ca	60 30 40	W2	R3	>5mm calcite and qtz sand @ fracture
202.5	Same as above with "specks" of yellowish gray (5Y 8/1) material		18	10" / 10"	7" / 10"	0 0 0			W2	R3	
205						1 0	J, PL, R, K(S)	40			
207.5						0 1					
210	210' Natural change to Slightly weathered mossive, yellowish gray (5Y 8/1), light bluish gray (5B 7/1), to light olive gray (5Y 6/1), m-C angular grain, med. strong calcite veins @ 60° to core axis, some lithic fragments					0 2 0	I, I, R, Ca J, PL, SM, Ca F, R, SM, Ca	20 40 25			210' shale lamina and veinlets Fracture along calcite vein (at I) 211' calcite veins TP to core axis
212.5			29	10" / 10"	6" / 10"	0 0 3 0			W2	R3	
215	215' to 216' Fracture & clay (gouge) to minor calcite infilling. Coarse quartz sand (angular) and calcite fragments @ 25° to core axis - some short smooth laminae @ 20° to CA.					0 1 1 0	J, ST, R, Ca(k) J, PL, ?, ? I, PL, SM, Ca	40 40 20			
217.5			30	8" / 8"	4" / 8"	1 2 0 1 2 2	J, I, R, Ca				

DEPTH SCALE 1" = 2.5' Golder Associates LOGGED BY

RECORD OF DRILLHOLE # U6

STA. OFFSET L R
PROJECT NO. 903 1025
INCLINATION 90 AZIMUTH
ELEVATION
DRILLING DATE
DATUM MSL
DRILL RIG LONGYEAR 44

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	RUN NO.	RECOVERY	R.Q.D.	FRACTURE INDEX PER FT.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	INDEX: WEATHERING	INDEX: STRENGTH	NOTES / WATER LEVELS / INSTRUMENTATION
225	225± Material change to more slightly weathered(?) material. Slightly weathered, massive, very light gray (N8), light olive gray (5Y 6/1) to light bluish gray (5B 7/1) coarse, angular, moderate strong SANDSTONE (GRAYWACKE)		30	8.4/8.4	4.0/8.4	1, 0, 0, B, B	J, R, SM, Ca; Avg. Fracture ∡ 20° to CA	60	W2	R3	Mechanically induced
227.5											
230	230± material change to increased calcite in matrix. Veining pattern not observed, calcite with large brecciated SS fragments					B, B					
232.5	232± zone of calcite c̄ sub angular SS fragments. Contact @ 30° to core axis		31	10.0/10.0	6.0/10.0	B, 0, 0, 0			W2	R3	
235											
	236± to 237± sub-angular to rounded fragments of Shaley/SS in SANDSTONE; calcite matrix as described above.					0					
237.5						1, 1	J, R, SM, Ca; J, PL, SM, Ca	70; 30			Fracture along Shaley SS
240	239± material change to slightly weathered, massive, yellowish gray (5Y 8/1), light bluish gray (5B 7/1), to light olive gray (5Y 6/1) ... angular ... grained ... red strong SANDSTONE, intermittent calcite veining @ 60° to CA. Strength increase					1	J, R, SM, Ca	20	W1	R4	Fracture along calcite vein
242.5	240± Material change to fresh, massive, light olive gray (5Y 6/1), light bluish gray (5B 7/1) ... gray (5GY 7/1), ... SANDSTONE, sparse calcite ... @ avg 50° to CA.		32	10.0/10.0	9.0/10.0	2, 0, 0, 0, 1, 0, 1, 0, 2, 1	J, PL, SM; J, PL, SM; J, PL, SM, Ca; J, PL, ..., Ca; J, PL, ..., Ca	30; 60; 50; 25	W1	R4	Mechanically induced; 245± to 245± calcite vein, ... Shaley/SS lamina at ... ; Mechanically induced; M2
250											

DEPTH SCALE
Golder Associates
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APPENDIX D

Bay Bridge Rock Testing Report Data
Excerpted from Appendices 3B and 3B, Volume 3
San Francisco Bay Bridge East Span Seismic Safety Project
Final Geotechnical Characterization Report
Yerba Buena Island Approach

Geo Test GTU Unlimited

Test Equipment Design & Fabrication
Laboratory & Field Testing
Consulting Services

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Letter Report
San Francisco Oakland Bay Bridge
Seismic Safety Project
Yerba Buena Island, Phase-2 Exploration
Rock Testing Program

This report details a suite of 111 unconfined compression tests, 21 modulus tests and 51 direct shear tests. GTU set up a rock testing lab on the island to expedite sample delivery and more easily coordinate the testing effort. An additional benefit of this arrangement was to more easily select samples suitable for testing and to reduce sample disturbance. As the cores were logged and stored in the refrigerated core shack, samples were chosen and withdrawn for testing. The samples were prepared and tested on Yerba Buena Island between the dates of October 23, 1999 and January 10, 2000. An additional direct shear sample was tested at GTU's Nevada City lab on January 30, 2000.

The sample preparation and testing procedures followed the ASTM Standards and ISRM Suggested Methods.

This letter report presents the test results and highlights any behavior exhibited during the tests which might have some bearing on interpreting the test results.

This report is accompanied by a set of data sheets and plots. The standard test procedures used by GTU are appended to this report. The sample photographs and a ZIP disk with all of the test data and GRAPHER files are also included with this report.

Sample Description

The rock which was tested in this program ranged from a medium gray coarse grained sandstone (locally called graywacke) to a dark gray siltstone (which in many cases had characteristics of shale). A few of the samples were unaltered, but the majority of them exhibited some form of alteration, to the extent that a few samples could almost be considered strong soil.

Generally the sandstone was a medium grained, slightly altered material, with calcite, and occasionally quartz, healed fractures. The grains of the sandstone typically consisted of gray claystone and siltstone clasts, with feldspars and possible some quartz making up the other portion of the samples. Although some samples were homogeneous, most of the samples exhibited some banding, probably due to bedding, with bedding angled between about 40 and 50 degrees to the core axis. The bedding was delineated by thin darker gray layers of either finer grained sandstone or siltstone. These thin beds often resulted in planes of weakness through the samples. The siltstone was generally quite fissile, with bedding generally between 40 and 50 degrees to the core axis. The planes

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were generally smooth and slickensided. The slickensides were probably due to microshears within the mass rather than due to displacements of any significant magnitude, similar to those found in clayshales of the Bay Area. As with the sandstones, the joints were often coated with calcite, although due to the slick nature of the bedding, the calcite generally adhered poorly to the siltstone.

At shallower depths, near the soil-rock interface, many of the joints became clay coated or filled. These filled joints appeared to be quite weak. Oxide staining was also prevalent, as were oxide coatings on the joints. Alteration of the rocks was expressed by an increased degree of fracturing, more open joints which might be partially calcite filled, and in the sandstones, a change in color from a medium to a tannish gray and ultimately to a brown color. The brown sandstone could be easily gouged with a knife whereas the strongest of the unaltered sandstone could be extraordinarily strong.

A small number of sandstone samples may have been taken from a shear zone. These samples appeared to consist of fragmented sandstone floating in a matrix of rock flour. The rock flour was very fine medium gray silt sized particles, which often was in a quite thin layer between the small medium gray sandstone clasts. The sandstone clasts were generally angular, and the matrix seemed to flow around the clasts.

Sample Preparation

The unconfined compression, modulus, and direct shear test samples were prepared using the procedures presented in the appendices. Some of the unconfined compression and modulus test samples were quite fragile as they contained many poorly healed fractures. In these cases the samples were first wrapped with heat shrink plastic wrap, and the wrap heated to confine the samples. They were then cut and surfaced in the regular manner. The wrap was removed just prior to testing. In a few cases, the weak sample ends had to be strengthened by either filling voids near the end with hydrostone (a strong plaster) or gluing the joints on or near the ends with cyanoacrylate glue.

After cutting and grinding the samples, they were stored in buckets of water. In the case of highly altered and weak samples, they were stored in a large plastic bag with a few wet towels to maintain a high degree of humidity. For these weakest of samples, the water bath tended to result in the samples falling apart, possibly due to lack of confinement and reduction of negative pore pressure along the sample joints.

In a few cases, the ends of the unconfined compression samples were flat, but not parallel. This condition was a result of the weak, partially open fractures which passed through the sample. These joints deformed as the samples were removed from the core grinding jig, rotating the ends and resulting in the non-parallel condition.

Test Procedures

Unconfined Compression Test Procedure

No deviations from the appended test procedure were required for these tests. A 222 kn. (50 kip) load cell was used for the weakest samples and a 890 kn. (200 kip) load cell was used for the samples which appeared stronger on initial examination.

Modulus Test Procedure

No deviations from the appended test procedure were required for these tests. A 222 kn. (50 kip) load cell was used for these tests.

Direct Shear Test Procedure

No deviations from the appended test procedure were required for these tests. The shear box was configured with the smaller sample holder, and the normal loads were applied using a pneumatic cylinder. 8.9 kn. (2 kip) load cells were used to measure the normal and shear loads. Generally, two sets of three stage tests were performed on each sample. One set was performed at very small shear displacements, in an attempt to capture the initial unsheared failure strength of the joint. The second set was performed at relatively large displacements to obtain a measure of the joint strength in an unmated configuration.

Test Results

Unconfined Compression Tests

Boring	Sample	Depth (ft)	Description	Density ($kn./m^3$) (pcf)	UC Strength (MPa) (psi)
B151	151-44	44.7-45.2	Gray sheared sandstone with thin siltstone interbeds and a few calcite healed joints.	26.08 (166.0)	6.98 (1012)
	151-45	45.2-45.7	Gray sheared sandstone with a few calcite healed joints and voids.	26.20 (166.8)	18.78 (2724)
	151-48	48.8-49.3	Gray highly sheared sandstone with a few calcite healed voids.	26.11 (166.2)	2.16 (313)
	151-123	123.8-124.2	Dark gray thinly bedded siltstone with bedding about 38 degrees to the core axis, with one calcite healed bedding joint.	26.28 (167.3)	4.19 (608)
	151-187	187.5-188.0	Bedded siltstone with bedding about 52 degrees to the core axis.	26.17 (166.6)	0.55 (80)
B152	152-90	90.9-91.3	Gray interbedded sandstone and siltstone which has been sheared and rehealed with calcite. Bedding is about 47 degrees to the core axis.	26.33 (167.6)	17.96 (2605)
	152-129	129.8-130.3	Gray sandstone with a few nearly horizontal calcite healed hairline fractures.	26.63 (169.5)	106.93 (15,509)
	152-145	145.8-146.3	Dark gray siltstone with a 1-inch thick bed of medium gray fine sandstone, with bedding about 61 degrees to the core axis.	26.34 (167.9)	47.36 (6869)
	152-177	177.0-177.5	Gray sandstone with a few calcite healed hairline fractures about 53 degrees to the core axis.	26.80 (170.6)	165.05 (23,938)
B153	153-6	6.0-6.5	Tan weathered sandstone with many dark brown oxide coated joints.	25.43 (161.9)	13.25 (1922)
	153-13	13.0-13.5	Light to medium tan intensely weathered sandstone with several dark brown stained joints.	25.31 (161.1)	7.09 (1028)

B153 (cont.)	153-19	19.0-19.5	Tan massive sandstone with one partially healed fractures about 30 degrees to the core axis.	26.00 (165.5)	31.24 (4531)
	153-26	26.3-26.8	Tan weathered sandstone with calcite healed fractures, one with large voids.	26.00 (165.5)	11.60 (1683)
	153-51	51.3-51.9	Gray sandstone with breciated clasts of siltstone with many calcite healed fractures	26.19 (166.7)	15.24 (2210)
	153-58	58.0-58.5	Massive gray sandstone with a few calcite healed hairline fractures about 10 degrees to the core axis.	26.61 (169.4)	66.21 (9602)
B155	155-17	17.2-17.7	Gray coarse grained sandstone with two non-through-going calcite healed fractures about 65 degrees to the core axis.	26.36 (167.8)	40.81 (5919)
	155-23	23.7-24.2	Highly fractures and sheared siltstone with an open joint about 60 degrees to the core axis and a calcite healed joint about 36 degrees to the core axis.	26.19 (166.7)	0.03 (~5)
	155-54	54.0-54.5	Gray fine grained sandstone with a few calcite healed joints 9 and 40 degrees to the core axis.	26.41 (168.1)	60.77 (8814)
	155-69	69.0-69.5	Gray sandstone with several calcite healed fractures, with a major one about 24 degrees to the core axis.	26.08 (166.0)	3.76 (545)
	155-77	77.0-77.5	Gray sandstone interfingered with siltstone with nearly axial jointing.	25.97 (165.3)	16.46 (2387)
	155-83	83.8-84.3	Dark gray siltstone with two interbeds of fine sandstone with bedding about 52 degrees to the core axis.	26.20 (166.8)	17.21 (2496)
	155-99	99.3-99.8	Gray fine grained sandstone with an axial calcite healed fracture about 17 degrees to the core axis.	26.45 (168.4)	55.75 (8086)
	155-127	127.5-128.0	Gray sandstone with many calcite healed hairline fractures and a few calcite healed joints, 22, 30, and 40 degrees to the core axis.	26.58 (169.2)	35.25 (5112)
B156	156-10	10.2-10.6	Dark gray fissile thinly bedded siltstone with a few open bedding plane fractures about 60 degrees to the core axis.	25.64 (163.2)	1.69 (245)
	156-11	11.5-11.9	Gray thinly bedded sandstone with bedding about 52 degrees to the core axis with a poorly healed diagonal joint about 21 degrees to the core axis.	26.03 (165.7)	23.27 (3375)
	156-16	16.0-16.5	Gray thinly bedded sandstone with a few dark gray thin siltstone beds about 49 degrees to the core axis.	25.87 (164.7)	1.45 (210)
	156-22	22.5-23.0	Gray bedded sandstone with bedding about 55 degrees to the core axis.	26.48 (168.6)	79.31 (11,235)
	156-31	31.5-31.9	Gray bedded sandstone with bedding about 58 degrees to the core axis and two nearly axial fractures.	26.50 (168.7)	99.99 (14,502)

156 (cont.)	156-35	35.7-36.2	Medium to dark gray thinly bedded sandstone with bedding about 57 degrees to the core axis.	26.36 (167.8)	29.92 (4340)
	156-67	67.8-68.2	Dark gray siltstone bedded about 53 degrees to the core axis with two calcite healed joints about 26 and 38 degrees to the core axis.	26.23 (167.0)	20.37 (2954)
	156-72	72.3-72.8	Sheared and recemented siltstone with a calcite healed fracture and a partially healed fracture about 40 degrees to the core axis.	26.26 (167.2)	1.57 (228)
	156-136	136.5-137.0	Sheared and recemented gray sandstone with jointing about 37 degrees to the core axis.	26.25 (167.1)	10.12 (1468)
B157	157-5	5.0-5.5	Gray highly fractured fine grained sandstone.	26.00 (165.5)	0.16 (23)
	157-55	55.1-55.6	Gray sandstone with a few small siltstone clasts and a calcite healed hairline fracture about 30 degrees to the core axis.	26.23 (167.0)	63.06 (9146)
	157-68	68.3-68.8	Sheared and recemented gray sandstone with stringers of siltstone and a few calcite healed joints about 12 and 25 degrees to the core axis.	26.05 (165.8)	21.93 (3181)
	157-92	92.9-93.4	Gray sandstone with two calcite healed hairline fractures about 22 and 31 degrees to the core axis.	26.64 (169.6)	70.56 (10,233)
	157-113	113.0-113.5	Sheared and recemented mass of siltstone and sandstone with a few calcite healed irregular hairline fractures.	26.42 (168.2)	62.01 (8994)
	157-127	127.9-128.3	Gray sandstone with large clasts of siltstone with many random fractures.	26.45 (168.4)	24.02 (3484)
	157-148	148.0-148.5	Gray sandstone with many calcite healed fractures and a main one about 11 degrees to the core axis.	26.75 (170.3)	58.58 (8496)
B158	158-9	9.0-9.5	Gray moderately weathered sandstone with several calcite healed hairline fractures.	26.31 (167.5)	62.88 (9120)
	158-18A	18.0-18.5	Gray bedded sandstone with bedding about 49 degrees to the core axis with many siltstone clasts and a few minor calcite healed fractures.	26.19 (166.7)	27.78 (4029)
	158-18B	18.5-19.0	Gray weak breciated sandstone with some large siltstone clasts and one weak joint about 36 degrees to the core axis.	25.79 (164.2)	3.01 (437)
	158-24	24.5-25.0	Dark gray siltstone with a few thin interbeds of sandstone bedded about 40 degrees to the core axis.	26.23 (166.9)	9.51 (1379)
	158-47	47.0-47.5	Gray bedded sandstone with a few siltstone interbeds about 53 degrees to the core axis with a few bedding plane fractures and one calcite healed fractures across the bedding.	26.15 (166.5)	11.31 (1641)
B159	159-8	8.5-8.9	Tan moderately weathered massive sandstone.	26.17 (166.6)	62.88 (9120)

B159 (cont.)	159-24	24.5-25.0	Gray sandstone with a few oxide stained joints and oxide staining about 1/4 inch from the joint, with one joint about 52 degrees to the core axis.	25.43 (161.9)	3.67 (532)
	159-29	29.0-29.5	Gray sandstone with a slightly open oxide stained joint.	26.30 (167.4)	36.94 (5357)
	159-33	33.0-33.5	Gray massive sandstone with a few open fractures and calcite healed fractures.	25.97 (165.3)	4.82 (699)
	159-34	34.5-35.0	Gray highly fractured siltstone with calcite healing of most joints.	26.03 (165.7)	4.04 (586)
B160	160-10	10.5-11.0	Gray to tan slightly to moderately weathered sandstone with two calcite healed fractures	26.56 (169.1)	73.87 (10,713)
	160-18	18.5-19.0	Tannish gray moderately weathered sandstone with two calcite healed fractures about 28 degrees to the core axis.	26.33 (167.6)	50.46 (7319)
	160-35	35.7-36.1	Tannish gray slightly weathered sandstone with no fractures.	26.59 (169.3)	124.17 (18,008)
B161	161-12	12.7-13.2	Tan severely weathered sandstone with many weak, generally axial fractures with on about 23 degrees to the core axis.	25.68 (163.5)	10.46 (1517)
	161-25	25.0-25.5	Tan sandstone with a poorly healed joint about 33 degrees to the core axis.	26.22 (166.9)	4.81 (697)
	161-50	50.0-50.5	Gray moderately weathered sandstone with many oxide stained and calcite healed joints with a thick calcite filled joint about 53 degrees to the core axis, and some axial joints.	26.31 (167.5)	17.80 (2582)
	161-79	79.0-79.5	Gray sheared and recemented sandstone with several steeply inclined shears.	26.26 (167.2)	7.56 (1096)
B165	165-12	12.3-12.8	Brown intensely weathered sandstone with a few partially healed fractures.	25.61 (163.0)	16.49 (2392)
	165-31	31.8-32.2	Gray moderately weathered coarse grained sandstone with one non-through-going fracture.	25.81 (164.3)	41.49 (6017)
	165-48	48.7-49.3	Gray interbedded sandstone and siltstone with bedding about 40 degrees to the core axis.	26.22 (166.9)	20.17 (2926)
	165-54	54.0-54.5	Gray sandstone with a calcite healed axial fracture.	26.42 (168.2)	147.46 (21,387)
	165-76	76.3-76.8	Gray sandstone with a few calcite healed hairline fractures about 32 and 53 degrees to the core axis and one thick calcite filled joint about 42 degrees to the core axis.	26.58 (169.2)	65.01 (9428)
	165-90	90.5-91.0	Gray sandstone with one calcite healed hairline fracture about 32 degrees to the core axis.	26.63 (169.5)	87.81 (12,736)
B166	166-2	2.0-2.5	Tan massive sandstone with one healed axial fracture.	26.11 (166.2)	47.78 (6929)
	166-8A	8.2-8.7	Tan sandstone with one weak joint about 13 degrees to the core axis.	26.12 (166.3)	41.66 (6042)

B166 (cont.)	166-8B	8.7-9.2	Tan sandstone with one weak axial joint.	26.09 (166.1)	26.92 (3905)
	166-24	24.0-24.5	Olive tan sandstone with a few tight fractures about 20, 35, and 50 degrees to the core axis.	26.48 (168.6)	62.90 (9122)
	166-32	32.0-32.5	Olive tan sandstone with one slightly altered joint about 52 degrees to the core axis.	26.44 (168.3)	83.88 (12,166)
	166-50	50.5-51.0	Gray moderately weathered sandstone with several weak calcite healed oxide stained fractures.	26.77 (170.4)	27.60 (4003)
	166-73	73.5-74.0	Gray coarse grained sandstone with a few minor calcite healed hairline fractures about 20 degrees to the core axis.	26.72 (170.1)	70.02 (10,156)
	166-88	88.5-89.0	Gray sandstone with several calcite healed fractures about 8 and 40 degrees to the core axis.	26.63 (169.5)	96.63 (14,015)
B167	167-27	27.5-28.0	Gray highly sheared sandstone with sandstone clasts floating in a rock flour matrix.	25.46 (162.1)	0.20 (29)
	167-29	29.5-30.0	Gray sandstone with a steeply inclined recemented shear zone and several calcite healed hairline fractures.	26.36 (167.8)	18.26 (2649)
	167-34	34.5-35.0	Gray sheared and recemented sandstone with a shear about 24 degrees to the core axis.	26.37 (167.9)	12.31 (1785)
	167-39	39.5-40.0	Gray sheared sandstone with many nearly vertical calcite healed hairline fractures.	26.26 (167.2)	17.15 (2487)
	167-44	44.5-45.0	Gray sheared and recemented sandstone.	26.33 (167.6)	17.67 (2563)
	167-64	64.5-65.0	Gray sandstone with a shear zone about 37 degrees to the core axis and two calcite healed hairline fractures about 26 and 32 degrees to the core axis.	26.50 (168.7)	50.22 (7284)
	167-91	91.3-91.8	Gray sandstone with one small calcite healed joint near the sample end.	26.72 (170.1)	186.51 (27,050)
B171	171-71	71.5-72.0	Tan severely weathered sandstone with a tan coated joint about 54 degrees to the core axis.	25.02 (159.3)	12.65 (1834)
	171-77	77.0-77.4	Gray moderately weathered sandstone with several oxide stained weak joints and shears along the core axis.	26.01 (165.6)	11.45 (1661)
B172	172-59	59.9-60.3	Tan severely weathered sandstone with weak axial joints.	25.31 (161.1)	10.36 (1502)
	172-66	66.0-66.4	Tan severely weathered sandstone with a weak joint about 22 degrees to the core axis.	25.59 (162.9)	2.81 (407)
B174	174-60	60.1-60.6	Tan weak sandstone with an oxide stained joint about 42 degrees to the core axis.	24.99 (159.1)	5.38 (781)
	174-77	77.2-77.6	Tan severely weathered sandstone with a few random oxide stained fractures.	25.56 (162.7)	24.29 (3523)
B301	301-14	14.8-15.3	Olive gray sandstone with two calcite healed hairline joints about 14 and 22 degrees to the core axis.	26.50 (168.7)	27.57 (3999)

B301 (cont.)	301-34	34.3-34.8	Gray fine grained sandstone with several calcite healed joints about 37 degrees to the core axis.	26.64 (169.6)	42.24 (6126)
B302	302-30	30.5-31.0	Gray fine grained sandstone with a few siltstone clasts and calcite healed joints about 14 and 40 degrees to the core axis.	26.17 (166.6)	33.99 (4930)
B303	303-15	15.0-15.4	Gray siltstone with thin vertical bedding with thin interbeds of tan fine sandstone and a cross bedding fracture about 12 degrees to the core axis.	25.07 (159.6)	4.83 (700)
	303-17	17.1-17.5	Tan and gray thinly bedded siltstone with bedding about 26 degrees to the core axis.	25.48 (162.2)	8.36 (1213)
B305	305-54	54.7-55.2	Tan to gray moderately weathered sandstone with two weak joints about 27 degrees to the core axis.	26.20 (166.8)	25.65 (3720)
	305-69	69.0-69.5	Gray slightly weathered fine grained sandstone with two calcite healed joints about 46 degrees to the core axis.	26.64 (169.6)	87.97 (12,759)
	305-74	74.4-74.9	Gray sandstone with oxide stained calcite healed joints about 36 degrees to the core axis and a few calcite healed axial joints.	26.67 (169.8)	19.34 (2805)
	305-88	88.3-88.8	Brown intensely weathered sandstone and gray bedded siltstone with the contact about 32 degrees to the core axis.	25.01 (159.2)	4.19 (608)
B312	312-89	89.3-89.7	Gray moderately weathered sandstone with tan oxide coated joints	25.46 (162.1)	10.13 (1470)
	312-97	97.5-97.9	Gray sandstone with a few oxide coated joints.	25.46 (162.1)	15.22 (2208)
	312-116	116.1-116.6	Gray sandstone with a few calcite healed hairline fractures about 26 and 60 degrees to the core axis.	26.55 (169.0)	137.96 (20,009)
B502	502-4	4.6-5.0	Tan to gray moderately weathered sandstone with several calcite healed joints and one unhealed joint about 46 degrees to the core axis.	26.11 (166.2)	26.10 (3785)
	502-5	5.0-5.5	Gray slightly weathered coarse grained sandstone with one calcite healed fracture about 30 degrees to the core axis and one oxide coated healed fractures about 65 degrees to the core axis.	26.31 (167.5)	69.16 (10,030)
	502-8	8.2-8.7	Tannish gray moderately weathered sandstone with many calcite healed joints.	26.12 (166.3)	53.77 (7798)
	502-29	29.5-30.0	Gray coarse grained bedded sandstone with large rounded siltstone clasts and three calcite healed joints 65, 65, and 90 degrees to the core axis and bedding about 70 degrees to the core axis.	26.25 (167.1)	68.33 (9910)
	502-35	35.0-35.5	Gray sandstone with a few thin siltstone beds about 56 degrees to the core axis near one end and a few calcite healed joints.	26.34 (167.7)	67.23 (9751)

B502 (cont.)	502-37	37.9-38.4	Gray fine grained sandstone with a few siltstone beds near one end with several calcite healed fractures.	26.53 (168.9)	37.54 (5445)
	502-40	40.1-40.6	Dark gray fine gray sandstone with siltstone at one end with a few calcite healed joints.	26.30 (167.4)	38.66 (5607)
	502-41	41.0-41.5	Sheared siltstone with overturned sandstone beds. Contains many fractures and a major shear about 50 to 67 degrees to the core axis.	26.11 (166.2)	0.10 (~14)
	502-42	42.3-42.8	Dark to light gray bedded sandstone and siltstone with many calcite healed fractures and joints.	26.19 (166.7)	19.26 (2793)
	502-43	43.3-43.8	Dark gray thinly bedded sandstone with unhealed and calcite healed bedding joints and one calcite healed joint about 49 degrees to the core axis.	26.14 (166.4)	10.36 (1502)
	502-46	46.4-46.8	Dark gray fractured sandstone with bedding about 55 degrees to the core axis.	26.05 (165.8)	0.34 (~50)
	502-47	47.0-47.4	Dark gray highly fractured siltstone with a shear zone about 50 degrees to the core axis.	26.00 (165.5)	0.08 (~12)
	502-49	49.9-50.3	Gray siltstone with an open joint about 64 degrees to the core axis with several unhealed and calcite healed fractures.	26.23 (167.0)	13.00 (1886)
	502-50	50.8-51.4	Dark gray highly fractured siltstone with many unhealed, poorly healed, and calcite healed joints.	25.95 (165.2)	2.11 (306)
	502-59	59.7-60.2	Dark gray bedded siltstone with bedding about 75 degrees to the core axis.	26.17 (166.6)	57.39 (8323)
	502-60	60.4-61.0	Dark gray bedded siltstone with one calcite healed bedding joint about 79 degrees to the core axis.	26.15 (166.5)	43.52 (6312)

Young's Modulus Tests

Boring	Sample	Depth (ft)	Description	Density ($kn./m^3$) (pcf)	Strength (MPa) (psi)	ν	E (GPa) ($x10^6$ psi)
B151	151-61	61.3-61.8	Gray sheared sandstone and siltstone with one thin calcite seam	26.05 (165.8)	21.11 (3061)	NA (.72)	59.4 (8.62)
	151-64	64.3-64.8	Gray bedded sandstone with bedding about 53 degrees to the core axis.	26.44 (168.3)	74.45 (10,798)	.34	69.0 (10.0)
	151-171	171.8-172.3	Gray sheared sandstone with many fractures and calcite healed fractures.	26.05 (165.8)	5.12 (743)	.17	10.6 (1.54)
	151-193	193.0-193.5	Gray fine grained sandstone with several hairline fractures and a few calcite healed joints.	26.47 (168.5)	25.05 (3633)	.36	37.4 (5.43)

B152	152-51	51.5-52.0	Gray fine grained sandstone with one hairline calcite healed joint about 29 degrees to the core axis.	26.39 (168.0)	49.72 (7211)	.38	35.9 (5.21)
	152-63	63.8-64.3	Medium and dark gray sandstone with a few siltstone clasts.	26.50 (168.7)	78.80 (11,428)	.25	30.0 (4.35)
	152-99	99.3-99.8	Gray sandstone with three calcite healed joints , with one about 32 degrees to the core axis.	26.56 (169.1)	82.69 (11,993)	.22	55.6 (8.06)
	152-132	132.9-133.2	Gray fine grained sandstone with several calcite healed joints about 30 degrees to the core axis.	26.30 (167.4)	40.09 (5815)	.32	46.0 (6.67)
	152-150	130.5-150.8	Gray sandstone with a calcite healed hairline fracture about 30 degrees to the core axis.	26.52 (168.8)	50.26 (7289)	.30	33.8 (4.90)
B158	158-51A	51.0-51.4	Bedded siltstone with bedding about 57 degrees to the core axis, with a partially open calcite healed fracture.	26.17 (166.6)	13.89 (2014)	NA (.56)	27.6 (4.00)
	158-51B	51.7-52.2	Dark gray interbedded sandstone (80%) and siltstone (20%)	26.23 (167.0)	14.10 (2045)	.34	15.3 (2.22)
	158-62	62.7-63.1	Gray sandstone with three calcite healed joints.	26.48 (168.6)	66.20 (9601)	.16	51.4 (7.46)
	158-72	72.0-72.5	Gray sandstone with a few calcite healed hairline fractures	26.41 (168.1)	65.52 (9502)	.21	43.6 (6.33)
	158-81	81.3-81.7	Gray sandstone wit several hairline fractures about 25 degrees to the core axis.	26.37 (167.9)	67.66 (9813)	.16	36.3 (5.26)
B159	159-15	15.5-16.0	Tan sandstone with two joints and a point load fracture which has been glued.	25.34 (161.3)	14.15 (2052)	NA? (.10)	10.1 (1.47)
	159-21	21.0-21.4	Highly fractured and sheared siltstone.	23.89 (152.1)	0.10 (~15)	NA[1]	NA[1]
B502	502-13	13.0-13.5	Tannish gray moderately weathered sandstone with two oxide stained joints about 8 and 45 degrees to the core axis.	26.00 (165.5)	21.42 (3106)	.36	30.0 (4.35)
	502-25	25.8-26.2	Gray bedded sandstone (1/3 of the sample) and dark gray bedded siltstone with a few fractures.	26.14 (166.4)	0.41 (~60)	NA? (.09)	3.4 (0.49)
	502-27	27.5-28.0	Dark gray interbedded sandstone and siltstone with one healed fracture near one end.	26.30 (167.4)	45.46 (6593)	.41	28.1 (4.08)
	502-31	31.0-31.5	Dark gray interbedded sandstone and siltstone with several calcite healed fractures.	26.30 (167.4)	16.33 (2369)	.39	26.5 (3.85)
	502-53	53.1-53.6	Interfingered sandstone and siltstone with an axial calcite healed joint.	26.23 (167.0)	17.34 (2515)	NA (.65)	34.5 (5.00)

1. These values could not be determined due to the extreme weakness of the sample.

Direct Shear Tests

Boring	Sample	Depth (ft)	Description	Initial Joint Strength		Final Joint Strength	
				Sj (KPa) (psi)	ϕ_j (deg)	Sj (KPa) (psi)	ϕ_j (deg)
B151	151-33	53.0	Undulating bedding plane joint in very thinly bedded sandstone and siltstone.	340 (58.0)	38.4	105 (15.2)	24.7
	151-124	124.2	Planar and smooth bedding plane joint in siltstone.	62 (9.0)	19.7	103 (14.9)	20.5
	151-156	156.3	Rough joint in gray sandstone with a thin calcite coating and some pyrite crystals on the joint.	208 (30.1)	39.8	132 (19.1)	28.8
	151-192	192.7	Planar joint across siltstone beds with a thin calcite coating.	208 (30.1)	29.7	10 (1.4)	24.7
B152	152-48	48.1	Well mated slightly rough joint with a thin calcite coating in fine grained gray sandstone.	255 (37.0)	35.1	57 (8.2)	32.6
	152-62	62.8	Well mated slightly rough planar joint in fine grained gray sandstone.	112 (16.3)	41.9	112 (16.3)	31.9
	152-82	82.5	Well mated undulating joint in siltstone with a sparse calcite coating and slickensides in the direction of shearing.	81 (11.7)	26.2	50 (7.3)	18.0
	152-118	118.7	1/4" thick intact shear zone with sheared siltstone and calcite.	468 (67.9)	31.5	205 (29.8)	20.4
B153	153-11A	11.0	Rough dark brown oxide coated joint in tan sandstone.	75 (10.9)	44.1	26 (3.8)	33.7
	153-11B	11.2	Planar smooth dark brown oxide coated joint in tan sandstone.	19 (2.8)	25.6	5 (0.8)	22.4
	153-20	20.5	Rough dark brown oxide coated joint in tan sandstone with a sparse brown clay or silt coating.	65 (9.4)	36.6	43 (6.3)	30.4
	153-24	24.7	Undulating joint in tan weathered sandstone with dark brown oxide staining.	17 (2.5)	33.9	44 (6.4)	26.1
	153-52	52.1	Undulating polished joint in siltstone.	132 (19.1)	26.0	69 (10.0)	25.9
B155	155-5	5.8	Rough planar joint in weathered tannish gray sandstone.	46 (6.7)	43.3	14 (2.1)	30.0
	155-12	12.5	Undulating joint in siltstone with calcite and brown oxide coating.	48 (7.0)	40.7	28 (4.1)	32.5
	155-15	15.0	Planar intact joint in gray sandstone.	91 (13.2)	40.0	36 (5.2)	33.1
	155-45	45.2	Wavy joint in dark gray siltstone.	238 (34.5)	33.4	66 (9.6)	27.7
B156	156-8	8.5	Planar slightly rough brown oxide coated bedding joint in gray siltstone.	14 (2.1)	34.2	11.7 (1.7)	23.3
	156-14	14.7	Well mated slightly rough planar bedding plane joint with brown oxide coating in gray sandstone.	43 (6.3)	33.8	23 (3.3)	25.5

B156 (cont.)	156-27	27.0	Rough well mated slickensided bedding plane joint in siltstone.	84 (12.2)	38.5	45 (6.5)	26.8
	156-58	58.9	Intact shear zone in siltstone with some granular filling and calcite coating.	105 (15.3)	16.7	70 (10.2)	21.9
	156-64A	64.0	Planar bedding plane joint with a thin calcite coating in siltstone.	NA[1]	NA[1]	46 (6.7)	18.5
	156-64B	64.3	Planar slightly rough calcite coated joint in gray sandstone.	58 (8.4)	21.6	83 (12.1)	16.4
B157	157-8	8.4	Wavy joint in dark gray siltstone.	41 (6.0)	40.6	3 (0.5)	29.1
	157-26	26.0	Planar joint in gray sandstone with a tan oxide coating and a tan silty sand filling.	23 (3.4)	29.7	45 (6.5)	26.9
	157-40	40.5	Slightly rough joint in dark gray siltstone.	26 (3.7)	28.2	69 (10.0)	27.7
	157-49	49.5	Planar joint in dark gray siltstone with a thick (~1/32") calcite coating.	24 (3.5)	22.3	20 (2.9)	19.3
B158	158-29	29.5	Smooth planar joint in siltstone.	10 (1.4)	21.5	33 (4.8)	21.2
	158-54	54.3	Undulating joint with a thin calcite coating in siltstone.	197 (28.6)	23.3	54 (7.9)	22.3
	158-70	70.1	Planar slightly rough joint with a thin calcite coating in gray sandstone.	250 (36.2)	42.4	112 (16.2)	26.3
	158-76	76.3	Planar smooth joint in siltstone.	26 (3.8)	25.2	34 (4.9)	21.6
B160	160-33	33.0	Planar well mated and slightly rough joint in sandstone with dark brown staining.	223 (32.4)	42.0	40 (5.8)	29.5
	160-57	57.0	Rough calcite coated joint with dark brown oxide staining in gray sandstone.	212 (30.7)	45.9	99 (14.4)	30.8
B161	161-17	17.8	Slightly rough joint in weathered tan sandstone with a brown oxide coating.	41 (6.0)	36.8	18 (2.6)	24.6
	161-24	24.0	Planar intact joint with a 1/8" thick soft tan clay filling.	13 (1.9)	1.6	NA[2]	NA[2]
B165	165-32	32.5	Planar smooth siltstone bedding plane with a thin brown clay coating.	46 (6.7)	16.0	26 (3.7)	10.5
	165-49	49.5	Clean slightly wavy siltstone parting at a sandstone/siltstone contact.	12 (1.7)	19.1	10 (1.5)	26.3
	165-53	53.8	Clean well mated slightly rough planar joint in gray sandstone.	157 (22.7)	38.6	49 (7.1)	33.1
B166	166-14	14.9	Poorly mated slightly wavy joint in tan sandstone with dark and light brown oxide coating.	32 (4.6)	29.0	21 (3.0)	18.8
	166-26A	26.0	Well mated slightly rough clean joint in tannish gray sandstone.	54 (7.8)	34.6	46 (6.6)	29.3
	166-26B	26.7	Slightly undulating joint in gray sandstone with a dark brown oxide coating and a thicker tan oxide coating.	38 (5.5)	35.7	12 (1.8)	29.4
B167	167-19	19.5	Slightly rough planar joint in tannish gray sandstone.	23 (3.4)	33.1	26 (3.8)	27.9
	167-24	24.9	Slightly curved joint in weathered siltstone with a calcite coating.	34 (5.0)	12.9	34 (4.9)	14.3
B301	301-10	10.9	Slightly undulating joint in tannish gray sandstone with a sparse tan silt coating.	18 (2.6)	39.8	1 (0.2)	30.3

B302	302-14	14.0	Planar oxide stained joint in tan sandstone.	30 (4.4)	30.4	28 (4.0)	29.0
B303	303-8	8.1	Planar smooth joint in severely weathered siltstone with slickensides and coating of weathered calcite and tan clay.	9 (1.3)	11.1	12 (1.7)	12.8
B303 (cont.)	303-16	16.9	Planar joint in weathered brown sandstone with a black sandy coating (possibly organic).	29 (4.2)	27.9	32 (4.6)	22.5
B305	305-50	50.8	Well mated rough planar joint in tan sandstone with brown oxide staining.	53 (7.7)	35.7	23 (3.3)	28.3
	305-58	58.3	Well mated planar joint in tannish gray sandstone with dark brown oxide staining.	91 (13.2)	32.9	52 (7.5)	29.1
B312	312-81	81.2	Intact oxide stained joint in tan sandstone with a thin gray and tan clay coating.	83 (12.0)	10.3	92 (13.4)	9.3
B00-154	0154-34	34.3	Intact quartz filled joint with some voids in tannish gray sandstone.	NA[3]	NA[3]	NA[3]	NA[3]

1. The initial data file was lost for this sample and the sample was retested. These are the retested results.
2. This sample seemed to exhibit a constant shear strength irrespective of normal load, in the manner of an undrained clay. Much of the filling squeezed out of the joint during the test.
3. The joint strength could not be attained prior to the sample rotating out of the shear box. The shear strength exceeded 1.74 MPa (252 psi) with a normal stress of 0.30 MPa (43 psi) and exceeded 2.94 MPa (426 psi) with a normal stress of 1.17 MPa (170 psi).

Sample Behavior and Test Interpretation

Unconfined Compression Tests

This suite of unconfined compression tests resulted in a range of strengths from 0.10 MPa (14 psi) to 186.51 MPa (27,050 psi) for the sandstone samples and between 0.03 MPa (5 psi) and 57.39 MPa (8323 psi) for the siltstone. Cumulative distributions of unconfined strengths for the two rock types (Figure 1a) demonstrate that there does not appear to be any large grouping of strengths. However the siltstone does not generally exceed about 20 MPa (2900 psi) and the sandstone generally does not exceed about 70 MPa (10,150 psi). The histogram (Figure 1b) of the sandstone tests indicate two main concentrations of strengths, one between 10 and 20 MPa (1450 and 2900 psi) representative of the more fractured rock, and another peak in the range of 60 to 70 MPa (8700 to 10,150 psi) representative of the intact rock.

These distributions may not properly represent the real distribution found in the field for two reasons. Firstly, the focus of the investigation was to try and characterize the weaker rocks. Core which was clearly strong was often rejected for testing in preference to somewhat weaker samples. The addition of these stronger samples would probably have made the peak in the 60-70 MPa range in the histogram more pronounced. It is unlikely that exceedingly strong values would have been obtained as these strengths appeared to develop in rock with an unblemished nature (medium gray homogeneous texture with no fractures, calcite, or quartz veins) which was quite uncommon. It is likely that the core which was generally bypassed for testing was in the 50 MPa (7000 psi) to 80 MPa (12,000 psi) range.

Another distortion to the distribution arises due to the weakness of the insitu rock. Rock which turned to rubble while being drilled, or rock which was too fractured to result in sufficiently long samples could not be tested. These samples would likely have been quite weak and thus would have resulted in a much steeper distribution, with a corresponding weaker average rock mass strength. The addition of such weak samples probably would have tended to fill in the histogram in the 0 to 10 MPa range.

The high siltstone strengths were clearly anomalous, and should not be relied upon for generating strength. the siltstone in particular was difficult to sample and a great majority of the siltstone core could not be tested due to its fissile and flaking nature. More often than not, insufficient lengths of core could be found from which to prepare samples. It is likely that if more samples could have been found for testing, they would have had strengths less than about 10 MPa (1500 psi) or so.

The mode of failure in the unconfined tests likely impacted the measured strengths. Samples generally failed along joints and planes of weakness where such favorably oriented planes were available. The inclination of bedding (40-50 degrees) coupled with the weak nature of the calcite healed joints or poorly healed joints, resulted in samples which often failed prematurely along these planes of weakness. If the holes were drilled in another orientation relative to the bedding, one might expect to get a different strength distribution.

Modulus Tests

Of the samples selected for modulus testing, three could be classified as siltstones and the balance were sandstone samples. The siltstone moduli were 27.6 GPa (4.00×10^6 psi) and 3.4 GPa (0.49×10^6 psi) and the third sample was too weak to be able to measure a modulus. The sandstone moduli (Figure 2) also covered a large range, with the bulk of them falling between 30 and 40 GPa (4×10^6 psi to about 6×10^6 psi). These Youngs' moduli were evaluated on the unloading and reloading portions of the stress strain curves and are quite a bit higher than the initial tangent loading moduli.

A few of the poisson's ratios exceeded 0.5. At first these values might seem unreasonable as they exceed the 0.5 theoretical limit of a perfectly plastic material. But these materials are not homogeneous anisotropic materials. The fractures which pass through the samples can concentrate deformations, by sliding on joints for instance, and cause local deformations which exceed the theoretical limit. Vertical fractures are other features which can result in excessively large radial deformations. If the radial gauge is positioned so that it picks up some component of this deformation, then an excessively high poisson's ratio would be evaluated. Similarly, exceedingly low poisson's ratios can also develop. For these reasons, the ratios below about 0.2 are thought to be unrepresentative of the rock mass. The majority of the Poison's ratios fall between 0.32 and 0.40 as depicted in Figure 3.

During one of these tests (Sample 158-51B), the sample was held at a constant load which appeared to be sufficiently below the peak strength (as indicated by the slope of the stress-strain curves) for a short period of time, and the sample progressed to failure. This behavior clearly demonstrated creep behavior of the sample and highlights the possible need to address the time dependent behavior of the weaker, more clay rich rocks.

Direct Shear Tests

The initial normal stress used in these tests was calculated to be the overburden caused by 1.25 psi per foot of sample depth. This stress was doubled for the second stress level and doubled again for the third stress level. In a number of cases, this last level of loading exceeded the capacity of the loading ram and load cells used in the pneumatic system. In these cases a peak load of 8.9 kn. (2000 lb.) was used for the last load, 1/2 of this for the second stage load, and half again for the first load.

The cumulative distributions of friction angles for the sandstone and siltstone (Figures 4 and 5) demonstrate that the initial strengths are clearly higher than the final strengths. For the sandstones, most of the initial friction angles fall in the range of 33 to 40 degrees, whereas the majority of the final friction angles lie between 25 and 31 degrees. Although there seems to be a bit of scatter in the shear intercepts, there does not appear to be a large impact of shearing on these values and they generally range between 20 and 80 KPa (3 and 12 psi).

The siltstone joints (Figure 5) demonstrated a somewhat different trend. The initial friction angle distribution was quite broad, ranging quite uniformly from about 18 degrees to about 40 degrees. The influence of shearing was to tighten this range of values to between 18 and 28 degrees. The shear intercepts did not appear to be particularly impacted by the shearing, and generally ranged from about 10 to 80 KPa (2 to 12 psi).

For both sandstone and siltstone joints, the exceptionally high shear intercepts encountered in the initial shearing stages were significantly reduced to below 130 KPa (19 psi) in all cases.

Four tests on clay filled or coated joints should be highlighted. Samples 161-24, 165-32, 303-8, and 312-81 had friction angles of 1.6, 16.0, 11.1 and 10.3 degrees respectively. The behavior of Sample 161-24 was quite different from the other samples in that the strength did not appear to increase with confining pressure. The strength appeared to be that of an undrained clay (which was in fact filling the joint). At one point during this test (a shear displacement of about 0.16 inch), shearing was halted and the sample allowed to sit for about 10 minutes. After this period, shearing resumed and the sample was found to be a bit stronger, indicating that consolidation had occurred. Alternatively the soft clay could have continued to squeeze sideways out of the joint resulting in a larger percentage of the normal load being taken by the wall rock-to wall rock contacts, with the corresponding increase in strength.

The final direct shear sample, Sample 0154-43, consisted of a quartz healed joint in sandstone, with a number of voids in the filling. It was thought that the joint would be weak, but testing proved otherwise. Before the joint could shear, the sample was pulled out of the shear box, making it not possible to fail the sample with the current test configuration. One could only state that the joint strength exceeded the shear stress applied to the joint.

In a few samples (156-58, 165-49, 167-24, and 303-8) the final friction angles were found to be higher than the initial friction angles. At first this behavior might feel counterintuitive, but might be explained in light of the disturbance to the joint surface. In the cases of the last three samples, the joints were quite smooth prior to testing. Under these conditions, the friction angles and strengths might be expected to be representative of the smooth surfaces and be quite low. As the samples sheared, gouging developed (as

seen after most of the tests) and the smoothness of the surface would have been disrupted, indicated by a non-polished rough oval spots at the contacts between the two sample halves. Such a set of roughened contacts would likely be stronger than the initial smooth polished surface.

In the case of Sample 156-58, the joint was intact and consisted of a granular filled and calcite coated surfaces. Perhaps is this instance the granular filling started to bare against the wall rock after some level of shear displacement was realized and thereby mobilizing its contribution to the shear strength.

The increase in joint friction angle could also be explained by the deterioration of the calcite coatings. Prior to testing, some of the samples had thin calcite coatings, completely coating the joint surface. These coating were generally adhered poorly to the rock (in particular to the smooth siltstone surfaces). As shear displacements developed along the joints, the calcite layer would often break apart, allowing the bare wall rock to come in contact with each other. Thus the initial strength would be representative of the calcite layer whereas the final strength might be representative of the rock-to-rock contact.

Conclusions

1) Due to the high degree of fracturing, the distribution of unconfined strengths developed from this testing program may be somewhat skewed to the right. In addition, a decision was made to test a less than representative number of the strong intact samples, thus reducing the density of test results in the high strength region of the strength distribution curves. As a result of these two influences, both of weaker and harder rock may be encountered than might be expected from the strength distribution plot.

Many of the sample failures were joint controlled. Thus kinematics plays an important role in assessing the samples' strengths. If the core had been drilled at a different orientation to the main jointing orientations, different strengths might have developed. The concrete/rock bond strength might be higher than expected if ones bases the strength on other rock strength-concrete bond strength relationships. The high degree of fracturing found in this rock mass would tend to weaken the rock mass, but might not necessarily degrade the rock/concrete bond strength.

2) The modulus tests and some of the direct shear tests demonstrated aspects of creep. It appears that the weaker rock can creep and relax. In one modulus test, axial load of less than the ultimate strength was inadvertently left on the sample for a fairly short duration, which culminated in the failure of the sample. In a few of the direct shear tests, the test displacement rate was reduced with a corresponding reduction in shear load. When the shear displacement rate was stopped altogether, the shear load started to relax. These behaviors are indicative of creep and relaxation, and should be addressed in evaluating the long term load bearing capacity and deformability of the rock mass.

3) Due to the highly fractured nature of the rock mass, a fairly good representation of the joints was obtained for this testing program. Joints in rough sandstone joints resulted in the highest friction angles, and the smooth planar siltstone joints resulted in the lower strengths. Of particular note are the clay filled joints. It was often difficult to obtain good

quality clay filled joints suitable for testing. But those that were obtained resulted in very low friction angles, as low as about 2 degrees, although more typically around 10 degrees. If such joints are encountered in the field, it might be expedient to remove any removable blocks bounded by these joints rather than trying to support such blocks. Since these clay joints typically occurred near the soil/rock interface, they may not be difficult to deal with. On the other hand if such a joint is encountered in a deep excavation, it may pose a serious stability problem.

for GeoTest Unlimited

Dr. Anders Bro

APPENDIX E

Tables Excerpted From
Practical Rock Engineering, Course Notes, Hoek, (2000)

Table 4.4: Rock Mass Rating System (After Bieniawski 1989).

A. CLASSIFICATION PARAMETERS AND THEIR RATINGS									
Parameter			Range of values						
1	Strength of intact rock material	Point-load strength index	>10 MPa	4 - 10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range - uniaxial compressive test is preferred		
		Uniaxial comp. strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5 - 25 MPa	1 - 5 MPa	< 1 MPa
	Rating		15	12	7	4	2	1	0
2	Drill core Quality *RQD*		90% - 100%	75% - 90%	50% - 75%	25% - 50%	< 25%		
	Rating		20	17	13	8	3		
3	Spacing of discontinuities		> 2 m	0.6 - 2 . m	200 - 600 mm	60 - 200 mm	< 60 mm		
	Rating		20	15	10	8	5		
4	Condition of discontinuities (See E)		Very rough surfaces Not continuous No separation Unweathered wall rock	Slightly rough surfaces Separation < 1 mm Slightly weathered walls	Slightly rough surfaces Separation < 1 mm Highly weathered walls	Slickensided surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation > 5 mm Continuous		
	Rating		30	25	20	10	0		
5	Ground water	Inflow per 10 m tunnel length (l/m)	None	< 10	10 - 25	25 - 125	> 125		
		(Joint water press)/ (Major principal σ)	0	< 0.1	0.1, - 0.2	0.2 - 0.5	> 0.5		
		General conditions	Completely dry	Damp	Wet	Dripping	Flowing		
	Rating		15	10	7	4	0		

B. RATING ADJUSTMENT FOR DISCONTINUITY ORIENTATIONS (See F)						
Strike and dip orientations		Very favourable	Favourable	Fair	Unfavourable	Very Unfavourable
Ratings	Tunnels & mines	0	-2	-5	-10	-12
	Foundations	0	-2	-7	-15	-25
	Slopes	0	-5	-25	-50	

C. ROCK MASS CLASSES DETERMINED FROM TOTAL RATINGS					
Rating	100 ← 81	80 ← 61	60 ← 41	40 ← 21	< 21
Class number	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock

D. MEANING OF ROCK CLASSES					
Class number	I	II	III	IV	V
Average stand-up time	20 yrs for 15 m span	1 year for 10 m span	1 week for 5 m span	10 hrs for 2.5 m span	30 min for 1 m span
Cohesion of rock mass (kPa)	> 400	300 - 400	200 - 300	100 - 200	< 100
Friction angle of rock mass (deg)	> 45	35 - 45	25 - 35	15 - 25	< 15

E. GUIDELINES FOR CLASSIFICATION OF DISCONTINUITY conditions					
Discontinuity length (persistence) Rating	< 1 m 6	1 - 3 m 4	3 - 10 m 2	10 - 20 m 1	> 20 m 0
Separation (aperture) Rating	None 6	< 0.1 mm 5	0.1 - 1.0 mm 4	1 - 5 mm 1	> 5 mm 0
Roughness Rating	Very rough 6	Rough 5	Slightly rough 3	Smooth 1	Slickensided 0
Infilling (gouge) Rating	None 6	Hard filling < 5 mm 4	Hard filling > 5 mm 2	Soft filling < 5 mm 2	Soft filling > 5 mm 0
Weathering Ratings	Unweathered 6	Slightly weathered 5	Moderately weathered 3	Highly weathered 1	Decomposed 0

F. EFFECT OF DISCONTINUITY STRIKE AND DIP ORIENTATION IN TUNNELLING**			
Strike perpendicular to tunnel axis		Strike parallel to tunnel axis	
Drive with dip - Dip 45 - 90°	Drive with dip - Dip 20 - 45°	Dip 45 - 90°	Dip 20 - 45°
Very favourable	Favourable	Very unfavourable	Fair
Drive against dip - Dip 45-90°	Drive against dip - Dip 20-45°	Dip 0-20 - Irrespective of strike°	
Fair	Unfavourable	Fair	

* Some conditions are mutually exclusive . For example, if infilling is present, the roughness of the surface will be overshadowed by the influence of the gouge. In such cases use A.4 directly.

** Modified after Wickham et al (1972).

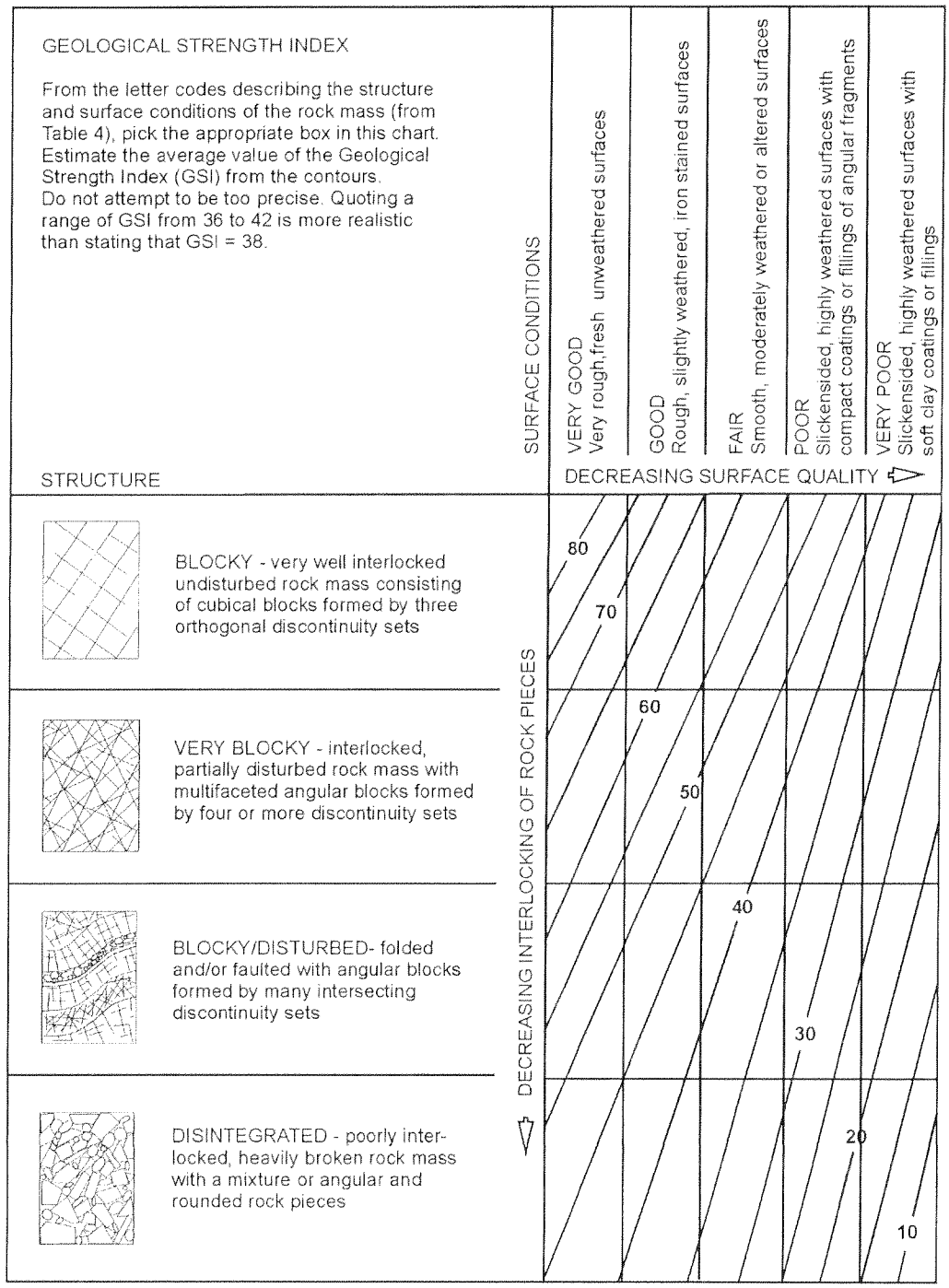
Table 11.3: Values of the constant m_i for intact rock, by rock group. Note that values in parenthesis are estimates.

Rock type	Class	Group	Texture			
			Coarse	Medium	Fine	Very fine
SEDIMENTARY	Clastic		Conglomerate (22)	Sandstone 19 — Greywacke (18)	Siltstone 9	Claystone 4
	Non-Clastic	Organic		Chalk 7; Coal (8-21)		
		Carbonate	Breccia (20)	Sparitic Limestone (10)	Micritic Limestone 8	
		Chemical		Gypstone 16	Anhydrite 13	
METAMORPHIC	Non Foliated		Marble 9	Hornfels (19)	Quartzite 24	
	Slightly foliated		Migmatite (30)	Amphibolite 25 - 31	Mylonites (6)	
	Foliated*		Gneiss 33	Schists 4 - 8	Phyllites (10)	Slate 9
IGNEOUS	Light		Granite 33; Granodiorite (30)		Rhyolite (16); Dacite (17)	Obsidian (19)
	Dark		Diorite (28); Gabbro 27; Norite 22	Dolerite (19)	Andesite 19; Basalt (17)	
	Extrusive pyroclastic type		Agglomerate (20)	Breccia (18)	Tuff (15)	

* These values are for intact rock specimens tested normal to bedding or foliation. The value of m_i will be significantly different if failure occurs along a weakness plane.

In deciding upon the value of σ_{ci} for foliated rocks, a decision has to be made on whether to use the highest or the lowest uniaxial compressive strength obtained from

Table 11.6: Estimate of Geological Strength Index GSI based on geological descriptions.



Slide Analysis Information

Document Name

File Name: sec e pro

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Radius increment: 10
Minimum Elevation: Not Defined
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack

Material Properties

Material: FILL
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 25 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Material 2
Strength Type: Generalised Hoek-Brown
Unit Weight: 155 lb/ft3
Unconfined Compressive Strength (intact): 50000 psf
mb: 0.0471656
s: 8.57494e-006
a: 0.522344
Water Surface: Water Table
Custom Hu value: 1

Material: GRAYWACKE
Strength Type: Generalised Hoek-Brown
Unit Weight: 165 lb/ft3
Unconfined Compressive Strength (intact): 1.008e+006 psf
mb: 0.477966
s: 0.000240369
a: 0.505734
Water Surface: Water Table
Custom Hu value: 1

Material: Bay Mud
Strength Type: Mohr-Coulomb
Unit Weight: 70 lb/ft3
Cohesion: 100 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.153320
Center: 2411.272, 257.479
Radius: 668.344
Left Slip Surface Endpoint: 2689.538, -350.181
Right Slip Surface Endpoint: 3031.777, 9.170
Resisting Moment=3.21391e+009 lb-ft
Driving Moment=2.78667e+009 lb-ft

Method: spencer
FS: 1.237560
Center: 1769.676, 974.469
Radius: 1611.930
Left Slip Surface Endpoint: 2689.855, -349.007
Right Slip Surface Endpoint: 3060.510, 9.034
Resisting Moment=7.44461e+009 lb-ft
Driving Moment=6.01558e+009 lb-ft
Resisting Horizontal Force=3.4059e+006 lb

Driving Horizontal Force=2.75212e+006 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 1341
Number of Invalid Surfaces: 0

Method: spencer
Number of Valid Surfaces: 328
Number of Invalid Surfaces: 1013
Error Codes:
Error Code -108 reported for 712 surfaces
Error Code -111 reported for 301 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-111 = safety factor equation did not converge