

APPENDIX D

Soil Boring Logs

Appendix D: Soil Boring Logs

Appendix D presents the soil boring and monitoring well constructions logs for all borings and monitoring wells installed before and during the remedial investigation. Appendix D also contains the soil logs for shallow soil samples collected from discrete soil sampling locations and background locations. The appendix contains the following logs:

D.1: Soil Boring Logs

D.2: Soil Sample Log for background, delineation, and decision unit soil samples

D.2.1: Background Soil Sample Log

D.2.2: Delineation Soil Sample Log

D.2.3: Decision Unit Soil Sample Log

Appendix D.1: Soil Boring Logs



ARCADIS

BOREHOLE LOG

WELL NO.

MW-1A

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 1

PROJECT NUMBER: WA000712.0003.00002

WELL COMPLETION DETAILS:

PROJECT NAME: Reserve Silica Site

LOCATION: Ravensdale, WA

LOGGED BY: Brett Bardsley

DRILLING CO: Cascade Drilling Inc.

DRILLER: Andy Flagan

DRILLING METHOD: Hollow Stem Auger

DATE BEGUN: 07/11/05

DATE COMPLETED: 07/11/05

SURVEYED ELEVATION: 609.83 FT

DTW / (DATE): 35.43 (08/18/05)

TYPES

DEPTH (FT BLS)

SURFACE CASING GROUT TYPE: Concrete

0-2

SEAL TYPE: Bentonite chips

2-26

WELL SCREEN: 15', 2" PVC screen, 0.010" slots

28-43

SAND PACK: 2 X 12 grade sand

26-44

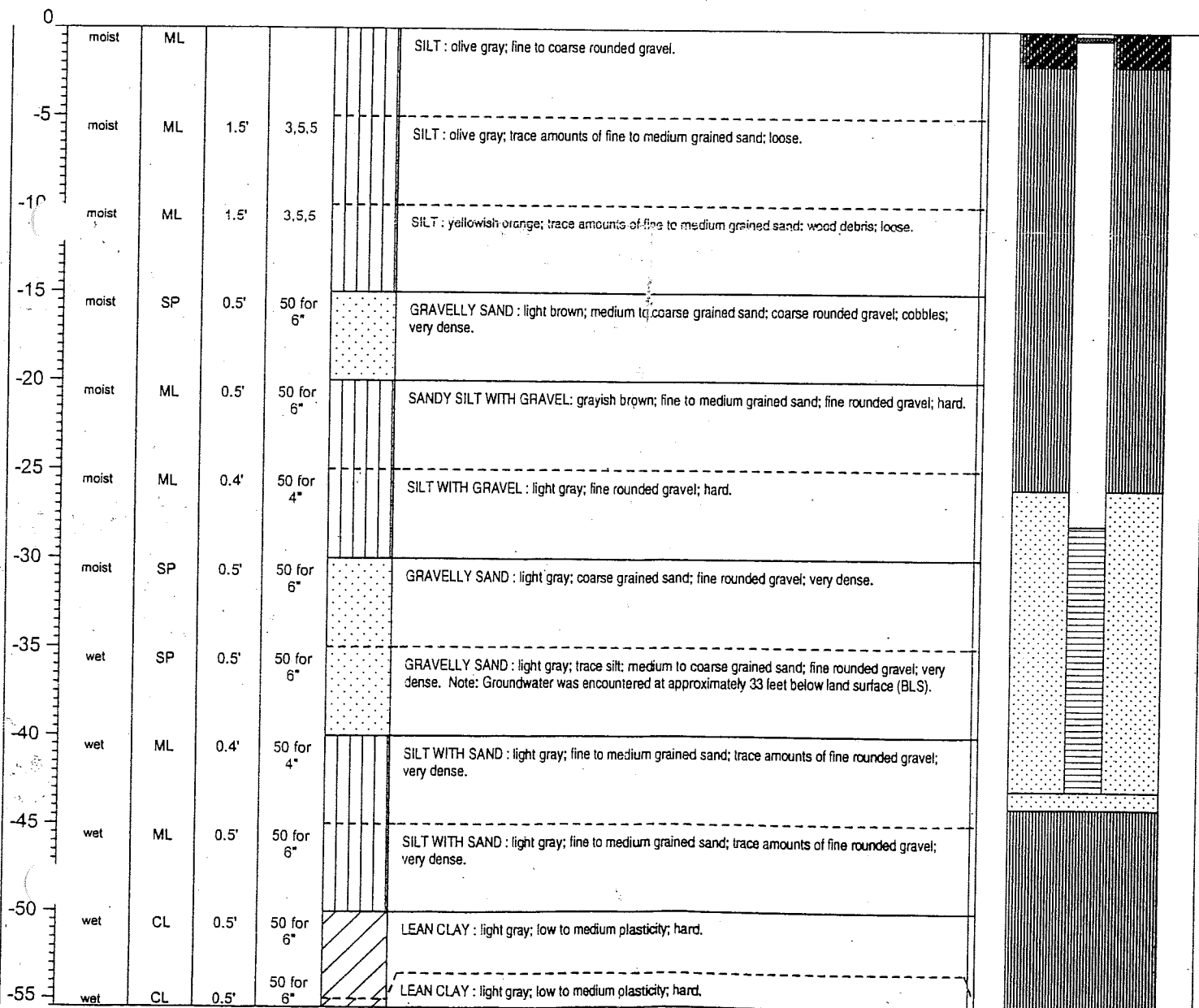
BACKFILL: Bentonite chips

44-55.5

TOTAL DEPTH DRILLED:

55.5

DEPTH	MOISTURE	U. S. C. S. CLASS	CORE RECOVERY	DENSITY BLOWS/6"	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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ARCADIS

BOREHOLE LOG

WELL NO.

MW-2A

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 1

PROJECT NUMBER: WA000712.0003.00002

WELL COMPLETION DETAILS:

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, WA

LOGGED BY: Brett Bardsley

DRILLING CO: Cascade Drilling Inc.

DRILLER: Andy Flagan

DRILLING METHOD: Hollow Stem Auger

DATE BEGUN: 07/12/05

DATE COMPLETED: 07/15/05

SURVEYED ELEVATION: 603.61 FT

DTW / (DATE): 29.18 (08/18/05)

TYPES

DEPTH (FT BLS)

SURFACE CASING GROUT TYPE: Concrete

0-2

SEAL TYPE: Bentonite chips

2-23

WELL SCREEN: 15', 2" PVC screen, 0.010" slots

25-40

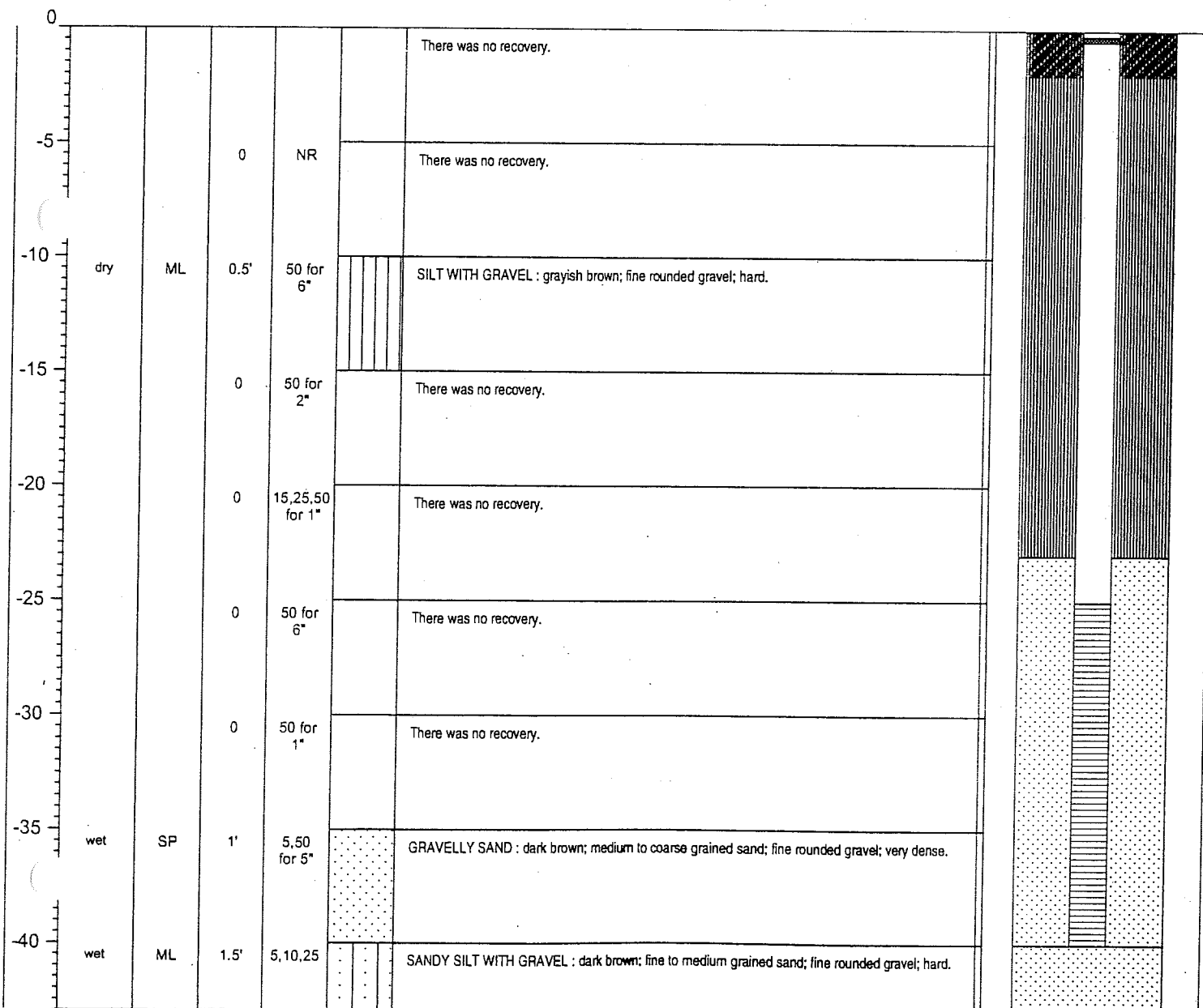
SAND PACK: 2 X 12 grade sand

23-40

TOTAL DEPTH DRILLED:

43

DEPTH	MOISTURE	U. S. C. S. CLASS	CORE RECOVERY	DENSITY BLOWS/6"	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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ARCADIS

BOREHOLE LOG

WELL NO.

MW-3A

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 1

PROJECT NUMBER: WA000712.0003.00002

WELL COMPLETION DETAILS:

JECT NAME: Reserve Silica Site

LOCATION: Ravensdale, WA

LOGGED BY: Brett Bardsley

DRILLING CO: Cascade Drilling Inc.

DRILLER: Andy Flagan

DRILLING METHOD: Hollow Stem Auger

DATE BEGUN: 07/12/05

DATE COMPLETED: 07/12/05

SURVEYED ELEVATION: 685.51 FT

DTW / (DATE): 6.09 (07/15/05)

TYPES

DEPTH (FT BLS)

SURFACE CASING GROUT TYPE: Concrete

0-2

SEAL TYPE: Bentonite chips

2-4

WELL SCREEN: 15', 2" PVC screen, 0.010" slots

4-20

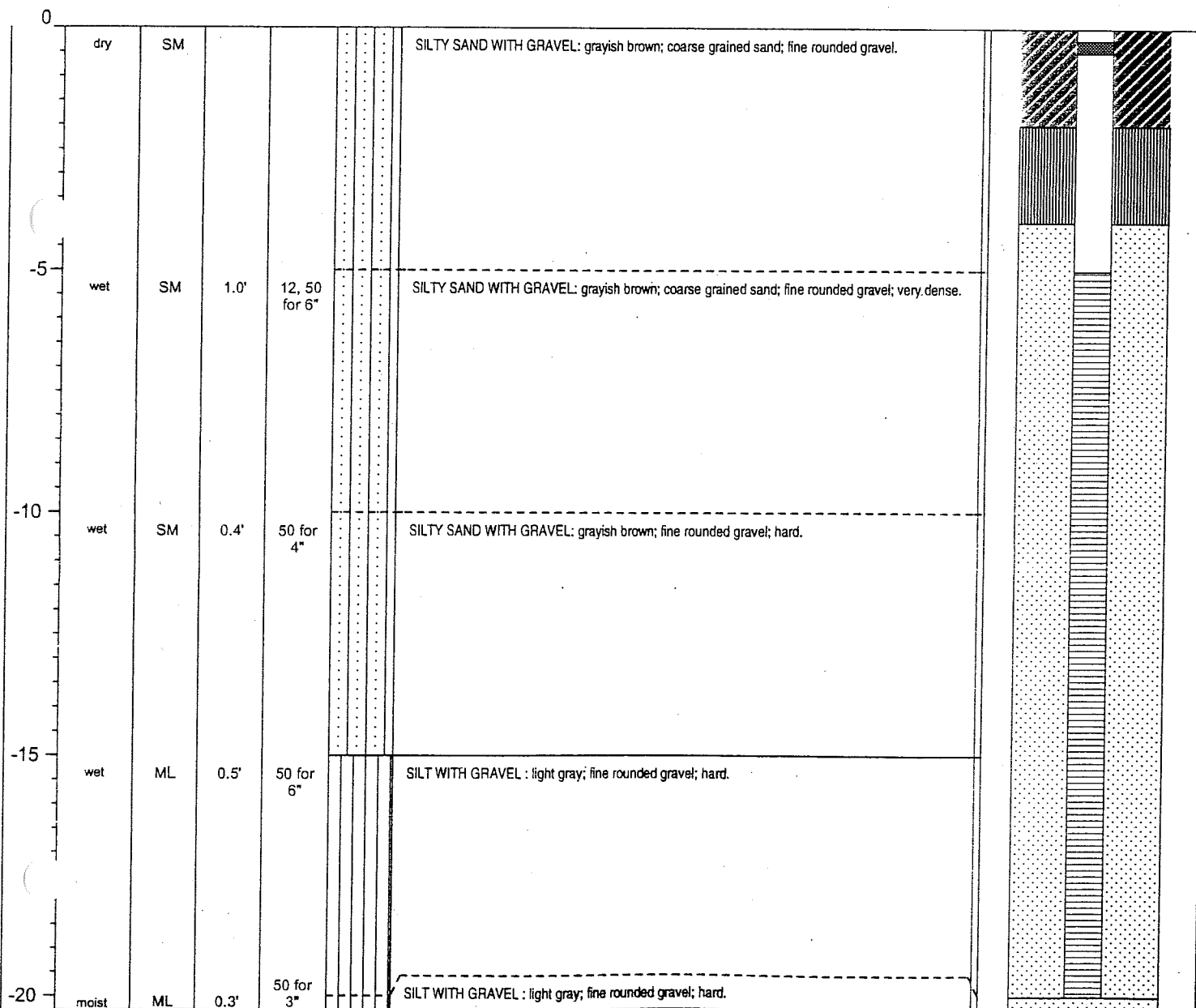
SAND PACK: 2 X 12 grade sand

5-20

TOTAL DEPTH DRILLED:

20.3

DEPTH	MOISTURE	U. S. C. S. CLASS	CORE RECOVERY	DENSITY BLOWS/6"	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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ARCADIS

BOREHOLE LOG

WELL NO.

MW-4A

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 1

PROJECT NUMBER: WA000712.0003.00002

WELL COMPLETION DETAILS:

PROJECT NAME: Reserve Silica Site

LOCATION: Ravensdale, WA

LOGGED BY: Brett Bardsley

DRILLING CO: Cascade Drilling Inc.

DRILLER: Andy Flagan

DRILLING METHOD: Hollow Stem Auger

DATE BEGUN: 07/13/05

DATE COMPLETED: 07/13/05

SURVEYED ELEVATION: 701.85 FT

DTW / (DATE): 4.60 (07/15/05)

TYPES

DEPTH (FT BLS)

SURFACE CASING GROUT TYPE: Concrete

0-2

SEAL TYPE: Bentonite chips

2-4

WELL SCREEN: 15', 2" PVC screen, 0.010" slots

5-20

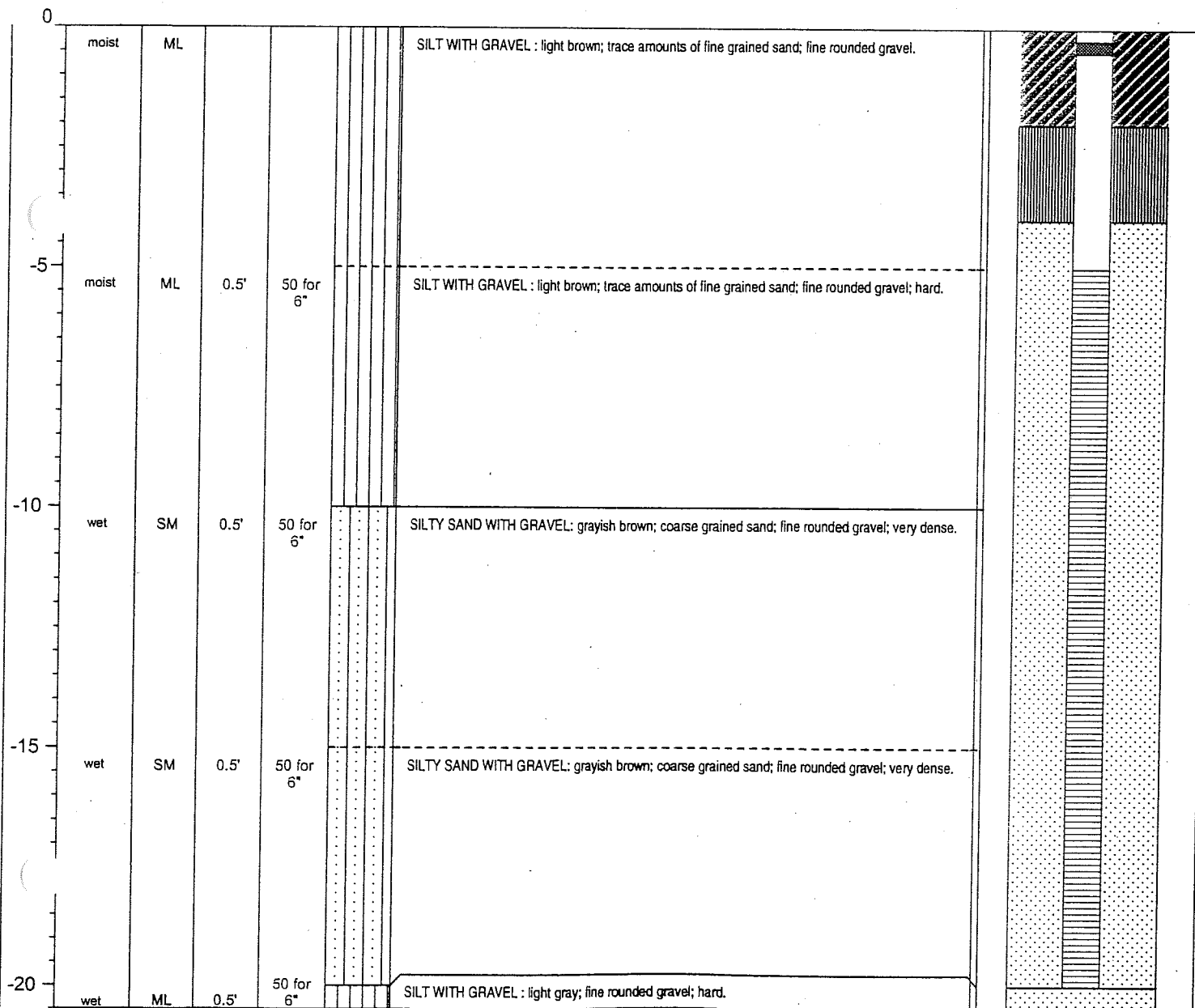
SAND PACK: 2 X 12 grade sand

4-20

TOTAL DEPTH DRILLED:

20.5

DEPTH	MOISTURE	U. S. C. S. CLASS	CORE RECOVERY	DENSITY BLOWS/6"	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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ARCADIS

BOREHOLE LOG

WELL NO.

MW-5A

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 1

PROJECT NUMBER: WA000712.0003.00002

PROJECT NAME: Reserve Silica Site

LOCATION: Ravensdale, WA

LOGGED BY: Brett Bardsley

DRILLING CO: Cascade Drilling Inc.

DRILLER: Andy Flagan

DRILLING METHOD: Hollow Stem Auger

DATE BEGUN: 07/13/05

DATE COMPLETED: 07/13/05

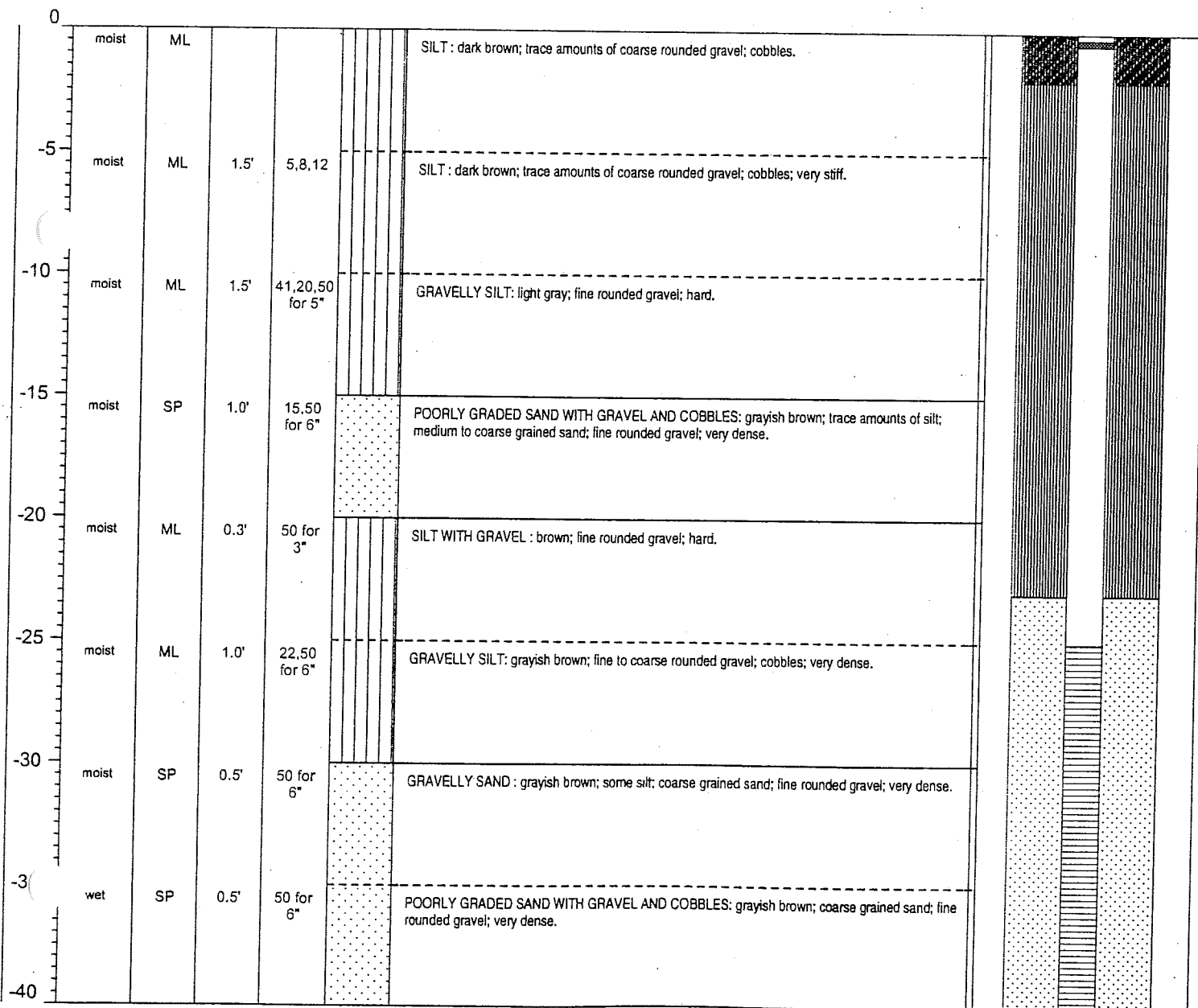
SURVEYED ELEVATION: 607.61 FT

DTW / (DATE): 33.33 (08/18/05)

WELL COMPLETION DETAILS:

TYPES	DEPTH (FT-BLS)
SURFACE CASING GROUT TYPE: Concrete	0-2
SEAL TYPE: Bentonite chips	2-23
WELL SCREEN: 15', 2" PVC screen, 0.010" slots	25-40
SAND PACK: 2 X 12 grade sand	23-40
TOTAL DEPTH DRILLED:	40

DEPTH	MOISTURE	U. S. C. S. CLASS	CORE RECOVERY	DENSITY BLOWS/6"	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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ARCADIS

BOREHOLE LOG

WELL NO.

MW-6A

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 1

PROJECT NUMBER: WA000712.0003.00002

JECT NAME: Reserve Silica Site

E LOCATION: Ravensdale, WA

LOGGED BY: Brett Bardsley

DRILLING CO: Cascade Drilling Inc.

DRILLER: Andy Flagan

DRILLING METHOD: Hollow Stem Auger

DATE BEGUN: 07/14/05

DATE COMPLETED: 07/14/05

SURVEYED ELEVATION: 605.35 FT

DTW / (DATE): 30.89 (08/18/05)

WELL COMPLETION DETAILS:

TYPES

DEPTH (FT BLS)

SURFACE CASING GROUT TYPE: Concrete

0-2

SEAL TYPE: Bentonite chips

2-22

WELL SCREEN: 15', 2" PVC screen, 0.010" slots

24-39

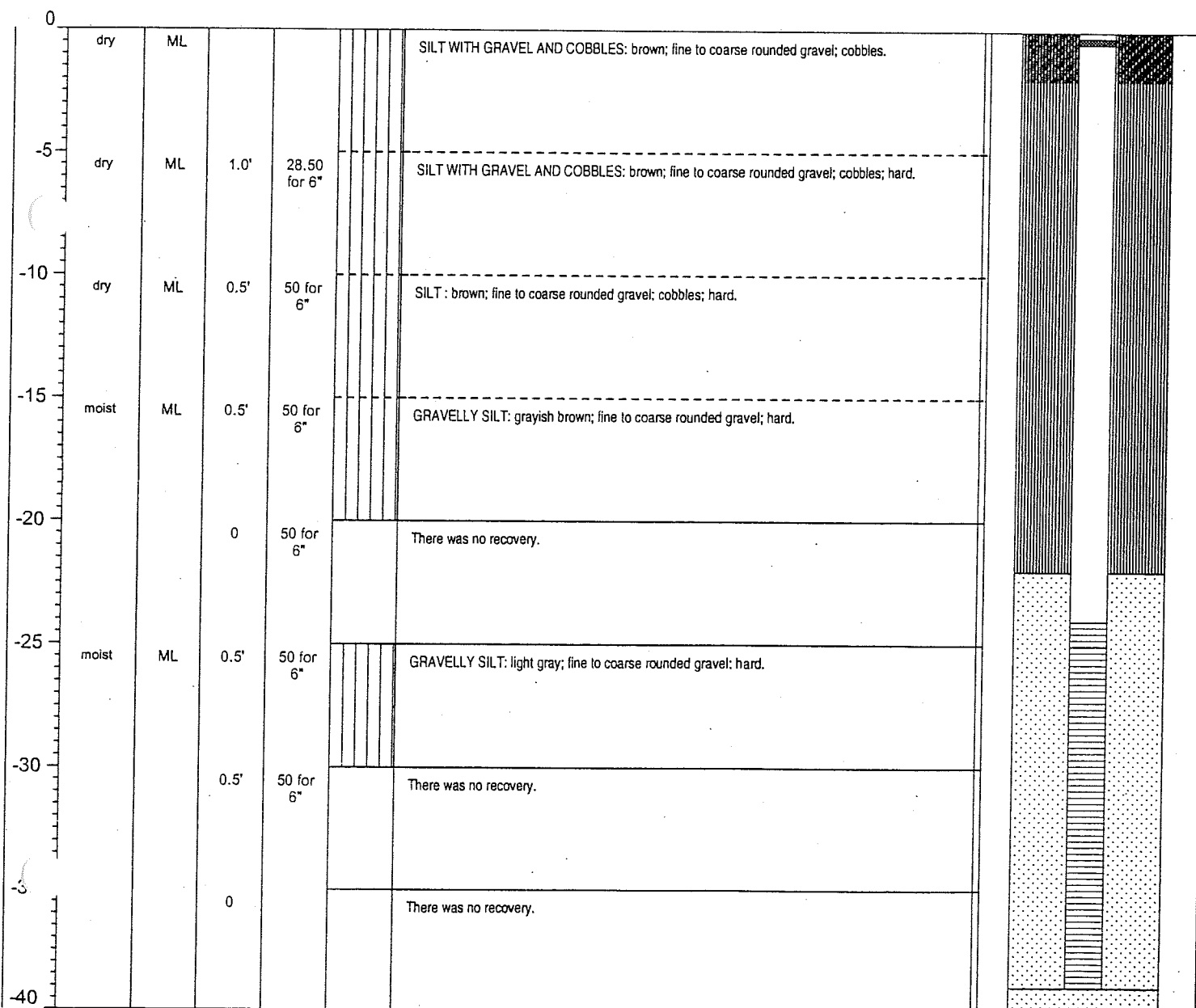
SAND PACK: 2 X 12 grade sand

22-39

TOTAL DEPTH DRILLED:

40.0

DEPTH	MOISTURE	U. S. C. S. CLASS	CORE RECOVERY	DENSITY BLOWS/6"	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-1LDA

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 12/04/06

DATE COMPLETED: 12/05/06

TOP OF PVC CASING ELEVATION (TOC): 701.08 feet

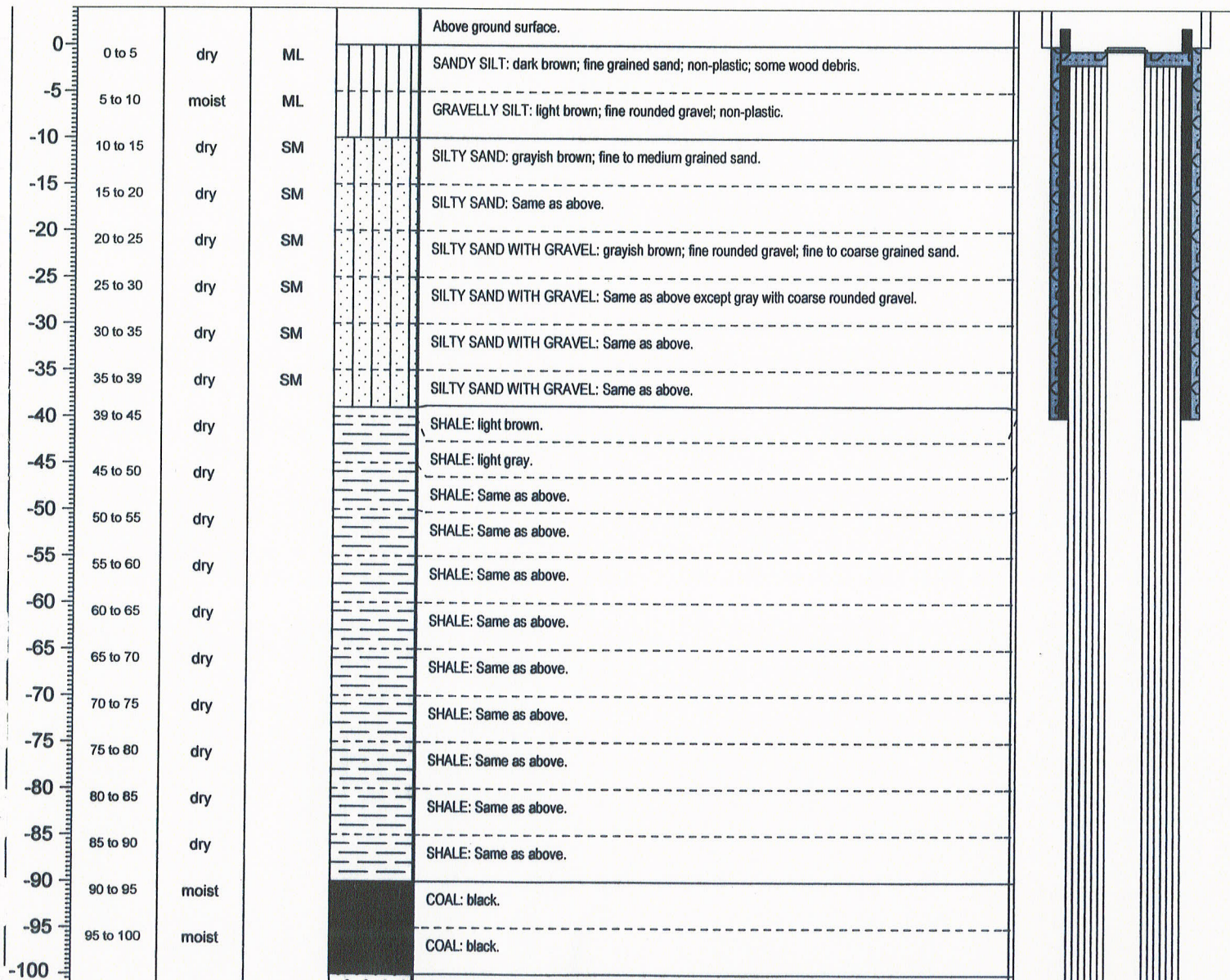
DEPTH TO WATER BELOW TOC / (DATE): 26.51 (12/18/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-115
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-40
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-105
	Bridge Sand	105-107
SAND PACK:	2 X 12 grade sand	107-135
WELL SCREEN:	20', 2" PVC screen, 0.010" slots	115-135
BACKFILL:	2 X 12 grade sand	135-155
TOTAL DEPTH DRILLED:		155

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-1LDA

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 2 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 12/04/06

DATE COMPLETED: 12/05/06

TOP OF PVC CASING ELEVATION (TOC): 701.08 feet

DEPTH TO WATER BELOW TOC / (DATE): 26.51 (12/18/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-115
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-40
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-105
	Bridge Sand	105-107
SAND PACK:	2 X 12 grade sand	107-135
WELL SCREEN:	20', 2" PVC screen, 0.010" slots	115-135
BACKFILL:	2 X 12 grade sand	135-155
TOTAL DEPTH DRILLED:		155

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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-105	100 to 105	dry		SANDSTONE: light gray; well sorted fine grained sand.	
-110	105 to 110	dry		SANDSTONE: Same as above except fine to medium grained sand.	
-115	110 to 115	dry		SANDSTONE: Same as above.	
-120	115 to 120	dry		SANDSTONE: Same as above.	
-125	120 to 125	dry		SANDSTONE: Same as above.	
-130	125 to 130	moist		SANDSTONE: Same as above except only fine grained sand.	
-135	130 to 135	moist		SANDSTONE: Same as above.	
-140	135 to 140	moist		SANDSTONE: Same as above except fine to medium grained sand.	
-145	140 to 145	moist		SANDSTONE: Same as above.	
-150	145 to 150	moist		SANDSTONE: Same as above except fine grained sand.	
-155	150 to 155	moist		SANDSTONE: Same as above except fine to medium grained sand.	



BORING / WELL COMPLETION LOG

WELL NO.

MWB-2LDA

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 11/30/06

DATE COMPLETED: 12/05/06

TOP OF PVC CASING ELEVATION (TOC): 738.06 feet

DEPTH TO WATER BELOW TOC / (DATE): 36.82 (12/18/06)

WELL COMPLETION DETAILS

	TYPES	DEPTH (FT BLS)
WELL CASING:	2" Schedule 40 PVC	0-110
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-70
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-103
	Bridge Sand	103-105
SAND PACK:	2 X 12 grade sand	105-125
WELL SCREEN:	15', 2" PVC screen, 0.010" slots	110-125
TOTAL DEPTH DRILLED:		125

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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0	0 to 5	dry	SM		Above ground surface.	
-5	5 to 10	dry	SM		SILTY SAND WITH GRAVEL: grayish brown; fine rounded gravel; fine to coarse grained sand.	
-10	10 to 15	dry	SM		SILTY SAND WITH GRAVEL: Same as above.	
-15	15 to 25	saturated	GM		SILTY GRAVEL: brown; fine rounded gravel; non-plastic. Groundwater was encountered at approximately 15 feet bls.	
-20	25 to 30	saturated	GM		SILTY GRAVEL: Same as above.	
-25	30 to 35	moist	ML		SANDY SILT: grayish brown; non-plastic.	
-30	35 to 40	wet	CL/ML		SILTY CLAY WITH GRAVEL: grayish brown; fine rounded gravel; low to medium plasticity.	
-35	40 to 45	moist	ML		SILT: light brown; non-plastic; some wood debris.	
-40	45 to 50	moist	ML		SILT: Same as above.	
-45	50 to 60	moist	ML		GRAVELLY SILT: light gray; fine rounded gravel.	
-50	60 to 67	moist	ML		GRAVELLY SILT: Same as above.	
-55	67 to 70	dry			SHALE: light gray; trace fine grained sand. Note: Bedrock was encountered at approximately 67 feet bls.	
-60	70 to 75	dry			SANDSTONE: light gray; well sorted fine grained sand.	
-65	75 to 80	dry			SANDSTONE: Same as above.	
-70	80 to 85	dry			SANDSTONE: Same as above.	



BORING / WELL COMPLETION LOG

WELL NO.

MWB-2LDA

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 2 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 11/30/06

DATE COMPLETED: 12/05/06

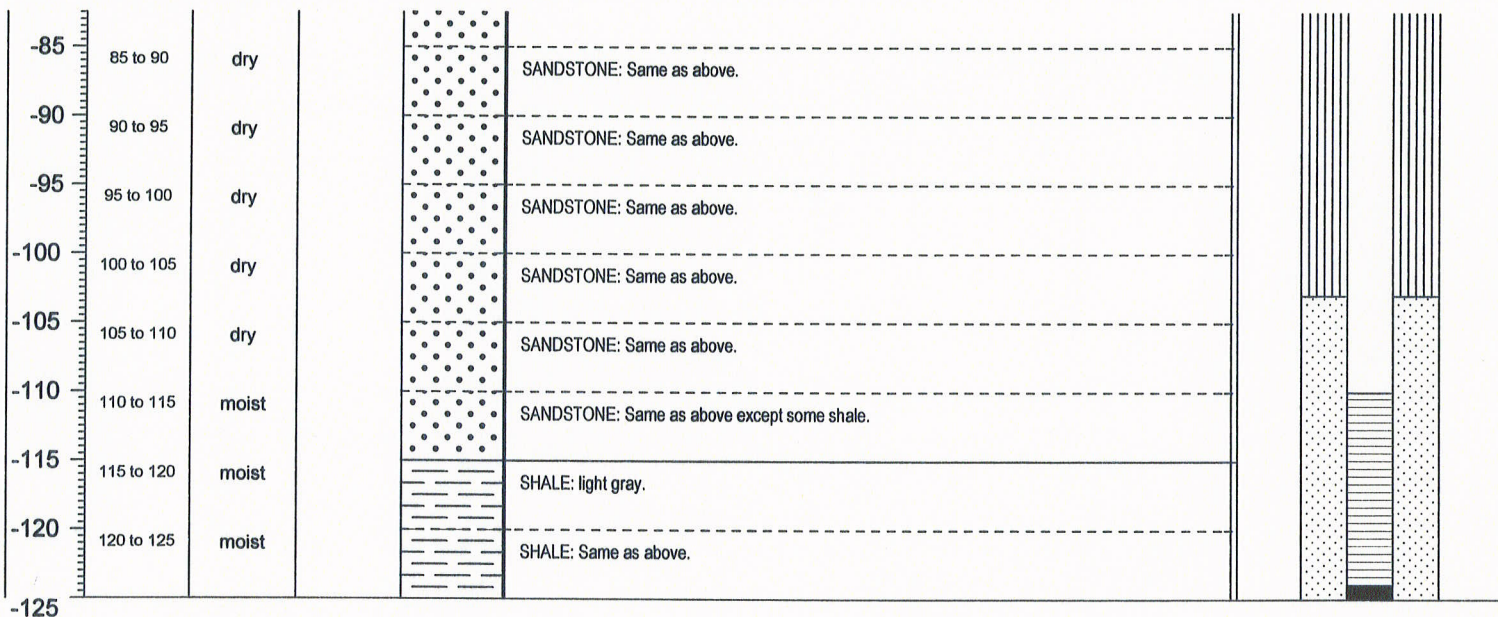
TOP OF PVC CASING ELEVATION (TOC): 738.06 feet

DEPTH TO WATER BELOW TOC / (DATE): 36.82 (12/18/06)

WELL COMPLETION DETAILS

	TYPES	DEPTH (FT BLS)
WELL CASING:	2" Schedule 40 PVC	0-110
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-70
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-103
	Bridge Sand	103-105
SAND PACK:	2 X 12 grade sand	105-125
WELL SCREEN:	15', 2" PVC screen, 0.010" slots	110-125
TOTAL DEPTH DRILLED:		125

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-3LDA

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 11/30/06

DATE COMPLETED: 12/05/06

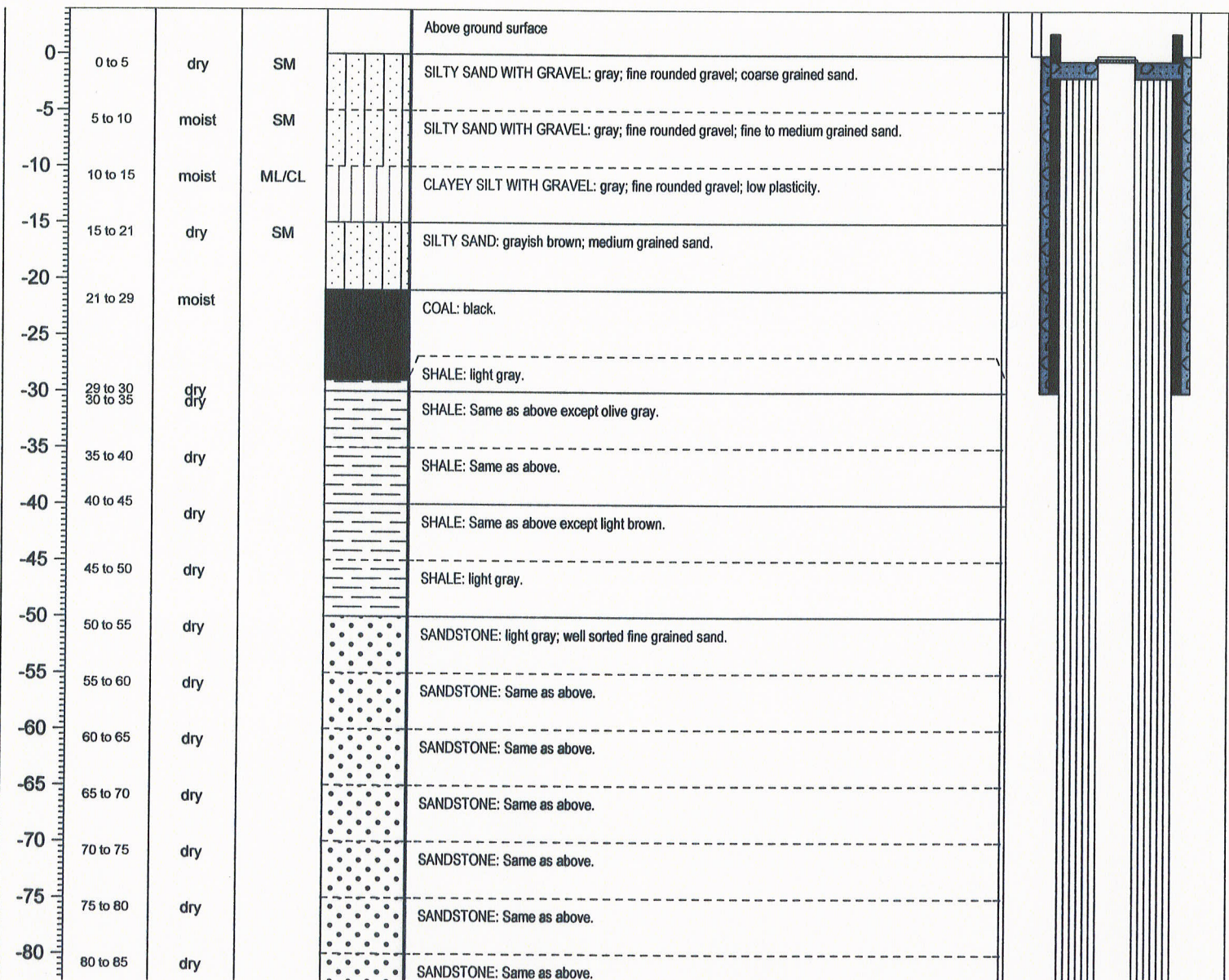
TOP OF PVC CASING ELEVATION (TOC): 740.59 ft

DEPTH TO WATER BELOW TOC / (DATE): 7.08 (12/18/06)

WELL COMPLETION DETAILS

	TYPES	DEPTH (FT BLS)
WELL CASING:	2" Schedule 40 PVC	0-125
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-30
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-115
	Bridge Sand	115-117
SAND PACK:	2 X 12 grade sand	117-145
WELL SCREEN:	20', 2" PVC screen, 0.010" slots	125-145
TOTAL DEPTH DRILLED:		145

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-3LDA

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 2 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 11/30/06

DATE COMPLETED: 12/05/06

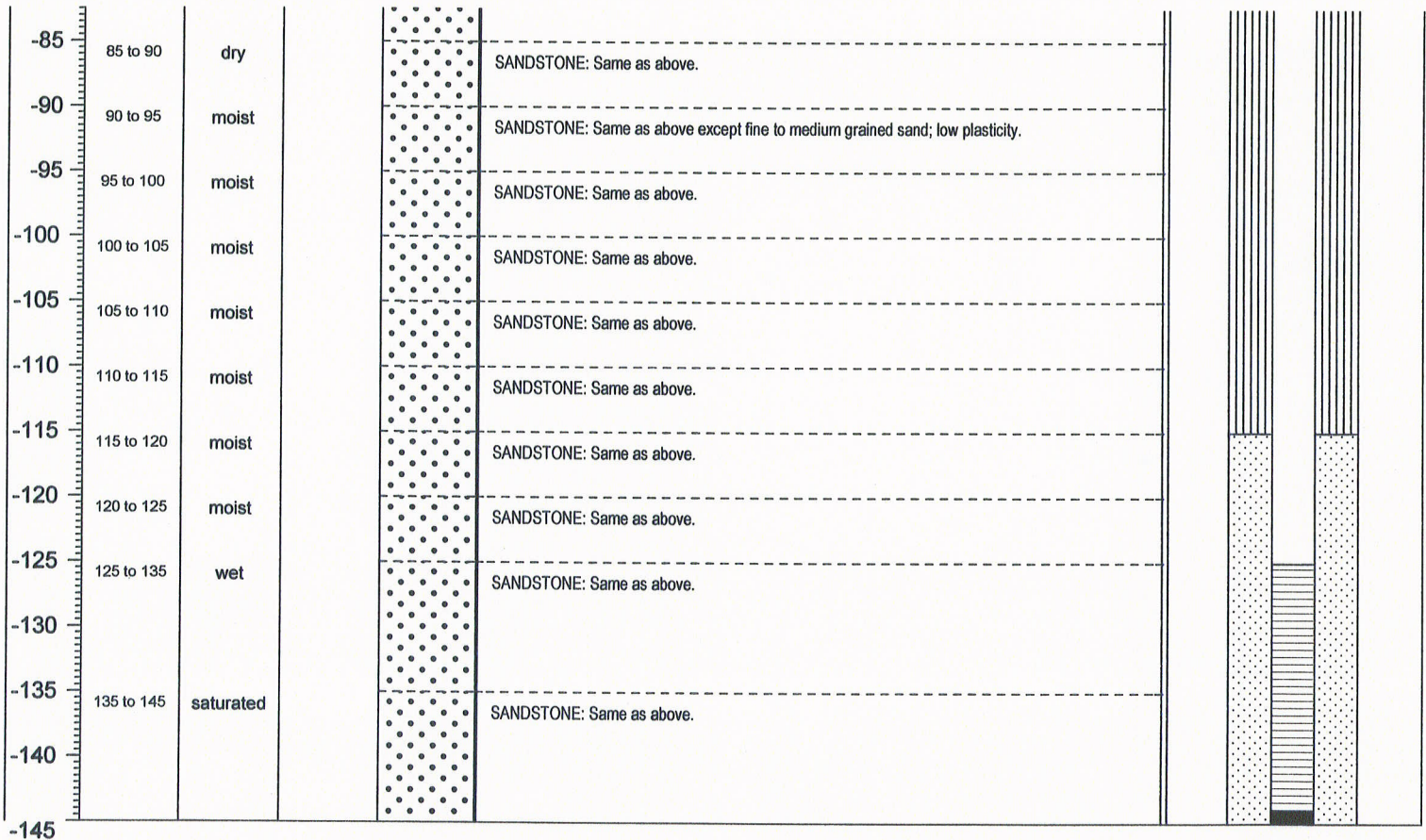
TOP OF PVC CASING ELEVATION (TOC): 740.59 ft

DEPTH TO WATER BELOW TOC / (DATE): 7.08 (12/18/06)

WELL COMPLETION DETAILS

	TYPES	DEPTH (FT BLS)
WELL CASING:	2" Schedule 40 PVC	0-125
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-30
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-115
	Bridge Sand	115-117
SAND PACK:	2 X 12 grade sand	117-145
WELL SCREEN:	20', 2" PVC screen, 0.010" slots	125-145
TOTAL DEPTH DRILLED:		145

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-1SDSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 2

PROJECT NUMBER: WA000712

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Wayne Harmon

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 12/06/02

DATE COMPLETED: 12/09/02

TOP OF PVC CASING ELEVATION (TOC): 932.69 feet

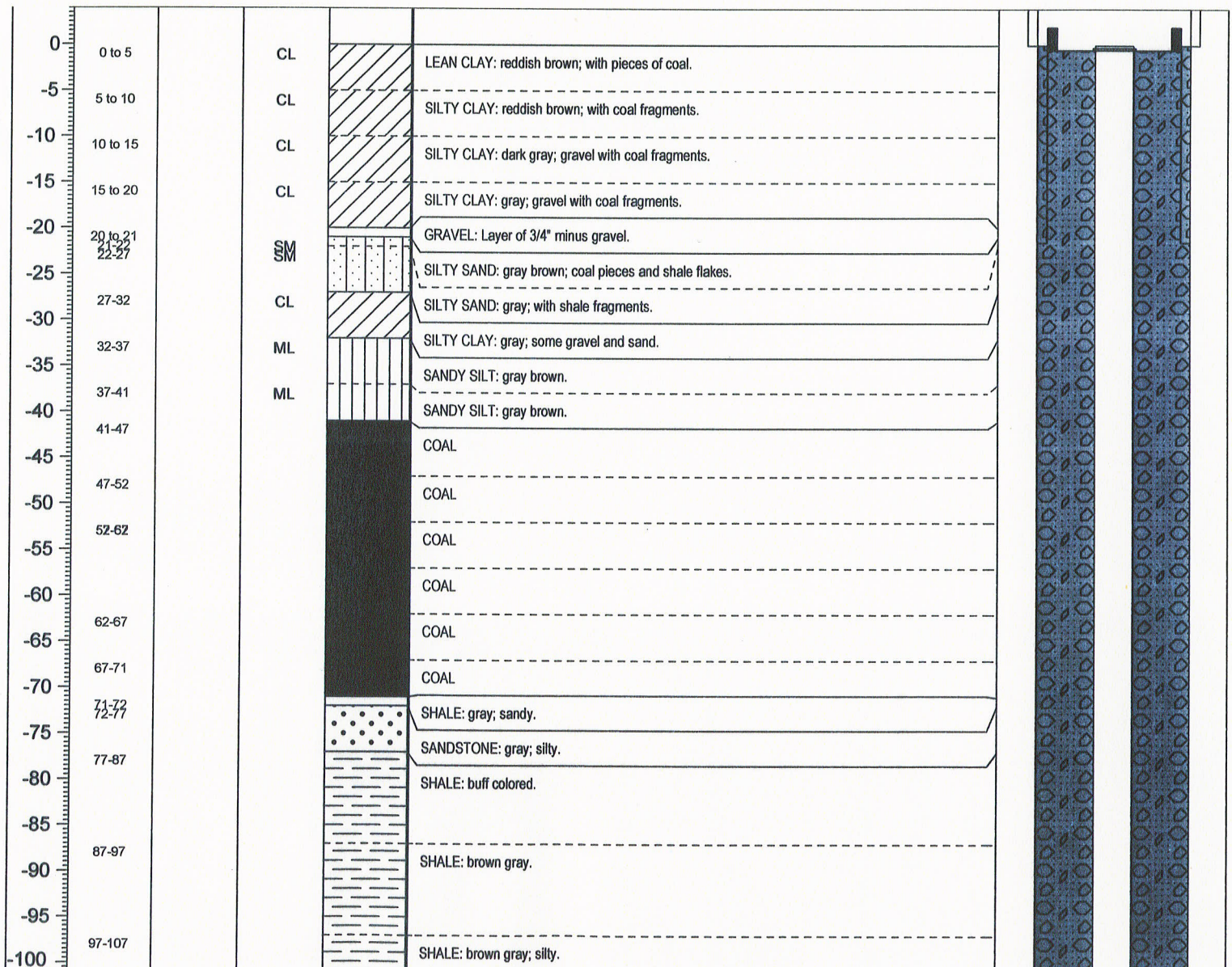
DEPTH TO WATER BELOW TOC / (DATE): 33.20 (12/28/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-150
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-21.5
SURFACE CASING GROUT TYPE:	Concrete	0-138
SEAL TYPE:	Bentonite chips	138-148
SAND PACK:	2 X 12 grade sand	148-160
WELL SCREEN:	10', 2" PVC screen, 0.010" slots	150-160
BACKFILL:	2 X 12 grade sand	160-165
TOTAL DEPTH DRILLED:		165

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-1SDSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 2 of 2

PROJECT NUMBER: WA000712

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Wayne Harmon

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 12/06/02

DATE COMPLETED: 12/09/02

TOP OF PVC CASING ELEVATION (TOC): 932.69 feet

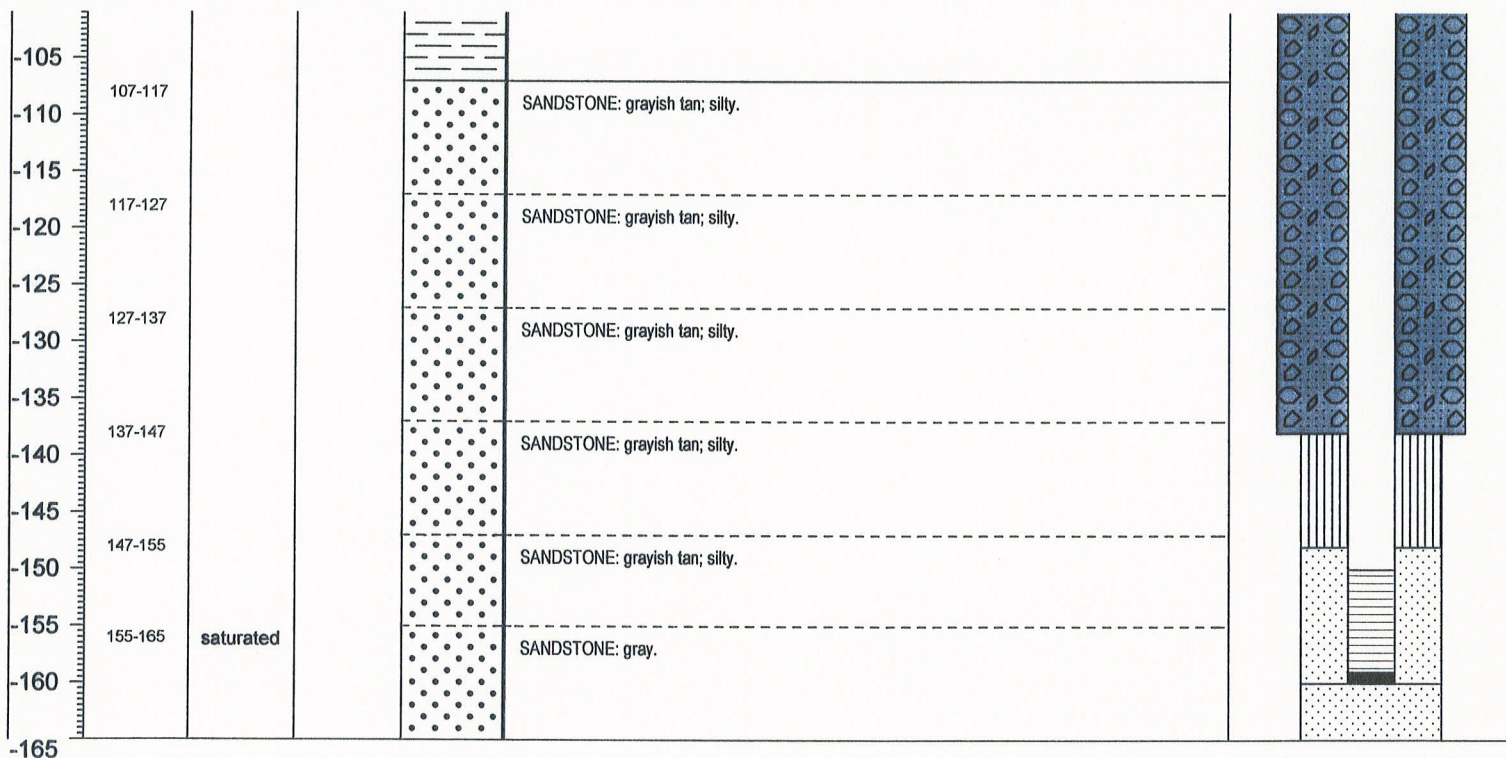
DEPTH TO WATER BELOW TOC / (DATE): 33.20 (12/28/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-150
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-21.5
SURFACE CASING GROUT TYPE:	Concrete	0-138
SEAL TYPE:	Bentonite chips	138-148
SAND PACK:	2 X 12 grade sand	148-160
WELL SCREEN:	10', 2" PVC screen, 0.010" slots	150-160
BACKFILL:	2 X 12 grade sand	160-165
TOTAL DEPTH DRILLED:		165

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-1DDSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 3

PROJECT NUMBER: WA000712

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Wayne Harmon

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 12/03/02

DATE COMPLETED: 12/09/02

TOP OF PVC CASING ELEVATION (TOC): 931.77 FT

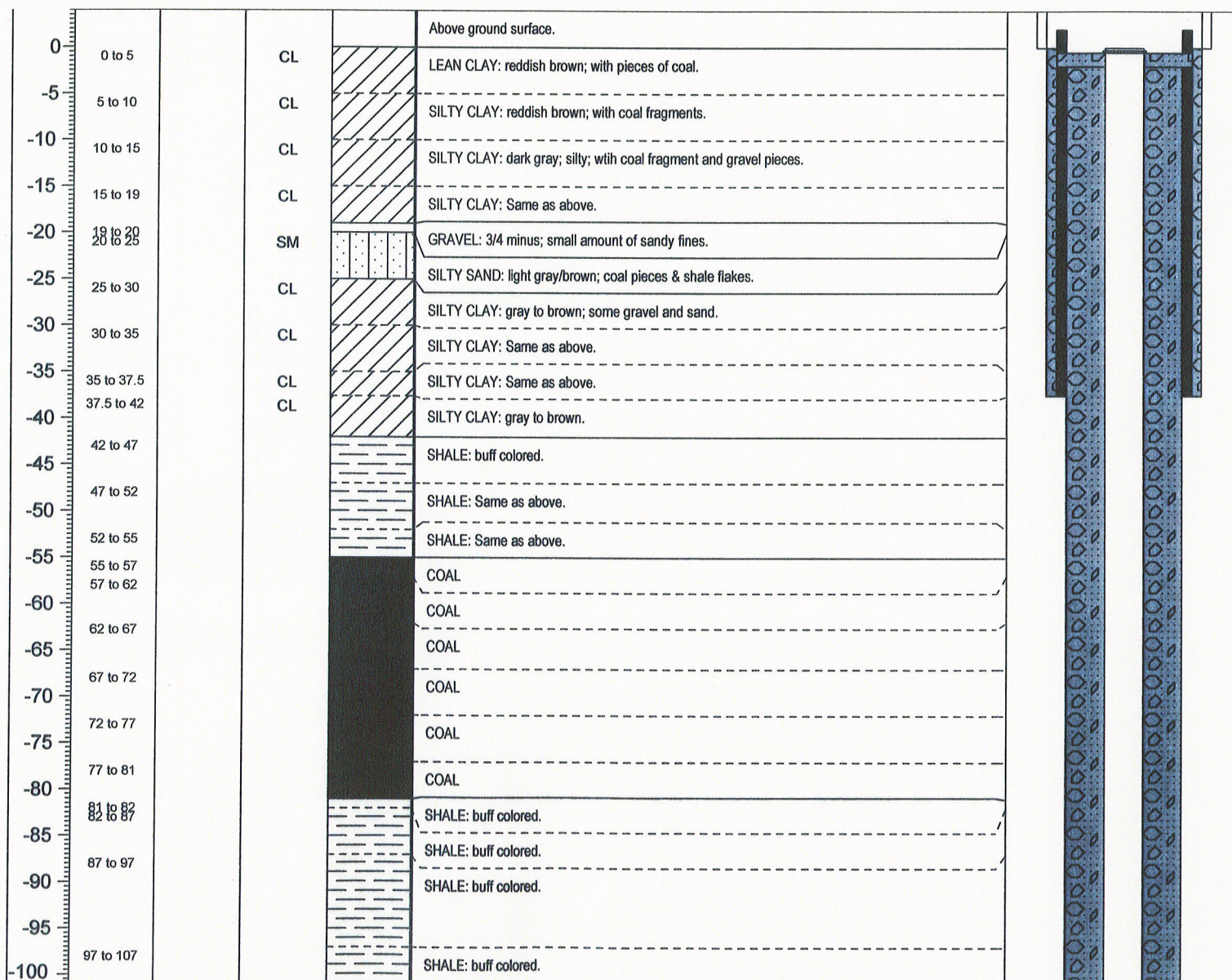
DEPTH TO WATER BELOW TOC / (DATE): 48.26 (12/28/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-255
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	37.5
SURFACE CASING GROUT TYPE:	Concrete	0-243
SEAL TYPE:	Bentonite chips	243-253
SAND PACK:	2 X 12 grade sand	253-265
WELL SCREEN:	10', 2" PVC screen, 0.010" slots	255-265
BACKFILL:	2 X 12 grade sand	265-270
TOTAL DEPTH DRILLED:		270

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-1DDSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 2 of 3

PROJECT NUMBER: WA000712

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Wayne Harmon

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Todd Meham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 12/03/02

DATE COMPLETED: 12/09/02

TOP OF PVC CASING ELEVATION (TOC): 931.77 FT

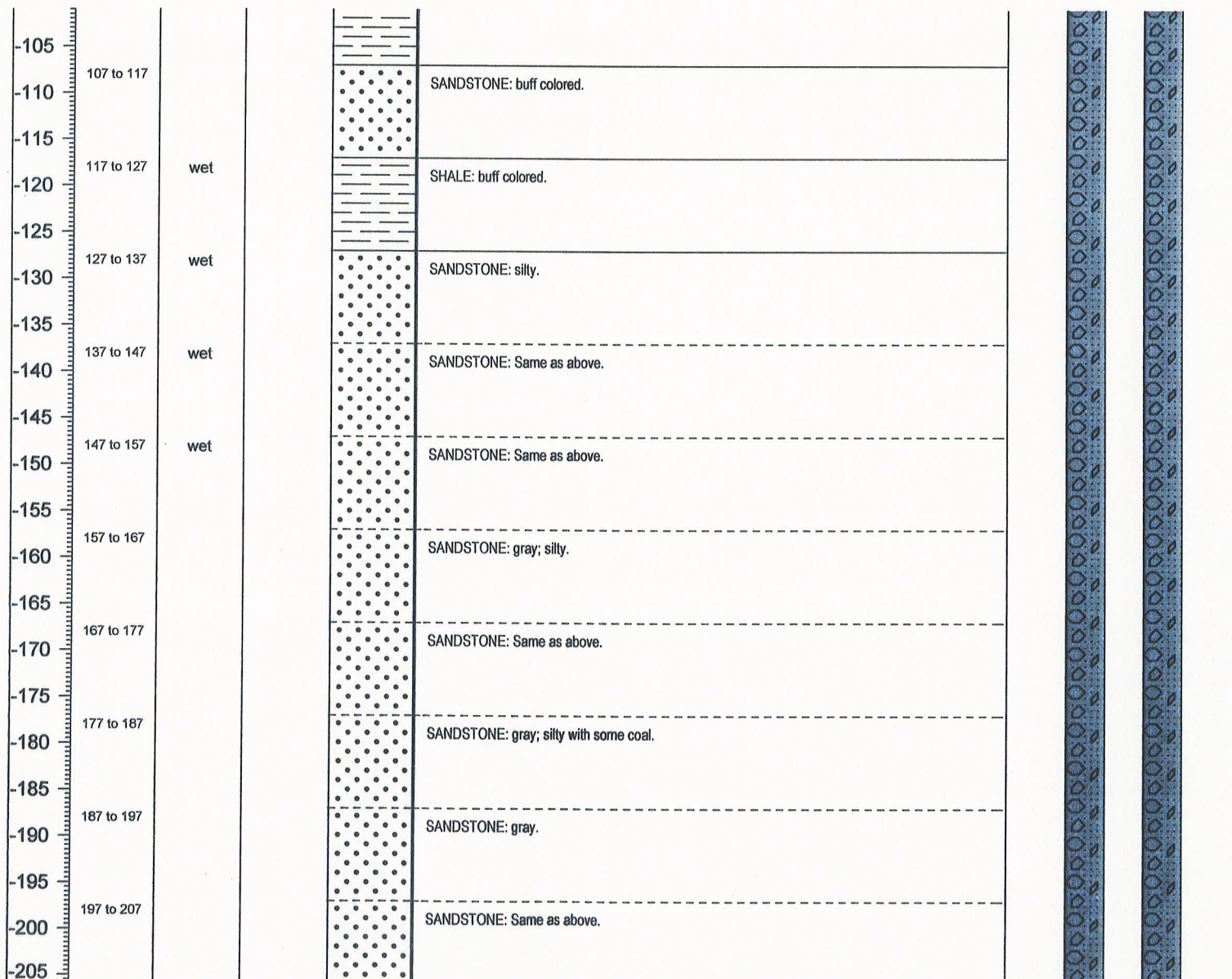
DEPTH TO WATER BELOW TOC / (DATE): 48.26 (12/28/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-255
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	37.5
SURFACE CASING GROUT TYPE:	Concrete	0-243
SEAL TYPE:	Bentonite chips	243-253
SAND PACK:	2 X 12 grade sand	253-265
WELL SCREEN:	10', 2" PVC screen, 0.010" slots	255-265
BACKFILL:	2 X 12 grade sand	265-270
TOTAL DEPTH DRILLED:		270

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-1DDSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 3 of 3

PROJECT NUMBER: WA000712

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Wayne Harmon

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 12/03/02

DATE COMPLETED: 12/09/02

TOP OF PVC CASING ELEVATION (TOC): 931.77 FT

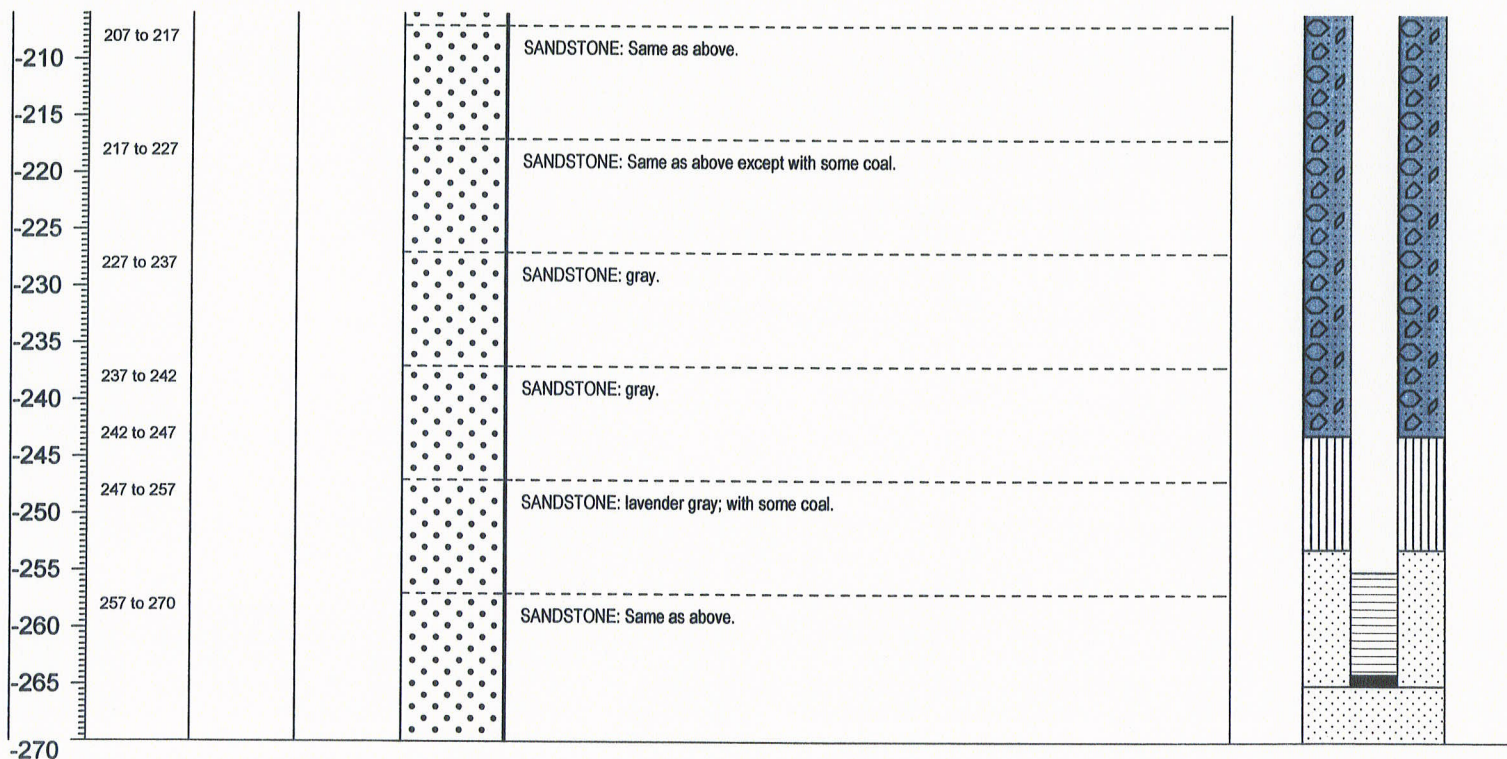
DEPTH TO WATER BELOW TOC / (DATE): 48.26 (12/28/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-255
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	37.5
SURFACE CASING GROUT TYPE:	Concrete	0-243
SEAL TYPE:	Bentonite chips	243-253
SAND PACK:	2 X 12 grade sand	253-265
WELL SCREEN:	10', 2" PVC screen, 0.010" slots	255-265
BACKFILL:	2 X 12 grade sand	265-270
TOTAL DEPTH DRILLED:		270

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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Test Well 2

INDUSTRIAL MINERAL PRODUCTS

RAVENSDALE

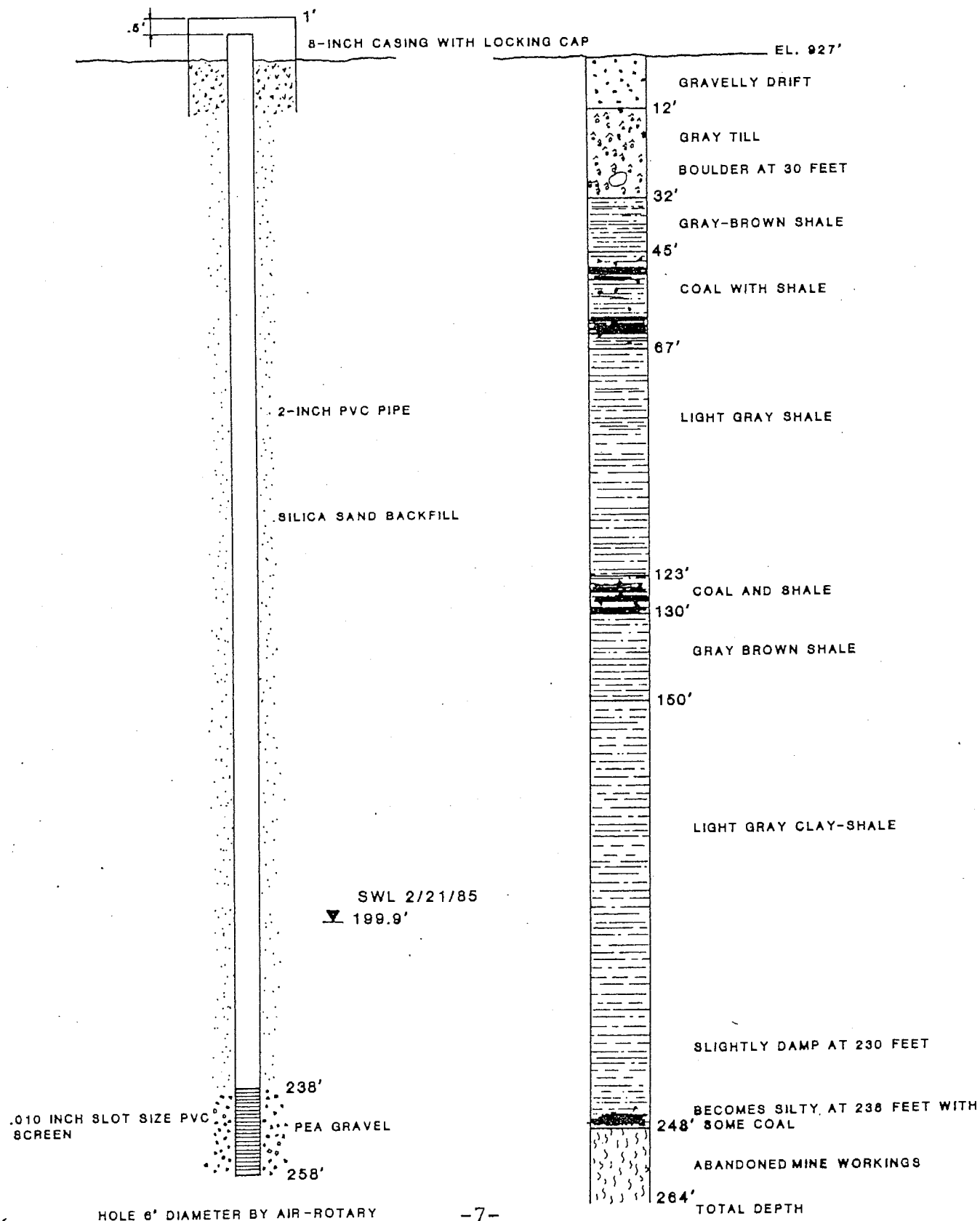
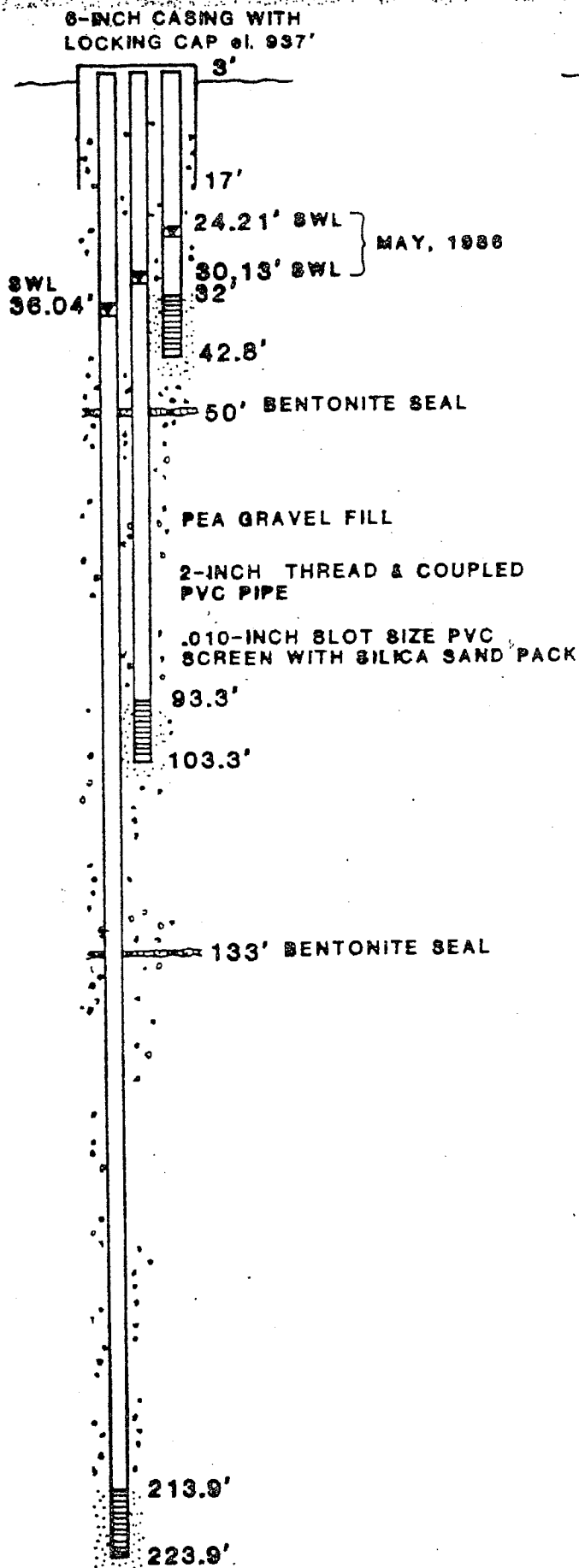


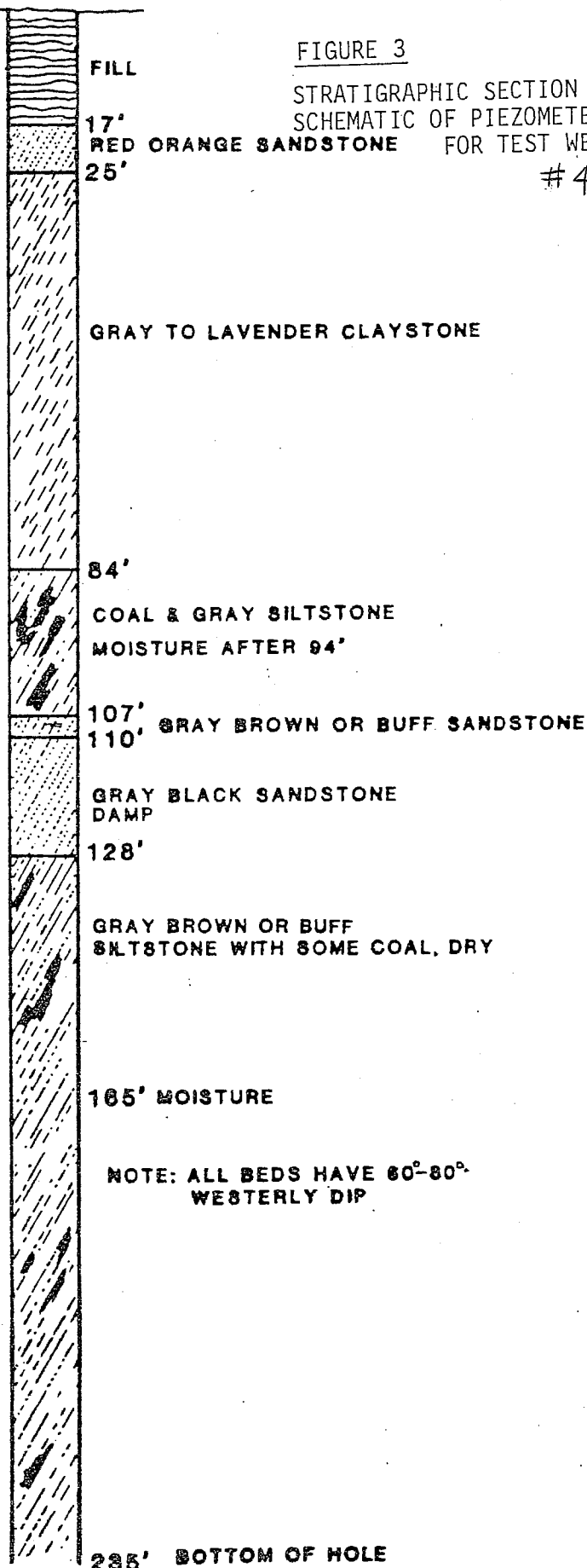
FIGURE 3

STRATIGRAPHIC SECTION AND
SCHEMATIC OF PIEZOMETER P
FOR TEST WELL

#4



6-INCH DIAMETER HOLE BY AIR ROTARY





BORING / WELL COMPLETION LOG

WELL NO.

MWB-5DSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 1

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 11/27/06

DATE COMPLETED: 11/29/06

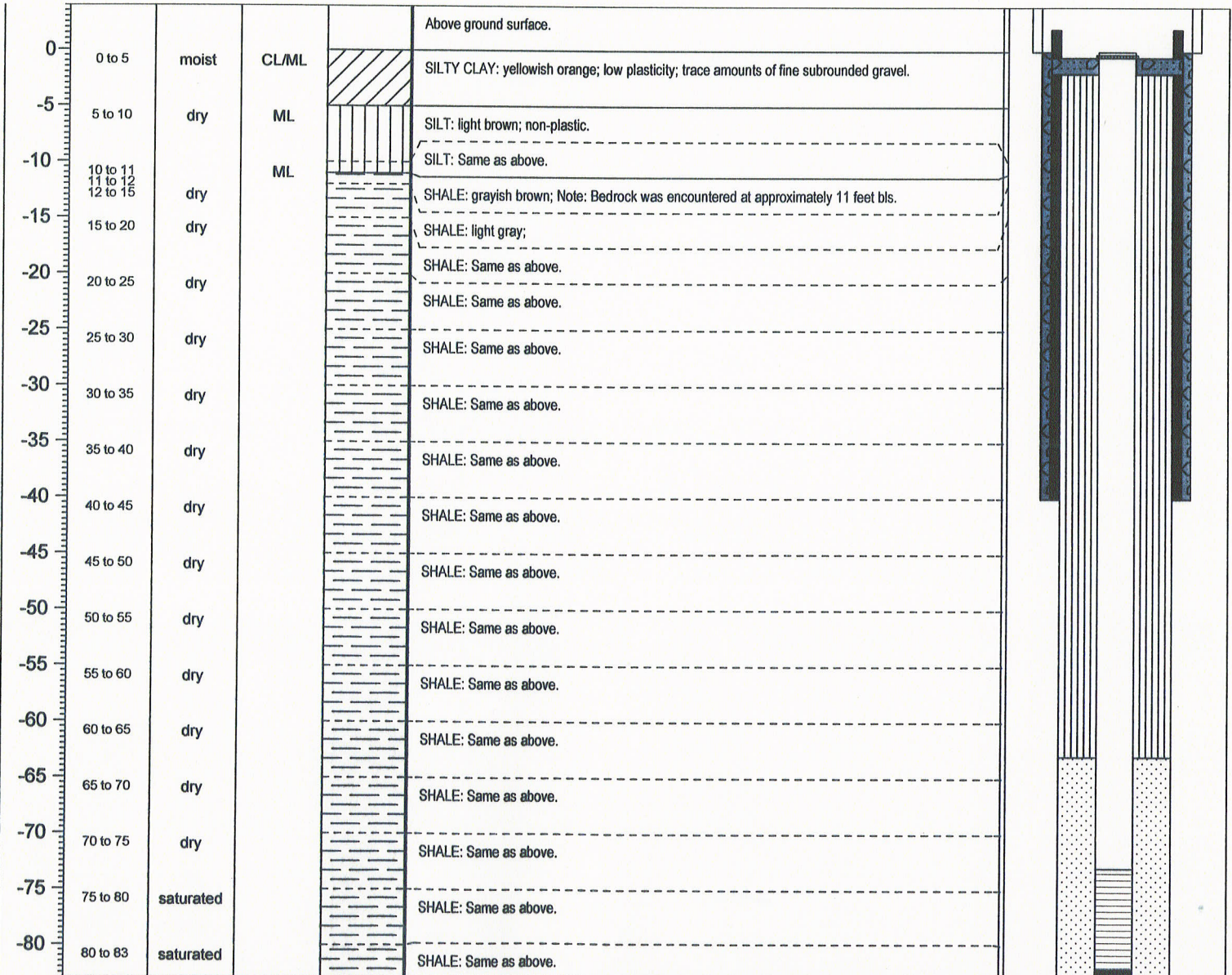
TOP OF PVC CASING ELEVATION (TOC): 931.45

DEPTH TO WATER BELOW TOC / (DATE): 20.56 (12/28/06)

WELL COMPLETION DETAILS

	TYPES	DEPTH (FT BLS)
WELL CASING:	2" Schedule 40 PVC	0-73
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-20
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-61
	Bridge Sand	61-63
SAND PACK:	2 X 12 grade sand	63-83
WELL SCREEN:	10', 2" PVC screen, 0.010" slots	73-83
TOTAL DEPTH DRILLED:		83

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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BORING / WELL COMPLETION LOG

WELL NO.

MWB-6DSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 1 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 11/28/06

DATE COMPLETED: 11/30/06

TOP OF PVC CASING ELEVATION (TOC): 902.35 feet

DEPTH TO WATER BELOW TOC / (DATE): 8.13 (12/28/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

WELL CASING:	2" Schedule 40 PVC	0-120
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-20
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-108
	Bridge Sand	108-110
SAND PACK:	2 X 12 grade sand	110-195
WELL SCREEN:	75', 2" PVC screen, 0.010" slots	120-195
BACKFILL:	2 X 12 grade sand	195-199
TOTAL DEPTH DRILLED:		199

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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0	0 to 5	moist	SM		Above ground surface.	
-5	5 to 12	dry	ML		SILTY SAND WITH GRAVEL: gray; fine rounded gravel; fine to coarse grained sand.	
-10					SILT: light brown; non-plastic; minor amounts of coarse grained sand.	
-15	12 to 15	dry			SHALE: light gray. Note: Bedrock was encountered at approximately 12 feet bls.	
-15	15 to 20	dry			SHALE: Same as above.	
-20	20 to 25	dry			SHALE: Same as above.	
-25	25 to 30	dry			SHALE: Same as above.	
-30	30 to 35	dry			SHALE: Same as above.	
-35	35 to 40	dry			SHALE: Same as above.	
-40	40 to 45	moist			SHALE: Same as above.	
-45	45 to 50	moist			SHALE: Same as above.	
-50	50 to 55	moist			COAL: black.	
-55	55 to 58	moist			COAL: Same as above.	
-55	58-67	moist			COAL: Same as above.	
-60					COAL: Same as above. A thin shale bed was encountered at approximately 58 feet bls.	
-65					COAL: Same as above.	
-70	67 to 70	dry			SHALE: grayish brown.	
-70	70 to 75	dry			SANDSTONE: grayish brown; well sorted fine grained sand.	
-75	75 to 80	wet			SHALE: grayish brown. Note: Driller began introducing water in borehole at approximately 80 feet bls to help remove drill cuttings.	
-80	80 to 90				SHALE: Same as above.	
-85						
-90	90-95				SANDSTONE: light gray; well sorted fine grained sand.	
-95	95-100				SANDSTONE: Same as above.	
-100	100-105				SANDSTONE: Same as above.	
-105	105-110				SANDSTONE: Same as above.	



BORING / WELL COMPLETION LOG

WELL NO.

MWB-6DSP

11411 NE 124th Street, Suite 270, Kirkland, WA 98034

Tel: 425 821-2100 Fax: 425 821-2111

Page 2 of 2

PROJECT NUMBER: WA000712.0013.00001

PROJECT NAME: Reserve Silica Site

SITE LOCATION: Ravensdale, Washington

LOGGED BY: Brett Bardsley, L.G.

DRILLING CO: Cascade Drilling, Inc.

DRILLER: Jarod Kump & Todd Mecham

DRILLING METHOD: Air-Rotary

DATE BEGUN: 11/28/06

DATE COMPLETED: 11/30/06

TOP OF PVC CASING ELEVATION (TOC): 902.35 feet

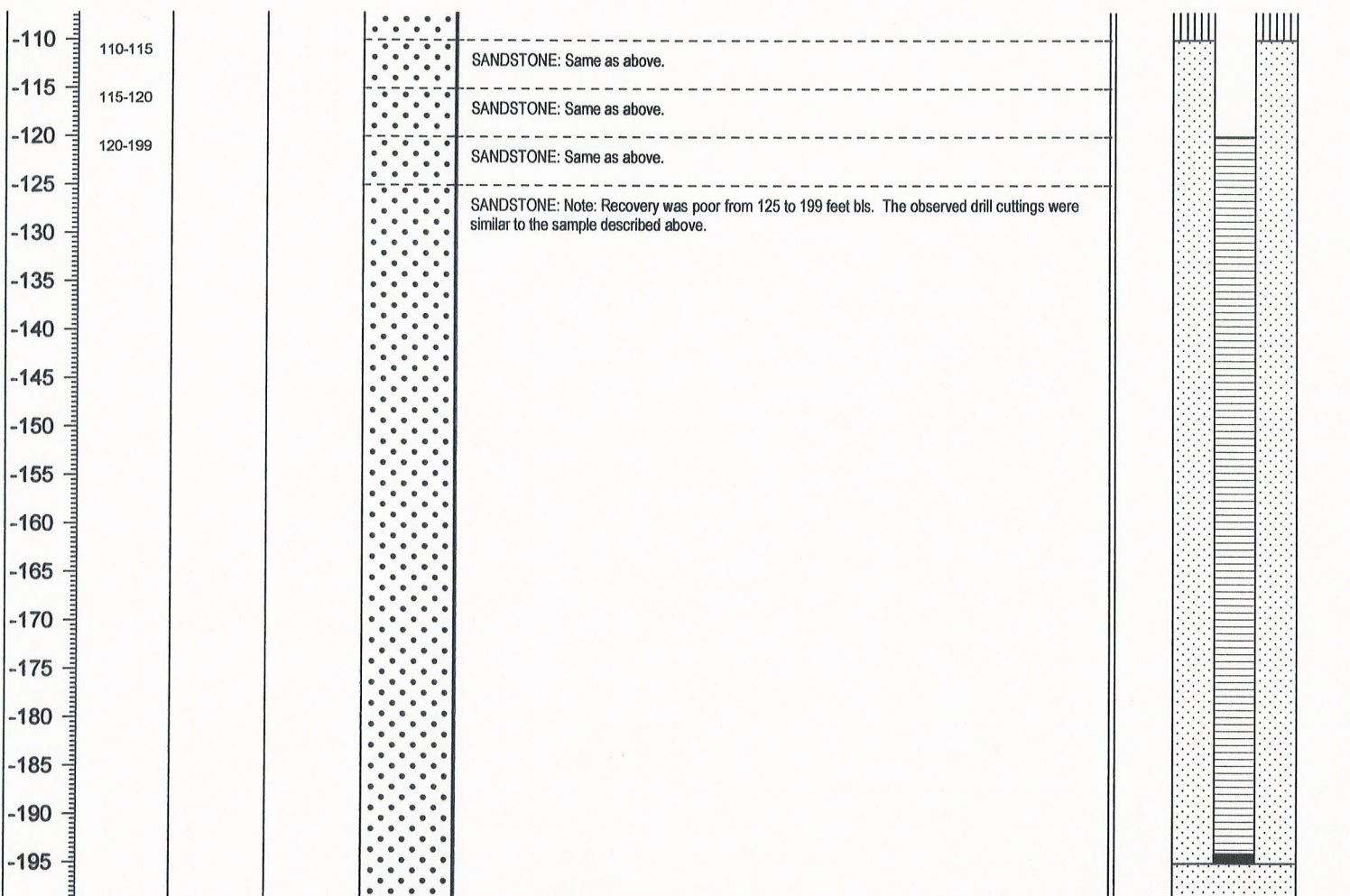
DEPTH TO WATER BELOW TOC / (DATE): 8.13 (12/28/06)

WELL COMPLETION DETAILS

DEPTH (FT BLS)

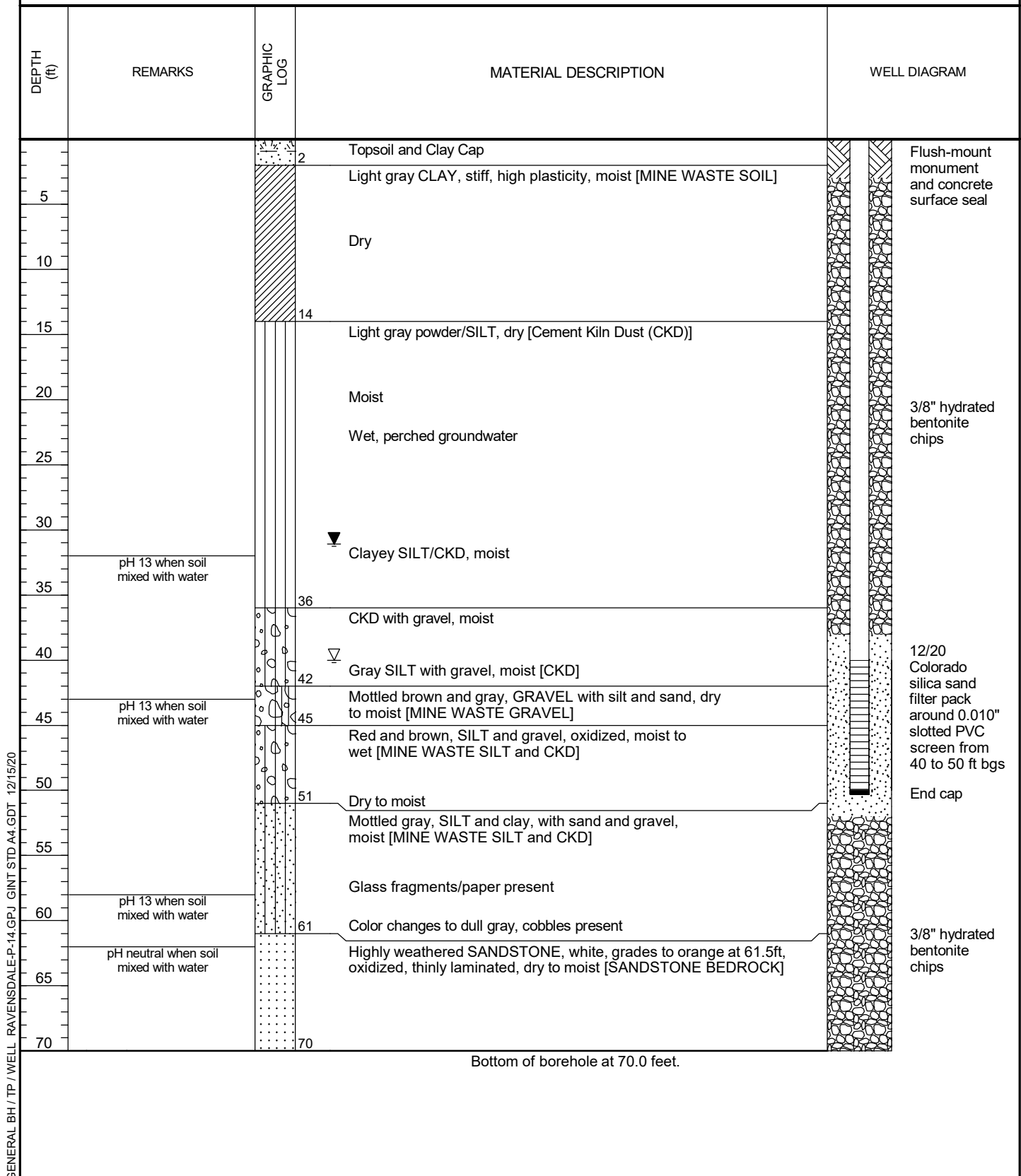
WELL CASING:	2" Schedule 40 PVC	0-120
6 5/8" CONDUCTOR PIPE:	Grouted with neat cement grout and 5% bentonite	0-20
SURFACE CASING GROUT TYPE:	Concrete	0-2
SEAL TYPE:	Bentonite chips	2-108
	Bridge Sand	108-110
SAND PACK:	2 X 12 grade sand	110-195
WELL SCREEN:	75', 2" PVC screen, 0.010" slots	120-195
BACKFILL:	2 X 12 grade sand	195-199
TOTAL DEPTH DRILLED:		199

DEPTH	SAMPLE INTERVAL	MOISTURE CONTENT	U.S.C.S. CLASS	LITHOLOGY	DESCRIPTION	WELL INSTALLATION
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CLIENT	Holcim	PROJECT NAME	Reserve Silica Reclamation Site
PROJECT NUMBER	152030402	PROJECT LOCATION	Ravensdale, WA
DATE STARTED	11/20/20	COMPLETED	11/20/20
DRILLING CONTRACTOR	Cascade Drilling	GROUND ELEVATION	Not Surveyed
DRILLING METHOD	Sonic	HOLE SIZE	6-inch
LOGGED BY	T. Haskins, LG	CHECKED BY	G. Zimmerman
NOTES	Ecology Well ID: BLZ447		
		GROUND WATER LEVELS:	
		▽ DURING DRILLING	40.0 feet bgs
		▼ AFTER DRILLING	31.09 feet bgs



RECORD OF BOREHOLE P-1 PROBE

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hydraulic Direct Push
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 745
 INCLINATION: -90

DRILL RIG: Geoprobe 7720DT

COORDINATES: N: 1,712,874.52 E: 127,628.32

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40				
					DEPTH (ft)						WATER CONTENT (PERCENT)							
											W _p	W _L	W _U	W _h	W _i			
0	Hydraulic Direct Push 2.25-Inch Rod Diameter	0.0 - 18.0 Loose to compact, medium brown to medium gray, mottled, heterogeneous, mix of silty fine to medium SAND and fine to medium sandy SILT, little to some organics (rootlets), damp to moist (SM) (FILL-MINE SPOILS) 1.0 - 1.5 Loose to compact, light gray, mottled, imported cement kiln dust, damp (FILL) Sample S-1 collected at 1 ft bgs	SM			Run 1	GRAB			1.8 5.0								
5		5.0 - 10.0 No recovery in Run 2																
10		10 - 15 Poor recovery in Run 3 10 - 15 Scattered wood fibers observed Sample S-2 collected at 10 ft bgs				Run 2	NR			0.0 5.0								
15		15 - 18 Little fine gravel observed				Run 3	GRAB			0.3 5.0								
20		18.0 - 22.0 Compact to dense, medium to olive brown, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little to some fine gravel, little organics (rootlets), moist (SM/CL-ML) (FILL-MINE SPOILS)	SM/ CL-ML		727.0 18.0	Run 4	GRAB			4.0 5.0								
		Log continued on next page																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: K. Goble

LOGGED: S. Morgan
 CHECKED: J. DeLaChapelle
 DATE: 10/7/2010



RECORD OF BOREHOLE P-1 PROBE

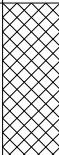
SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hydraulic Direct Push
 DRILL DATE: 9/27/10
 DRILL RIG: Geoprobe 7720DT

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,874.52 E: 127,628.32

ELEVATION: 745
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)											
20		Sample S-3 collected at 18 ft bgs 18.0 - 22.0 Compact to dense, medium to olive brown, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little to some fine gravel, little organics (rootlets), moist (SM/CL-ML) (FILL-MINE SPOILS) (Continued)	SM/ CL-ML			Run 4	GRAB			$\frac{2.0}{2.0}$					Soil density estimated from probe action	
		20.0 Becomes dense to very dense			723.0											
		Sample S-4 collected at 21 ft bgs			22.0											
		No groundwater encountered at time of probing Refusal in mine spoils Boring completed at 22.0 ft.														
25																
30																
35																
40																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: K. Goble

LOGGED: S. Morgan
 CHECKED: J. DeLaChapelle
 DATE: 10/7/2010



RECORD OF BOREHOLE P-2 PROBE

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hydraulic Direct Push
 DRILL DATE: 9/27/10
 DRILL RIG: Geoprobe 7720DT

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,977.30 E: 127,350.47

ELEVATION: 775
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ——— W _L					
											10	20	30	40		
0	Hydraulic Direct Push 2.25-inch Rod Diameter	0.0 - 3.5 Compact to dense, orange-brown, mottled, heterogeneous, silty fine to medium SAND, little fine gravel, little organics (rootlets), trace fine-grained coal fragments, damp to moist (SM) (FILL-MINE SPOILS)	SM			Run 1 GRAB				3.5 5.0						
		Sample S-1 collected at 3 ft bgs			771.5											
		3.5 - 20.0 Compact to dense, medium brown to medium gray, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT with little to some fine to medium sand, little fine gravel, little organics (rootlets), trace fine-grained coal fragments, damp to moist (SM/CL-ML) (FILL-MINE SPOILS)	SM/ CL-ML		3.5											
5		5.0 - 10.0 Scattered wood fragments observed														
		Sample S-2 collected at 6 ft bgs														
10																
		Sample S-3 collected at 13 ft bgs														
		13.0 1-inch thick pocket of wood fragments observed														
15																
		Sample S-4 collected at 16 ft bgs														
		16.0 - 19.0 2 to 4-inch zones of imported cement kiln dust interlayered between orange-brown fine to medium sand														
20		Log continued on next page			755.0											

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: K. Goble

LOGGED: S. Morgan
 CHECKED: J. DeLaChapelle
 DATE: 10/7/2010



SHEET 2 of 2

ELEVATION: 775
INCLINATION: -90

COORDINATES: N: 1,712,977.30 E: 127,350.47

Soil density estimated
from probe action

**Golder
Associates**

RECORD OF BOREHOLE P-5 PROBE

SHEET 1 of 1

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hydraulic Direct Push
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 765
 INCLINATION: -90

DRILL RIG: Geoprobe 7720DT

COORDINATES: N: 1,713,014.40 E: 126,648.65

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p I ——— W _L					
											10	20	30	40		
0	Hydraulic Direct Push 2.25-inch Rod Diameter	0.0 - 2.0 Compact to dense, medium brown, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little to some organics (rootlets), scattered pockets of fine-grained coal fragments, damp (CL) (FILL-LOW PERMEABILITY SOIL COVER)	CL		763.0											
		Sample S-1 collected at 1 ft bgs			2.0	Run 1	GRAB			1.4 5.0						
		2.0 - 12.0 Compact to dense, tan to medium brown to medium gray, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little angular gravel clasts, little organics (rootlets), scattered pockets of fine-grained coal fragments, damp (SM/CL-ML) (FILL-MINE SPOILS)	SM/ CL-ML													
5		Sample S-2 collected at 7.5 ft bgs				Run 2	GRAB			5.0 5.0						
		Sample S-3 collected at 10 ft bgs														
10			12.0 - 16.0 Dense to very dense, light gray, mottled, heterogeneous, cement kiln dust, damp (FILL-IMPORTED CEMENT KILN DUST)	N/A		753.0	Run 3	GRAB			5.0 5.0					
		Sample S-4 collected at 15 ft bgs					Run 4	GRAB			1.0 1.0					
15		No groundwater encountered at time of probing				749.0										
		Refusal in cement kiln dust Boring completed at 16.0 ft.				16.0										
20																

Soil density estimated from probe action

Soil density estimated from probe action

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: K. Goble

LOGGED: S. Morgan
 CHECKED: J. DeLaChapelle
 DATE: 10/7/2010



RECORD OF BOREHOLE P-6 PROBE

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013
LOCATION: Fill east of LDA Cover

DRILLING METHOD: Hydraulic Direct Push
DATUM: Local
AZIMUTH: N/A

ELEVATION: 820
INCLINATION: -90

DRILL RIG: Geoprobe 7720DT

COORDINATES: N: 1,713,164.94 E: 127,156.60

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40		
					DEPTH (ft)						WATER CONTENT (PERCENT)					
											W _p	I _w	W _L	W _U		

0	Hydraulic Direct Push 2.25-Inch Rod Diameter	0.0 - 28.0 Loose to very dense, medium brown to gray, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little fine gravel, little organics (rootlets, wood fragments), damp to moist, organic odor (SM) (FILL-MINE SPOILS)	SM																
		Sample S-1 collected at 2 ft bgs				Run 1 GRAB				2.2 5.0									
5		6.0 - 7.0 Orange-brown, silty sand to silt with scattered fine-grained coal fragments observed				Run 2 GRAB				4.0 5.0									
10		Sample S-3 collected at 12 ft bgs				Run 3 GRAB				3.0 5.0									
15		Sample S-4 collected at 15 ft bgs Sample S-5 collected at 16 ft bgs				Run 4 GRAB				3.2 5.0									
20		16.0 - 18.0 Light to medium gray, fine to medium sand with little to some silt observed																	
		20.0 Becomes dense to very dense																	
		Log continued on next page																	

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: K. Goble

LOGGED: S. Morgan
CHECKED: J. DeLaChapelle
DATE: 10/7/2010



RECORD OF BOREHOLE P-6 PROBE

SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013
LOCATION: Fill east of LDA Cover

DRILLING METHOD: Hydraulic Direct Push
DATUM: Local
AZIMUTH: N/A

ELEVATION: 820
INCLINATION: -90

DRILL RIG: Geoprobe 7720DT

COORDINATES: N: 1,713,164.94 E: 127,156.60

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS															
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)																				
					DEPTH (ft)						W _p I ————— W _L																				
											10	20	30	40																	
20	Hydraulic Direct Push 2.25-Inch Rod Diameter	Sample S-6 collected at 20 ft bgs 0.0 - 28.0 Loose to very dense, medium brown to gray, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little fine gravel, little organics (rootlets, wood fragments), damp to moist, organic odor (SM) (FILL-MINE SPOILS) (Continued) 21.0 - 22.0 Light gray, fine to medium sand with little to some silt observed Sample S-7 collected at 21 ft bgs	SM				Run 5 GRAB			3.0 5.0																					
25		25.0 - 28.0 Light to medium gray, mottled, silty fine to medium sand to silt with little to some fine to medium sand observed No groundwater encountered at time of probing																792.0 28.0					Run 6 GRAB			3.0 3.0					
		Refusal on cobble, boulder or bedrock Boring completed at 28.0 ft.																													
30																	Soil density estimated from probe action														
35																															
40																															

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: K. Goble

LOGGED: S. Morgan
CHECKED: J. DeLaChapelle
DATE: 10/7/2010



RECORD OF BOREHOLE P-10 PROBE

SHEET 1 of 1

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: MWB-3LDA

DRILLING METHOD: Hydraulic Direct Push
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 740
 INCLINATION: -90

DRILL RIG: Geoprobe 7720DT

COORDINATES: N: 1,713,016.99 E: 126,268.70

DEPTH (ft)	BORING METHOD	SOIL PROFILE			SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS			
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)							
					DEPTH (ft)						W _p ——— W _L							
											10 20 30 40							
0	Hydraulic Direct Push 2.25-Inch Rod Diameter	0.0 - 10.0 Compact to dense, light to medium gray to medium brown, mottled, heterogeneous, silty fine to medium SAND, little fine gravel, little organics (rootlets, wood fragments), scattered fine-grained coal fragments, damp (SM) (FILL-MINE SPOILS)	SM			Run 1	GRAB			2.5 5.0								
5			Sample S-2 collected at 7 ft bgs			Run 2	GRAB			3.3 5.0								
10			10.0 - 13.0 Zone of fine-grained coal	PT		730.0 10.0												
			Sample S-3 collected at 11 ft bgs					Run 3	GRAB			4.0 5.0						
15		13.0 - 18.0 Dense, olive brown, mottled, heterogeneous, mix of silty fine to medium SAND and sandy SILT, little fine gravel, little organics (rootlets), moist (SM) (FILL-MINE SPOILS)	SM		727.0 13.0													
		Sample S-4 collected at 15 ft bgs					Run 4	GRAB			2.8 3.0							
		No groundwater encountered at time of probing			722.0 18.0													
20		Refusal on cobble/boulder/bedrock Boring completed at 18.0 ft.															Soil density estimated from probe action	

Soil density estimated from probe action

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: K. Goble

LOGGED: S. Morgan
 CHECKED: J. DeLaChapelle
 DATE: 10/7/2010



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-4A HSA

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/16/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,901.94 E: 126,734.19

ELEVATION: 752
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)						
					DEPTH (ft)						W _p ——— W ——— W _i						
											10	20	30	40			
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 2.0 Compact to dense, medium brown, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little to some organics (rootlets), scattered pockets of fine-grained coal fragments, damp (CL) (FILL-LOW PERMEABILITY SOIL COVER)	CL		750.0												
		2.0 - 10.0 Loose, medium gray, mottled, heterogeneous, mix of SILT and fine to medium SAND, little fine to coarse subrounded to subangular gravel, moist (SM) (FILL-MINE SPOILS)	SM		2.0												
5		5.0 - 5.5 Scattered organics (rootlets) observed			S-1	CA	5-4-5	9	1.1 1.5								
10		10.0 - 27.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, dry to damp (FILL-IMPORTED CEMENT KILN DUST)	N/A		742.0	S-2	CA	50/6"	>50	0.9 0.5							>> ■
15					S-3	CA	40-50/5"	>50	1.5 1.0								>> ■
20																	

Log continued on next page

Log continued on next page

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-4A HSA

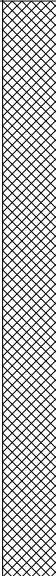
SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/16/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,901.94 E: 126,734.19

ELEVATION: 752
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)							
					DEPTH (ft)						W_p ——— W ——— W_L							
											10	20	30	40				
20	Hollow Stem Auger 8-inch Casing Diameter	10.0 - 27.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, dry to damp (FILL-IMPORTED CEMENT KILN DUST) (Continued)	N/A		724.5 27.5	S-4	CA	32-50/4"	>50	$\frac{1.5}{1.0}$					>>■			
25																		>>■
		27.0 - 27.5 Mix of silty sand and cement kiln dust with scattered fine-grained coal fragments observed																
		No groundwater encountered at time of drilling				S-6	SPT	60/6"	>50	$\frac{0.3}{0.5}$					>>■			
		The drilling conditions are too dense and the angle of the drill is too great to continue drilling Boring completed at 27.5 ft.																
30																		
35																		
40																		

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



SHEET 1 of 3

ELEVATION: 820
INCLINATION: -90

COORDINATES: N: 1,713,045.00 E: 127,291.00

Hollow Stem Auger
8-inch Casing Diameter

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE B-1 HSA

SHEET 2 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: Fill east of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/2/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,045.00 E: 127,291.00

ELEVATION: 820
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ——— W _L					
20	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 30.0 Loose to very dense, medium brown to gray, heterogeneous, mix of silty fine to medium SAND and SILT, little to some fine subrounded gravel, scattered pockets of fine-grained coal fragments, little organics (rootlets), damp to moist (SM) (FILL- MINE SPOILS) (Continued)	SM			S-1	CA	6-24-40	>50	0.4 1.5					>>■	
25						S-2	CA	30-50/6"	>50	1.0 1.0					>>■	
30			30.0 - 40.3 Slightly weathered, non-stratified, very light gray (N8), fine-grained, extremely weak (R0), dry to damp, SANDSTONE (PUGET GROUP)	N/A		790.0 30.0	S-3	CA	50/3"	>50	0.5 0.3					>>■
		30.0 - 35.0 Orange-brown mottling observed														
35							S-4	CA	50/3"	>50	0.6 0.3					>>■
40		No groundwater encountered at time of drilling														
		Log continued on next page														

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-1 HSA

SHEET 3 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013 DRILLING METHOD: Hollow Stem Auger
 LOCATION: Fill east of LDA Cover DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,045.00 E: 127,291.00
 ELEVATION: 820
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ————— W _L					
											10	20	30	40	W _i	
40		Boring completed at 40.3 ft.	N/A		779.8 40.3	S-5	CA	50/3"	>50	0.5 0.3					>>■	
45																
50																
55																
60																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-2 HSA

SHEET 1 of 3

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013
LOCATION: East of LDA Cover

DRILLING METHOD: Hollow Stem Auger
DRILLING DATE: 12/2/10
DRILL RIG: CME 65 Limited Access

DATUM: Local
AZIMUTH: N/A
COORDINATES: N: 1,713,130.00 E: 127,000.00

ELEVATION: 795
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40					
					DEPTH (ft)						WATER CONTENT (PERCENT)					
											W _p	W _L	W _u	W _h		
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 25.0 Compact to very dense, medium gray, non-stratified, SILT, dry to damp (ML) (FILL- MINE SPOILS WITH SILTSTONE)	ML													
5		5.0 - 15.0 Driller notes gravel zone			S-1	CA	50/1"	>50	0.4 0.1							>>■
10		11.0 - 11.2 Zone of orange-gray coloring observed			S-2	CA	6-20-25	45	1.0 1.5							■
15		15.5 - 16.0 Orange-gray, silty fine to medium sand with some fine to medium subrounded to subangular gravel, scattered fine-grained coal fragments, and trace fibrous wood debris observed			S-3	CA	5-9-12	21	1.0 1.5							■
20		Log continued on next page														

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



RECORD OF BOREHOLE B-2 HSA

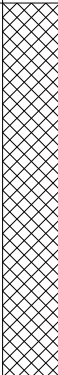
SHEET 2 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: East of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/2/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,130.00 E: 127,000.00

ELEVATION: 795
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)							
					DEPTH (ft)						W _p ——— W _L							
											10	20	30	40				
20	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 25.0 Compact to very dense, medium gray, non-stratified, SILT, dry to damp (ML) (FILL- MINE SPOILS WITH SILTSTONE) (Continued)	ML		770.0	S-4	CA	4-10-15	25	<u>0.8</u> 1.5								
		20.0 - 21.5 Scattered pockets of orange-gray silty fine to medium sand with some fine to medium subrounded to subangular gravel observed																
25		25.0 - 40.5 Slightly weathered, non-stratified, light gray (N7), fine-grained, extremely weak (R0), dry to damp, SANDSTONE (PUGET GROUP)	N/A		25.0	S-5	CA	50/3"	>50	<u>0.3</u> 0.3							>> ■	
		25.0 Driller notes large void during backfill																
30					S-6	CA	50/4"	>50	<u>0.6</u> 0.3									>> ■
35			S-7	CA	50/6"	>50	<u>0.4</u> 0.5										>> ■	
40																		

Log continued on next page.

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-2 HSA

SHEET 3 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: East of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/2/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,130.00 E: 127,000.00

ELEVATION: 795
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40					
					DEPTH (ft)						WATER CONTENT (PERCENT)					
											W _p	I ^W	W _L	W _U		
40		No groundwater encountered at time of drilling Boring completed at 40.5 ft.	N/A		754.5 40.5	S-8	CA	50/6"	>50	<u>0.6</u> 0.5					>>■	
45																
50																
55																
60																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-3 HSA

SHEET 1 of 1

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: S of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/3/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,162.51 E: 126,150.12

ELEVATION: 745
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40							
					DEPTH (ft)						WATER CONTENT (PERCENT)							
											W _p	I	W _L	W _i				
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 8.0 Very dense, olive brown to medium gray, mottled, non-stratified, silty fine to coarse SAND, little to some fine subrounded to subangular gravel, scattered cobble/boulder fragments, socketing, damp (SM) (FILL-MINE SPOILS)	SM															
5					S-1	CA	50/4"	>50	1.2 0.3								>>■	
		No groundwater encountered at time of drilling					737.0 8.0	S-2	CA	50/5"	>50	0.3 0.4						>>■
10		The drilling conditions too dense to continue drilling; may have encountered bedrock or a large boulder Boring completed at 8.0 ft.																
15																		
20																		

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-4 HSA

SHEET 1 of 1

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: S of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/3/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,159.55 E: 126,151.28

ELEVATION: 745
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)									
					DEPTH (ft)						W _p ————— W ————— W _i									
											10	20	30	40						
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 8.0 Very dense, olive brown, mottled orange-brown, non-stratified, silty fine to coarse SAND, some fine to coarse subrounded to subangular gravel, scattered cobble/boulder fragments, socketing, damp (SM) (FILL-MINE SPOILS)	SM																	
5																				
		No groundwater encountered at time of drilling																		
					737.0	S-1	CA	27-50/3"	>50	1.0 0.8							>>■			
						S-2	CA	50/1"	>50	0.0 0.1							>>■			
					8.0															
8.0		8.0 The drilling conditions too dense to continue drilling; may have encountered bedrock or a large boulder Boring completed at 8.0 ft.																		
10																				
15																				
20																				

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-5 HSA

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: S of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/3/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,191.12 E: 126,125.55

ELEVATION: 746
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40			
					DEPTH (ft)						WATER CONTENT (PERCENT)						
											W _p	W _L	W _U	W _h			
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 20.0 Very dense, olive brown, heterogeneous, silty fine to coarse SAND, some fine to coarse subrounded to subangular gravel, scattered cobble/boulder fragments, socketing, damp to moist (SM) (FILL-MINE SPOILS)	SM														
		5.0 - 6.0 Orange-brown mottling observed			S-1	CA	17-50/6"	>50	0.8 1.0							>>■	
						S-2	CA	50/4"	>50	0.2 0.3							>>■
10						S-3	CA	50/5"	>50	0.8 0.4							>>■
						S-4	CA	50/2"	>50	0.3 0.2							>>■
15						S-5	CA	50/5"	>50	0.0 0.4							>>■
						S-6	CA	50/6"	>50	0.3 0.5							>>■
20																	
		Log continued on next page			726.0												

Log continued on next page

726.0

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

SHEET 2 of 2
ELEVATION: 746
INCLINATION: -90
26,125.55

DATUM: Local ELEVATION: 746
AZIMUTH: N/A INCLINATION: -90
COORDINATES: N: 1,713,191.12 E: 126,125.55

[illegible]

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

Groundwater measured at 31.70 ft BGS A1D (borehole depth 32.5 ft)

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



RECORD OF BOREHOLE B-6 HSA

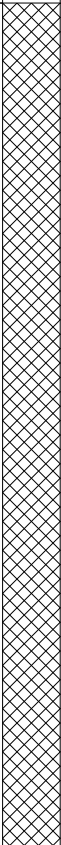
SHEET 1 of 1

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: S of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/3/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,180.30 E: 126,137.77

ELEVATION: 746
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 11.0 Very dense, olive to medium brown, mottled, non-stratified, silty fine to coarse SAND, some fine to coarse subrounded to subangular gravel, scattered cobble/boulder fragments, socketing, damp (SM) (FILL-MINE SPOILS)	SM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-7 HSA

SHEET 1 of 1

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: S of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/3/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,185.62 E: 126,130.47

ELEVATION: 746
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40				
					DEPTH (ft)						WATER CONTENT (PERCENT)				
											W _p	I	W		W _L
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 3.0 No sample recovery. Cuttings indicate: Very dense, olive to medium brown, silty fine to coarse SAND, some fine to coarse subrounded to subangular gravel, scattered cobble/boulder, damp (SM) (FILL-MINE SPOILS)	SM												
		No groundwater encountered at time of drilling			743.0										
		The drilling conditions too dense to continue drilling; may have encountered bedrock or a large boulder Boring completed at 3.0 ft.			3.0										
5															
10															
15															
20															

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-9 HSA

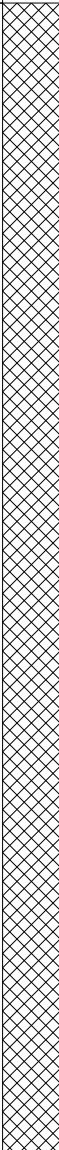
SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013
LOCATION: East of LDA Cover

DRILLING METHOD: Hollow Stem Auger
DRILLING DATE: 12/6/10
DRILL RIG: CME 65 Limited Access

DATUM: Local
AZIMUTH: N/A
COORDINATES: N: 1,713,153.23 E: 126,866.95

ELEVATION: 795
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40				
					DEPTH (ft)						WATER CONTENT (PERCENT)							
											W _p	W _L	W _u	W _h	W _i			
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 15.0 Dense to very dense, olive brown, mottled, heterogenuous, silty fine to medium SAND, little fine to medium subrounded to subangular gravel, scattered cobble/boulder fragments, scattered fine-grained coal fragments, trace organics (wood fibers), damp (SM) (FILL- MINE SPOILS)	SM															
5								S-1	CA	50/6"	>50	0.9 0.5						>>■
								S-2	CA	7-7-7	14	1.5	■					
10																		
								S-2	CA	25-23-12	35	0.5 1.5		■				
								S-4	CA	4-8-10	18	1.5		■				
15		15.0 - 35.5 Fresh, massive, brownish gray (5YR 4/1), very fine-grained to fine-grained, extremely weak (R0), dry, SILTSTONE, local coal seams (PUGET GROUP)	N/A		780.0 15.0	S-3	CA	50/5"	>50	0.5 0.4						>>■		
20		Log continued on next page																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



RECORD OF BOREHOLE B-9 HSA

SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: East of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/6/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,153.23 E: 126,866.95

ELEVATION: 795
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						10203040 20406080					
20	Hollow Stem Auger 8-inch Casing Diameter	15.0 - 35.5 Fresh, massive, brownish gray (5YR 4/1), very fine-grained to fine-grained, extremely weak (R0), dry, SILTSTONE, local coal seams (PUGET GROUP) (Continued)	N/A			S-4	CA	50/5"	>50	$\frac{0.5}{0.4}$					>>■	
						S-5	CA	50/5"	>50	$\frac{0.6}{0.4}$					>>■	
						S-6	CA	50/3"	>50	$\frac{0.3}{0.3}$					>>■	
						S-7	CA	50/5"	>50	$\frac{0.5}{0.4}$					>>■	
						S-8	CA	50/5"	>50	$\frac{0.6}{0.4}$					>>■	
						S-9	CA	50/6"	>50	$\frac{0.7}{0.5}$					>>■	
35		No groundwater encountered at time of drilling			759.5	S-10	CA	50/6"	>50	$\frac{0.5}{0.5}$					>>■	
		Boring completed at 35.5 ft.			35.5											

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-10 HSA

SHEET 1 of 1

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013 DRILLING METHOD: Hollow Stem Auger
 LOCATION: Access Road @ Main Road DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,133.31 E: 126,202.04
 ELEVATION: 745
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
					DEPTH (ft)						W_p ——— W ——— W_L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 10.2 Very dense, olive brown, mottled, non-stratified, silty fine to medium SAND, some fine to coarse subrounded to subangular gravel, scattered cobble/boulder fragments, socketing, damp (SM) (FILL-MINE SPOILS)	SM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



SHEET 1 of 3

ELEVATION: 747
INCLINATION: -90

COORDINATES: N: 1,712,881.46 E: 127,626.70

2 in nominal
diameter
solid
schedule 40
PVC pipe set
in bentonite
chips

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-1 HSA

SHEET 2 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/29/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,881.46 E: 127,626.70

ELEVATION: 747
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40						
					DEPTH (ft)						WATER CONTENT (PERCENT)									
											W _p	W _L	W _U	W _i						
20	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 35.0 Loose to dense, medium brown to medium gray, mottled, nonstratified, mix of silty fine to medium SAND and fine to medium sandy SILT, trace cobbles, little to some organics (rootlets), damp to moist (SM) (FILL-MINE SPOILS) (Continued)	SM																	
25						S-1	CA	50/4"	>50	0.3 0.3								>>■		
30						S-2	CA	50/4"	>50	0.1 0.3									>>■	2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips
35		35.0 - 55.3 Fresh, massive, light brownish gray (5YR 6/1), fine-grained, weak (R2), dry, SILTSTONE (PUGET GROUP)	N/A		712.0 35.0															
						S-3	CA	50/4"	>50	0.3 0.3								>>■		
40		Log continued on next page																		

2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-1 HSA

SHEET 3 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 747
 INCLINATION: -90

DRILL RIG: CME 65 Limited Access

COORDINATES: N: 1,712,881.46 E: 127,626.70

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS			
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)							
					DEPTH (ft)						W _p ——— W ——— W _i							
											10 20 30 40 20 40 60 80							
40	Hollow Stem Auger 8-inch Casing Diameter	35.0 - 55.3 Fresh, massive, light brownish gray (5YR 6/1), fine-grained, weak (R2), dry, SILTSTONE (PUGET GROUP) <i>(Continued)</i>	N/A			S-4	CA	50/3"	>50	0.3 0.3					>>			
45		45.0 Localized seam of fine-grained coal observed				S-5	CA	50/3"	>50	0.3 0.3							>>	
50						S-6	CA	50/2"	>50	0.4 0.2							>>	
55		No groundwater encountered at time of drilling Boring completed at 55.3 ft.			691.7 55.3	S-7	CA	50/3"	>50	0.5 0.3					>>	#2/12 silica sand backfill		
60																		

2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips

2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill

2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill

#2/12 silica sand backfill

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-3 HSA

SHEET 1 of 4

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013
LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
DATUM: Local
AZIMUTH: N/A
ELEVATION: 780
INCLINATION: -90
COORDINATES: N: 1,713,003.09 E: 126,929.39

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40						
					DEPTH (ft)						WATER CONTENT (PERCENT)									
													W _p		W _L					
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 2.0 Compact to dense, medium brown, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little to some organics (rootlets), scattered pockets of fine-grained coal fragments, damp (CL) (FILL-LOW PERMEABILITY SOIL COVER)	CL		778.0 2.0													Flush-mount monument set in concrete with locked well cap		
		2.0 - 10.0 Compact to very dense, medium brown to medium gray, mottled, heterogeneous, mix of SILT and fine to medium SAND, little fine to coarse gravel, little organics (rootlets), scattered pockets of fine-grained coal fragments, damp (SM) (FILL-MINE SPOILS)	SM			S-1	CA	14-14-14	28	1.5 1.5								2 in nominal diameter solid schedule 40 PVC pipe set in cement		
5																				
10		10.0 - 65.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, dry to wet (FILL-IMPORTED CEMENT KILN DUST)			770.0 10.0	S-2	CA	30-50/6"	>50	1.5 1.0									>>■	
15							S-3	CA	50/5"	>50	0.6 0.4								>>■	
20	Log continued on next page																			

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



RECORD OF BOREHOLE P-3 HSA

SHEET 2 of 4

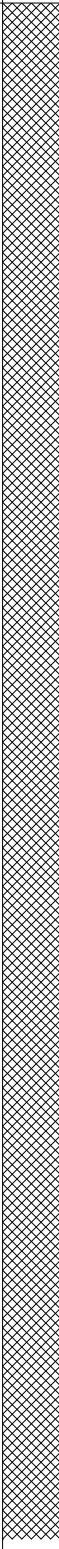
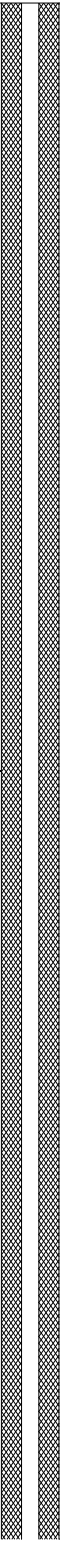
PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 780
 INCLINATION: -90

DRILL RIG: CME 65 Limited Access

COORDINATES: N: 1,713,003.09 E: 126,929.39

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS					
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40									
											WATER CONTENT (PERCENT)									
											$W_p \text{ --- } W \text{ --- } W_L$ 20 40 60 80									
20	Hollow Stem Auger 8-inch Casing Diameter	10.0 - 65.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, dry to wet (FILL-IMPORTED CEMENT KILN DUST) (Continued)	N/A			S-4	CA	50/5"	>50	$\frac{1.0}{0.4}$					>>■					
25																				
		25.5 Slightly cohesive cement kiln dust with trace to little fine gravel observed					S-5	CA	50/6"	>50	$\frac{1.0}{0.5}$								>>■	
30						S-6	CA	50/5"	>50	$\frac{1.1}{0.4}$					>>■	2 in nominal diameter solid schedule 40 VC pipe set in bentonite chips				
35		35.0 Band of slightly cohesive cement kiln dust observed				S-7	CA	50/6"	>50	$\frac{1.0}{0.5}$					>>■					
40		Log continued on next page																		

2 in nominal
 diameter
 solid
 schedule 40
 PVC pipe set
 in bentonite
 chips

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-3 HSA

SHEET 3 of 4

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 780
 INCLINATION: -90

DRILL RIG: CME 65 Limited Access

COORDINATES: N: 1,713,003.09 E: 126,929.39

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p	W _L	W _u	W _h		
40	Hollow Stem Auger 8-inch Casing Diameter	10.0 - 65.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, dry to wet (FILL-IMPORTED CEMENT KILN DUST) (Continued)	N/A			S-8	CA	50/6"	>50	1.5 0.5					>>■	
45		45.0 - 65.0 Moisture content increases from moist to wet				S-9	CA	50/6"	>50	1.0 0.5					>>■	
50						S-10	CA	50/5"	>50	0.8 0.4					>>■	
55		55.0 Band of slightly cohesive cement kiln dust observed				S-11A	CA	50/6"	>50	1.1 0.5					>>■	
60		Log continued on next page													2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill	

2 in nominal
diameter
solid
schedule 40
PVC pipe set
in bentonite
chips

2 in nominal
diameter
solid
schedule 40
PVC pipe set
in #2/12
silica sand
backfill

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-3 HSA

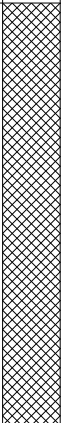
SHEET 4 of 4

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/16/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,003.09 E: 126,929.39

ELEVATION: 780
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40					
					DEPTH (ft)						WATER CONTENT (PERCENT)					
											W _p	W _L	W _p	W _L		
60	Hollow Stem Auger 8-inch Casing Diameter	10.0 - 65.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, dry to wet (FILL-IMPORTED CEMENT KILN DUST) (Continued)	N/A			S-12	CA	50/6"	>50	0.8 0.5						>>■
65		No groundwater encountered at time of drilling			714.5 65.5	S-13	CA	50/5"	>50	0.5 0.4						>>■ #2/12 silica sand backfill
		Boring completed at 65.5 ft.														
70																
75																
80																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



SHEET 1 of 4

ELEVATION: 735
INCLINATION: -90

COORDINATES: N: 1,712,901.94 E: 126,734.19

Hollow Stem Auger 3-inch Casing Diameter

715.0



**Golder
Associates**

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-4B HSA

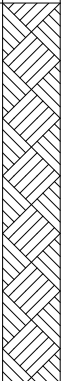
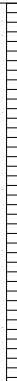
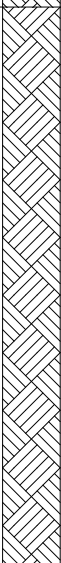
SHEET 2 of 4

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Toe Ditch

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/30/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,901.94 E: 126,734.19

ELEVATION: 735
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40								
					DEPTH (ft)						WATER CONTENT (PERCENT)								
											W _p ——— W _L	20	40	60	80				
20	Hollow Stem Auger 8-inch Casing Diameter	20.0 - 25.0 Lightly weathered, locally stratified, dark yellowish orange (10YR 6/6), fine-grained, extremely weak (R0), dry, silty fine-grained SANDSTONE (PUGET GROUP)	N/A		20.0	S-4	CA	50/4"	>50	0.4 0.3						>>■	2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill		
25			25.0 - 60.0 Slightly weathered, non-stratified, medium light gray (N6), fine-grained, extremely weak (R0), dry, SANDSTONE, quartz grains, subangular (PUGET GROUP)	N/A		710.0 25.0	S-5	CA	50/5"	>50	0.4 0.4						>>■	#2/12 silica sand backfill	
30			N/A			S-6	CA	50/4"	>50	0.4 0.3						>>■			
35			N/A			S-7	CA	50/2"	>50	0.5 0.2						>>■			
40	Log continued on next page																		

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-4B HSA

SHEET 3 of 4

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Toe Ditch

DRILLING METHOD: Hollow Stem Auger
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 735
 INCLINATION: -90

DRILL RIG: CME 65 Limited Access

COORDINATES: N: 1,712,901.94 E: 126,734.19

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40					
					DEPTH (ft)						WATER CONTENT (PERCENT)					
											W_p $\overset{W}{\curvearrowright}$ W_L					
40	Hollow Stem Auger 8-inch Casing Diameter	25.0 - 60.0 Slightly weathered, non-stratified, medium light gray (N6), fine-grained, extremely weak (R0), dry, SANDSTONE, quartz grains, subangular (PUGET GROUP) <i>(Continued)</i>	N/A			S-8	CA	50/5"	>50	$\frac{0.5}{0.4}$					>>■	
45						S-9	CA	50/3"	>50	$\frac{0.4}{0.3}$					>>■	
50						S-10	CA	50/3"	>50	$\frac{0.4}{0.3}$					>>■	
55						S-11	CA	50/5"	>50	$\frac{0.4}{0.4}$					>>■	
60		55.0 Still weak in strength, but appears more competent														
		Log continued on next page														
					675.0											

Bentonite chip backfill

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-4B HSA

SHEET 4 of 4

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Toe Ditch

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/30/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,901.94 E: 126,734.19

ELEVATION: 735
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40					
					DEPTH (ft)						WATER CONTENT (PERCENT)					
											W _p 20 40 60 80 W _L					
60	Hollow Stem Auger 8-inch Casing Diameter	60.0 - 65.3 Slightly weathered, non-stratified, dark yellowish orange (10YR 6/6), fine-grained, extremely weak (R0), dry, SANDSTONE, quartz grains, subangular (PUGET GROUP)	N/A		60.0	S-12	CA	50/5"	>50	0.5 0.4					>>■	
65		No groundwater encountered at time of drilling														
		Boring completed at 65.3 ft.			669.8 65.3	S-13	CA	50/3"	>50	0.4 0.3						
70																
75																
80																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-5 HSA

SHEET 1 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/17/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,037.39 E: 126,646.68

ELEVATION: 770
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)						
					DEPTH (ft)						W _p ——— W _L						
												10	20	30	40		
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 2.0 Compact to dense, medium brown, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little to some organics (rootlets), scattered pockets of fine-grained coal fragments, damp (CL) (FILL-LOW PERMEABILITY SOIL COVER)	CL		768.0											Flush-mount monument set in concrete with locked well cap 2 in nominal diameter solid schedule 40 PVC pipe set in cement	
		2.0 - 12.0 Compact to dense, tan to medium brown to medium gray, mottled, heterogeneous, mix of silty fine to medium SAND and cohesive, low plasticity SILT, little angular gravel clasts, little organics (rootlets), scattered pockets of fine-grained coal fragments, damp (SM/CL-ML) (FILL-MINE SPOILS)	SM/ CL-ML		2.0												
		12.0 - 50.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, scattered pockets of fine-grained coal fragments, scattered pockets of mine spoils, dry to moist (FILL-IMPORTED CEMENT KILN DUST)	N/A		758.0 12.0												2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips
20		Log continued on next page															

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-5 HSA

SHEET 2 of 3

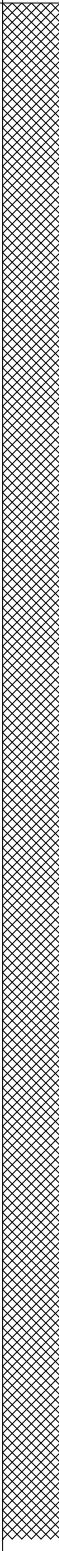
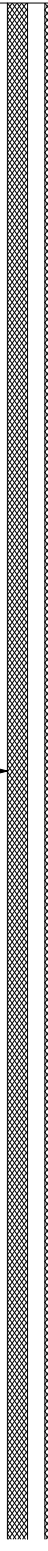
PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 770
 INCLINATION: -90

DRILL RIG: CME 65 Limited Access

COORDINATES: N: 1,713,037.39 E: 126,646.68

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC							
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)											
																			10 20 30 40			
												20 40 60 80										
20	Hollow Stem Auger 8-inch Casing Diameter	12.0 - 50.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, scattered pockets of fine-grained coal fragments, scattered pockets of mine spoils, dry to moist (FILL-IMPORTED CEMENT KILN DUST) (Continued)	N/A			S-1	CA	50/6"	>50	0.7 0.5						>>■	 2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips					
25						S-2	CA	50/6"	>50	0.8 0.5											>>■	
30																						
						S-3	CA	35-50/6"	>50	1.0 1.0												>>■
35																						
						S-4	CA	20-25-50/3"	>50	1.5 1.3							>>■					
40																						

Log continued on next page

Log continued on next page

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-5 HSA

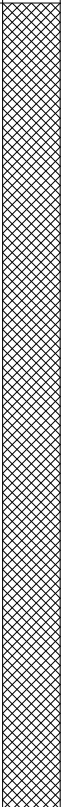
SHEET 3 of 3

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/17/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,037.39 E: 126,646.68

ELEVATION: 770
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS					
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)				GRAPHIC					
					DEPTH (ft)						W _p ————— W ————— W _L 20 40 60 80									
40	Hollow Stem Auger 8-inch Casing Diameter	12.0 - 50.5 Very dense, light gray, mottled, heterogeneous, cement kiln dust, scattered pockets of fine-grained coal fragments, scattered pockets of mine spoils, dry to moist (FILL-IMPORTED CEMENT KILN DUST) (Continued)	N/A			S-5	CA	50/3"	>50	0.4 0.3					>>■	2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips				
																				2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill
45						S-6	CA	50/6"	>50	1.5 0.5									>>■	Groundwater measured at 45.50 ft BGS ATD (borehole depth 50 ft)
																				2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill
50		Boring completed at 50.5 ft.			719.5 50.5	S-7	CA	50/6"	>50	1.5 0.5						>>■	#2/12 silica sand backfill			
55																				
60																				

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



SHEET 1 of 5

ELEVATION: 820
INCLINATION: -90

COORDINATES: N: 1,713,164.94 E: 127,156.60

Hollow Stem Auger
8-inch Casing Diameter

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-6 HSA

SHEET 2 of 5

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: Fill east of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/18/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,164.94 E: 127,156.60

ELEVATION: 820
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40			
					DEPTH (ft)						WATER CONTENT (PERCENT)						
											W _p	I	W	I	W _i		
20	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 65.0 Loose to very dense, medium brown to gray, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little to some fine gravel, little organics (rootlets, wood fragments), trace fine-grained coal fragments, damp to moist (SM) (FILL-MINE SPOILS) (Continued)	SM														2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips

Log continued on next page

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-6 HSA

SHEET 3 of 5

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: Fill east of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DATUM: Local
 AZIMUTH: N/A

ELEVATION: 820
 INCLINATION: -90

DRILL RIG: CME 65 Limited Access

COORDINATES: N: 1,713,164.94 E: 127,156.60

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
															W _p ——— W _L	
				10 20 30 40												

40	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 65.0 Loose to very dense, medium brown to gray, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little to some fine gravel, little organics (rootlets, wood fragments), trace fine-grained coal fragments, damp to moist (SM) (FILL-MINE SPOILS) (Continued)	SM			S-3	CA	50/6"	>50	0.3 0.5						>>■							
45																							
50		50.0 Zone of tan to orange-brown fine to medium sand observed				S-5	CA	28-43-50/6"	>50	1.2 1.2						>>■							

2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-6 HSA

SHEET 4 of 5

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: Fill east of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/18/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,164.94 E: 127,156.60

ELEVATION: 820
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS			
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)								
					DEPTH (ft)						W _p ——— W ——— W _i								
											10	20	30	40					
60	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 65.0 Loose to very dense, medium brown to gray, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little to some fine gravel, little organics (rootlets, wood fragments), trace fine-grained coal fragments, damp to moist (SM) (FILL-MINE SPOILS) (Continued)	SM		755.0	S-7	CA	24-37-50/4"	>50	0.0 1.3						>>■			
65		65.0 - 70.0 Zone of fine-grained coal	PT		65.0	S-8	CA	50/6"	>50	0.3 0.5						>>■		2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips	
																		Groundwater measured at 67.75 ft BGS ATD (borehole depth 70 ft)	
70		70.0 - 80.1 Highly weathered, non-stratified, mottled, grayish orange (10YR 7/4) to light olive gray (5YR 5/2), fine-grained, extremely weak (R0), dry, silty SANDSTONE, local thin coal seams (PUGET GROUP)	N/A		750.0	S-9	CA	26-50/6"	>50	1.1 1.0						>>■			
75		75.0 Less mottling observed	N/A		75.0	S-10	CA	50/2"	>50	0.5 0.2						>>■		2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill Groundwater measured at 75.00 ft BGS ATD (borehole depth 75 ft)	
80																		>>■	2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill

Log continued on next page

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-6 HSA

SHEET 5 of 5

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: Fill east of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 11/18/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,164.94 E: 127,156.60

ELEVATION: 820
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40				
					DEPTH (ft)						WATER CONTENT (PERCENT)				
											W _p	I	W	W _L	
80		Boring completed at 80.1 ft.			739.9 80.1	S-11	CA	50/1"	>50	0.6 0.1					#2/12 silica sand backfill

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



SHEET 1 of 4

ELEVATION: 815
INCLINATION: -90

COORDINATES: N: 1,713,322.53 E: 126,774.16

2 in nominal
diameter
solid
schedule 40
PVC pipe set
in bentonite
chips



**Golder
Associates**

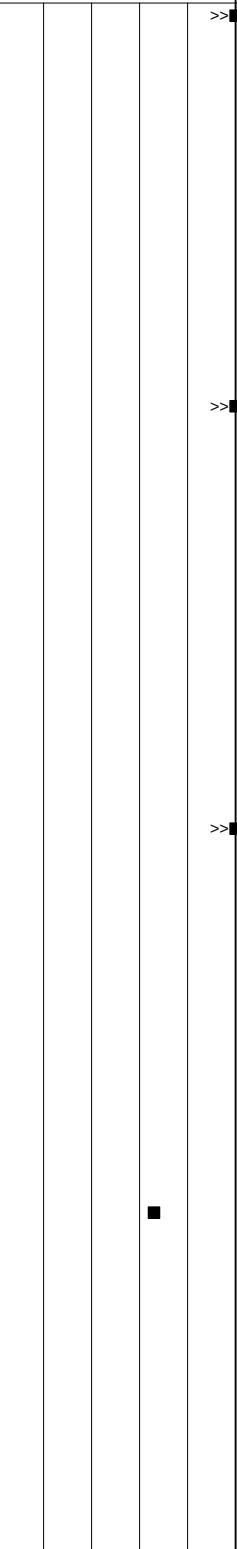
BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE P-8 HSA

SHEET 2 of 4

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013 DRILLING DATE: 11/18/10
 LOCATION: East of Access Road and LDA Drive RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,322.53 E: 126,774.16
 ELEVATION: 815
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)						
											W _p ——— W _l						
											10	20	30	40			
20	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 60.5 Dense to very dense, tan to olive brown to gray, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little to some fine subrounded gravel, scattered fine-grained coal fragments, little organics (rootlets, wood fragments), damp to wet (SM) (FILL-MINE SPOILS) (Continued) 20.0 3-inch diameter granite cobble core observed	SM			S-5	CA	50/4"	>50	<u>0.2</u> 0.3		W _p	W _l	>>■			
25						S-6	CA	50/6"	>50	<u>0.0</u> 0.5				>>■			
30		30.5 - 31.0 Zone of fine-grained coal fragments observed				S-7	CA	19-24-50/6"	>50	<u>1.0</u> 1.5				>>■		2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips	
35		35.0 - 40.0 Pockets of yellow-orange fine to medium sand				S-8	CA	7-10-23	33	<u>1.5</u> 1.5	■						
40		Log continued on next page															

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-8 HSA

SHEET 3 of 4

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013 DRILLING DATE: 11/18/10
LOCATION: East of Access Road and LDA Drive RIG: CME 65 Limited Access

DATUM: Local
AZIMUTH: N/A
ELEVATION: 815
INCLINATION: -90
COORDINATES: N: 1,713,322.53 E: 126,774.16

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS								
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40										
					DEPTH (ft)						WATER CONTENT (PERCENT)													
											W _p	W _L	W _p	W _L										
40	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 60.5 Dense to very dense, tan to olive brown to gray, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little to some fine subrounded gravel, scattered fine-grained coal fragments, little organics (rootlets, wood fragments), damp to wet (SM) (FILL-MINE SPOILS) (Continued)	SM			S-9	CA	18-30-24	>50	1.5 1.5							>>■							
45										S-10	CA	21-24-36	>50	1.5 1.5									>>■	2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips
50										S-11	CA	27-40-36	>50	1.5 1.5									>>■	
55		55.0 Pocket of fine-grained coal fragments observed				S-12	CA	20-50/6"	>50	1.5 1.0							>>■	2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill Groundwater measured at 53.61 ft BGS ATD (borehole depth 55 ft)						
60		Log continued on next page																						

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



RECORD OF BOREHOLE P-8 HSA

SHEET 4 of 4

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013 DRILLING DATE: 11/18/10
 LOCATION: East of Access Road and LDA Bore RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,322.53 E: 126,774.16
 ELEVATION: 815
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ————— W _L					
												10	20	30	40	
60			SM		754.5 60.5	S-13	CA	50/6"	>50	0.3 0.5					>> ■ #2/12 silica sand backfill 	
		Boring completed at 60.5 ft.														

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-9 HSA

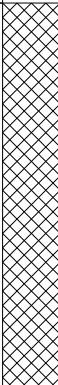
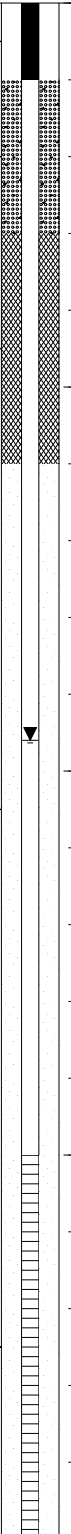
SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: East of MWB-3LDA

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/2/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,089.87 E: 126,260.19

ELEVATION: 740
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					GRAPHIC		
					DEPTH (ft)						W _p ——— W _l							
											10	20	30	40				
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 5.0 Very dense, light to medium brown, mottled, heterogeneous, mix of silty fine to medium SAND and SILT, little to some fine subrounded to subangular gravel, scattered cobbles, damp to wet (SM) (FILL-MINE SPOILS)	SM														Flush-mount monument set in concrete with locked well cap 2 in nominal diameter solid schedule 40 PVC pipe set in cement	
5		5.0 - 20.4 Highly weathered, non-stratified, mottled, grayish orange (10YR 7/4) to dark yellowish orange (10YR 6/6), fine-grained, extremely weak (R0), dry, SANDSTONE (PUGET GROUP)				735.0 5.0	S-1	CA	50/2"	>50	1.5 0.2	>>■						
10					S-2	CA	50/2"	>50	0.0 0.2	>>■						Groundwater measured at 9.60 ft BGS ATD (borehole depth 20 ft) 2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill		
15				N/A		S-3	CA	50/5"	>50	0.4 0.4	>>■						2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill	
20		Log continued on next page																

Flush-mount monument set in concrete with locked well cap
 2 in nominal diameter solid schedule 40 PVC pipe set in cement

2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips

Groundwater measured at 9.60 ft BGS
 ATD (borehole depth 20 ft)
 2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill

2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-9 HSA

SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: East of MWB-3LDA

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/2/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,089.87 E: 126,260.19

ELEVATION: 740
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ————— W _L					
												20	40	60	80	
20		20.0 - 20.4 Pockets of light gray fine to medium sand and iron-oxide staining observed Boring completed at 20.4 ft.	N/A		719.6 20.4	S-4	CA	50/5"	>50	0.8 0.4					>> ■ #2/12 silica sand backfill 	

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-11 HSA

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013
LOCATION: Adjacent to MWB-2LDA

DRILLING METHOD: Hollow Stem Auger
DATUM: Local
AZIMUTH: N/A

ELEVATION: 735
INCLINATION: -90

DRILL RIG: CME 65 Limited Access

COORDINATES: N: 1,712,741.18 E: 127,159.00

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40				GRAPHIC		
					DEPTH (ft)						WATER CONTENT (PERCENT)						
											W _p	W _L	W _p	W _L			
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 20.5 Compact to very dense, mottled, olive brown to medium gray, heterogeneous, mix of silty fine to medium SAND and SILT, some fine to coarse subrounded to subangular gravel, scattered cobble/boulder fragments, scattered pockets of fine-grained coal fragments, damp to wet (SM) (FILL-MINE SPOILS)	SM														Flush-mount monument set in concrete with locked well cap 2 in nominal diameter solid schedule 40 PVC pipe set in cement

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011



RECORD OF BOREHOLE P-11 HSA

SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013 DRILLING METHOD: Hollow Stem Auger
 LOCATION: Adjacent to MWB-2LDA DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,712,741.18 E: 127,159.00
 ELEVATION: 735
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ——— W _L					
												20	40	60	80	
20			SM		714.5 20.5	S-4	CA	50/6"	>50	0.5 0.5					>>■	
		Boring completed at 20.5 ft.														
													</			

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE P-12

SHEET 1 of 2
ELEVATION: 760
INCLINATION: -90

PROJECT: Holcim/LowerDisposalArea/WAD
PROJECT NUMBER: 073-93074-02.013
LOCATION: About 180 ft West of B-11
DRILLING METHOD: Hollow Stem Auger
DRILLING DATE: 12/13/2011
DRILL RIG: CME55 Limited Access Track-Mo
DATUM:
AZIMUTH: N/A
COORDINATES: not surveyed

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■		NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)			
					DEPTH (ft)						W _p	W _L		
0	4 1/4-inch inner diameter hollow stem auger with 140 lb wireline safety hammer	0.0 - 4.5 Dense to very dense, gray-brown to brown, heterogeneous, silty fine to coarse SAND, some fine to coarse gravel, coarse-sand-sized coal fragments, trace iron-oxide stained pockets, damp. (SM) (FILL)	SM		755.5 4.5	1	SS	50-19-18	37	1.1 1.5			DOE Well No. BHK 281 Flush-mount monument set in concrete.	
						2	SS	30-18-20	38	0.5 1.5				
5		4.5 - 35.5 Fresh, bedded, orange gray to yellow brown to light gray, fine sand grained, extremely weak (R0), SANDSTONE.	N/A			3	SS	5-6-6	12	0.5 1.5			2-inch diameter, schedule 40, PVC pipe embedded in bentonite chips.	
						4	SS	21-50/6"	>50	0.5 1.0				
10						5	SS	20-50/6"	>50	1.0 1.0				
						6	SS	25-50/6"	>50	1.0 1.0				
15						7	SS	20-50/6"	>50	0.9 1.0				
20						8	SS	37-50/5"	>50	0.9 0.9				

Log continued on next page

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, Inc
DRILLER: C. Askew

LOGGED: A. Dennison
CHECKED: S. Morgan
DATE: 12/16/2011



Groundwater measured 14.32 ft btc after well installed at 16:15 on 12/13/11.

BOREHOLE RECORD 07393074-02.013_P-12_AND_P-13.GPJ GLDR_WA.GDT 6/11/13

RECORD OF BOREHOLE P-12

SHEET 2 of 2
ELEVATION: 760
INCLINATION: -90

PROJECT: Holcim/LowerDisposalArea/WAD DRILLING METHOD: Hollow Stem Auger DATUM:
PROJECT NUMBER: 073-93074-02.013 DRILLING DATE: 12/13/2011 AZIMUTH: N/A
LOCATION: About 180 ft West of B-11 DRILL RIG: CME55 Limited Access Track-Mounted COORDINATES: not surveyed

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
											10	20	30	40		
20	4 1/4-inch inner diameter hollow stem auger with 140 lb wireline safety hammer	4.5 - 35.5 Fresh, bedded, orange gray to yellow brown to light gray, fine sand grained, extremely weak (R0), SANDSTONE. (Continued)	N/A			9	SS	20-30-50	>50	1.3 1.5					>>■	
						9	SS	28-50/6"	>50	1.0 1.0					>>■	
25						10	SS	50/5"	>50	0.4 0.4					>>■	
						11	SS	50/6"	>50	0.5 0.5					>>■	
30						12	SS	50/5"	>50	0.4 0.4					>>■	
						13	SS	50/6"	>50	0.5 0.5					>>■	
35	Boring completed at 35.5 ft.				724.5 35.5	14	SS	50/6"	>50	0.5 0.5					>>■	
40																



1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, Inc
DRILLER: C. Askew

LOGGED: A. Dennison
CHECKED: S. Morgan
DATE: 12/16/2011

Groundwater measured 31.5 ft bgs during drilling at 13:30 on 12/13/11.

BOREHOLE RECORD 07393074-02.013_P-12_AND_P-13.GPJ GLDR_WA.GDT 6/11/13

RECORD OF BOREHOLE P-13

SHEET 1 of 3
ELEVATION: 800
INCLINATION: -90

PROJECT: Holcim/LowerDisposalArea/WA DRILLING METHOD: Hollow Stem Auger DATUM:
PROJECT NUMBER: 073-93074-02.013 DRILLING DATE: 12/12/2011 AZIMUTH: N/A
LOCATION: About 140 ft North of P-12 DRILL RIG: CME55 Limited Access Track-Mob COORDINATES: not surveyed

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					GRAPHIC	
					DEPTH (ft)						W _p ——— W _L						
0	4 1/4-inch inner diameter hollow stem auger with 140 lb wireline safety hammer	0.0 - 4.5 Loose to compact, brown to brown-gray, heterogeneous, silty fine to coarse SAND, some fine to coarse angular to subangular gravel, coarse-sand-sized fragments of coal, trace pockets of iron-oxide staining, damp (SM) (FILL)	SM		795.5 4.5	1	SS	10-13-15	28	0.4 1.5							DOE Well No. BHK 280 Flush-mount monument set in concrete. Groundwater measured 10.56 ft b/c at 10:35 am on 12/13/11.
5		4.5 - 7.0 Loose, brown to dark brown, heterogeneous, silty fine to coarse SAND, some fine to coarse angular to subangular gravel, coarse-sand-sized fragments of coal, trace pockets of iron-oxide staining, damp. (SM) (FILL)	SM		793.0 7.0	3	SS	4-3-3	6	0.8 1.5							
		7.0 - 10.3 Compact, gray-brown, heterogeneous, fine to coarse SAND, little fine to coarse gravel, damp to moist (SM) (FILL)	SM		789.7 10.3	4	SS	3-3-14	17	0.9 1.5							
10		10.3 - 24.0 Slightly weathered, foliated, black, very fine grained, extremely weak (R0), COAL.	N/A			5	SS	5-7-10	17	0.7 1.5							
								6	SS	5-8-10	18	1.3 1.5					
15							7	SS	19-50/3"	>50	0.8 0.8				>>■		
					8	SS	50/4"	>50	0.7 0.3				>>■				
20																	

Log continued on next page

Groundwater measured 10.56 ft btc at 10:35 am on 12/13/11.

BOREHOLE RECORD 07393074-02.013_P-12_AND_P-13.GPJ GLDR_WA.GDT 6/11/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, Inc
DRILLER: C. Askew

LOGGED: A. Dennison
CHECKED: S. Morgan
DATE: 12/16/2011



RECORD OF BOREHOLE P-13

SHEET 2 of 3
ELEVATION: 800
INCLINATION: -90

PROJECT: Holcim/LowerDisposalArea/WAD
PROJECT NUMBER: 073-93074-02.013
LOCATION: About 140 ft North of P-12
DRILLING METHOD: Hollow Stem Auger
DRILLING DATE: 12/12/2011
DRILL RIG: CME55 Limited Access Track-Mo
DATUM: N/A
AZIMUTH: N/A
COORDINATES: not surveyed

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft		NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)			
					DEPTH (ft)						W _p	W _L		
20	4 1/4-inch inner diameter hollow stem auger with 140 lb wireline safety hammer	10.3 - 24.0 Slightly weathered, foliated, black, very fine grained, extremely weak (R0), COAL. (Continued)	N/A		776.0 24.0	9	SS	50/4"	>50	0.3 0.3			2-inch diameter, schedule 40, PVC pipe embedded in bentonite chips.	
						9	SS	30-50/6"	>50	0.8 1.0				
		24.0 - 26.0 Slightly weathered, jointed, gray to light gray, very fine grained, extremely weak to very weak (R0-R1), SILTSTONE, trace coal fragments.	N/A		774.0 26.0	10	SS	50/4"	>50	0.3 0.3				
25														
		26.0 - 31.5 Slightly weathered, foliated, black, very fine grained, extremely weak (R0), COAL.	N/A		768.5 31.5	11	SS	50/5"	>50	0.4 0.4				
			N/A			12	SS	50/4"	>50	0.3 0.3				
30														
		31.5 - 57.9 Slightly weathered, jointed, gray to light gray, very fine grained, extremely weak to very weak (R0-R1), SILTSTONE, trace coal fragments.	N/A			13	SS	50/5"	>50	0.4 0.5				
			N/A			14	SS	50/3"	>50	0.3 0.3				
35														
			N/A			15	SS	50/3"	>50	0.3 0.3				
40		Log continued on next page												

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, Inc
DRILLER: C. Askew

LOGGED: A. Dennison
CHECKED: S. Morgan
DATE: 12/16/2011



BOREHOLE RECORD 07393074-02.013_P-12 AND_P-13.GPJ GLDR_WA.GDT 6/11/13

SHEET 3 of 3
ELEVATION: 800
INCLINATION: -90

PROJECT: Holcim/LowerDisposalArea/WDRILLING METHOD: Hollow Stem Auger DATUM:
PROJECT NUMBER: 073-93074-02-13 DRILLING DATE: 12/12/2011 AZIMUTH: N/A
LOCATION: About 140 ft North of P-12 DRILL RIG: CM55 Limited Access Track-Mount COORDINATES: not surveyed

[illegible]

BOREHOLE RECORD 07393074-02.013 P-12 AND P-13.GPJ GLDR_WA.GDT 6/11/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling, Inc
DRILLER: C. Askew

LOGGED: A. Dennison
CHECKED: S. Morgan
DATE: 12/16/2011



Groundwater measured 49.3 ft bgs at 2:30pm on 12/12/11.

RECORD OF BOREHOLE B-8 HSA

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: S of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/6/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,206.74 E: 126,117.43

ELEVATION: 747
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS					
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40									
					DEPTH (ft)						WATER CONTENT (PERCENT)									
											W _p	W _L	W _u	W _h						
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 15.0 Compact to dense, mottled, medium brown to light gray, heterogeneous, silty fine to medium SAND to SILT with little fine to medium sand, little to some fine subrounded to subangular gravel, scattered cobble/boulder fragments, scattered pockets of light gray to tan fine to medium sand, scattered pockets of fine-grained coal fragments, damp to wet (SM) (FILL-MINE SPOILS) 2.0 12-inch diameter cobble/boulder removed from hole by hand	SM													Flush-mount monument set in concrete with locked well cap 2 in nominal diameter solid schedule 40 PVC pipe set in cement				
5																				
10																				
15		14.0 Lens of slightly cohesive, yellow, fine to medium sand observed			732.0															
		15.0 - 25.0 Very dense, olive brown to medium gray, mottled, non-stratified, fine to coarse SAND and fine to coarse subangular to subrounded GRAVEL, little to some silt, wet (SP-GP) (FILL)	SP-GP		15.0	S-5	CA	24-50/6"	>50	1.0 1.0						>>■	2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill			
		17.5 Organics (twig) observed						S-6	CA	60/2"	>50	0.3 0.2							>>■	
20		Log continued on next page																		

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

RECORD OF BOREHOLE B-8 HSA

SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013
 LOCATION: S of LDA Cover

DRILLING METHOD: Hollow Stem Auger
 DRILLING DATE: 12/6/10
 DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,206.74 E: 126,117.43

ELEVATION: 747
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS			
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40							
					DEPTH (ft)						WATER CONTENT (PERCENT)							
											W _p	W _L	W _p	W _L				
20	Hollow Stem Auger 8-inch Casing Diameter	15.0 - 25.0 Very dense, olive brown to medium gray, mottled, non-stratified, fine to coarse SAND and fine to coarse subangular to subrounded GRAVEL, little to some silt, wet (SP-GP) (FILL) (Continued)	SP-GP		722.0	S-7	CA	50/6"	>50	0.8 0.5					>>■			
																	>>■	
25		25.0 - 35.0 Highly weathered, non-stratified, very light gray (N8) to yellowish gray (5Y 8/1), fine-grained, extremely weak (R0), damp, SANDSTONE (PUGET GROUP)	N/A		25.0	S-9	CA	50/2"	>50	0.0 0.2					>>■			
								S-10	CA	32-50/2"	>50	0.8 0.7						>>■
30								S-11	CA	50/2"	>50	0.6 0.2						>>■
						S-12	CA	50/4"	>50	0.6 0.3					>>■			
35		Boring completed at 35.0 ft.				712.0	S-13	CA	50/4"	>50	0.5 0.3						>>■	
40					35.0													

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011

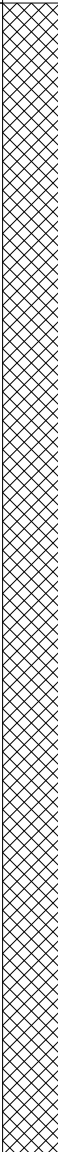


RECORD OF BOREHOLE B-11 HSA

SHEET 1 of 2

PROJECT: Resrve Silica LDA Field Invest
PROJECT NUMBER: 073-93074-02.013 DRILLING METHOD: Hollow Stem Auger
LOCATION: Access Road @ Main Road DRILL RIG: CME 65 Limited Access

DATUM: Local
AZIMUTH: N/A
COORDINATES: N: 1,713,129.98 E: 126,211.03
ELEVATION: 745
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■					NOTES WATER LEVELS				
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40					GRAPHIC				
					DEPTH (ft)						WATER CONTENT (PERCENT)									
											W _p	W _L	W _u	W ₁						
0	Hollow Stem Auger 8-inch Casing Diameter	0.0 - 15.0 Very dense, olive brown to medium gray, mottled, nonstratified, silty fine to medium SAND, little to some fine to coarse subrounded to subangular and faceted gravel, scattered cobble/boulder fragments, contains fragments of intact till incorporated into mine spoils, damp to moist (SM) (FILL-MINE SPOILS)	SM													Flush-mount monument set in concrete with locked well cap 2 in nominal diameter solid schedule 40 PVC pipe set in cement 2 in nominal diameter solid schedule 40 PVC pipe set in bentonite chips 2 in nominal diameter solid schedule 40 PVC pipe set in #2/12 silica sand backfill 2 in nominal diameter 0.020-inch slotted schedule 40 PVC pipe set in #2/12 silica sand backfill #2/12 silica sand backfill Bentonite chip backfill				
5					S-1	CA	50/2"	>50	0.4 0.2											
		7.5 Little coarse sand observed				S-2	CA	50/1"	>50	0.4 0.1										
10						S-3	CA	50/3"	>50	0.4 0.3										
						S-4	CA	50/1"	>50	0.3 0.1										
15					15.0 - 23.0 Highly weathered, non-stratified, mottled, dark yellowish orange (10YR 6/6), fine-grained, extremely weak (R0), damp, SANDSTONE (PUGET GROUP)	N/A		730.0 15.0	S-5A S-5B	CA GRAB	50/6"	>50	0.7 0.5							
											S-6	CA	50/4"	>50	0.5 0.3					
20			Log continued on next page																	

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
DRILLING CONTRACTOR: Cascade Drilling Inc.
DRILLER: S. Stivers

LOGGED: S. Morgan
CHECKED: D. Findley
DATE: 1/12/2011

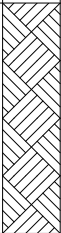


RECORD OF BOREHOLE B-11 HSA

SHEET 2 of 2

PROJECT: Resrve Silica LDA Field Invest
 PROJECT NUMBER: 073-93074-02.013 DRILLING METHOD: Hollow Stem Auger
 LOCATION: Access Road @ Main Road DRILL RIG: CME 65 Limited Access

DATUM: Local
 AZIMUTH: N/A
 COORDINATES: N: 1,713,129.98 E: 126,211.03
 ELEVATION: 745
 INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ■				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	WATER CONTENT (PERCENT)					
					DEPTH (ft)						W _p ——— W _L					
											20	40	60	80		
20		15.0 - 23.0 Highly weathered, non-stratified, mottled, dark yellowish orange (10YR 6/6), fine-grained, extremely weak (R0), damp, SANDSTONE (PUGET GROUP) (Continued)	N/A			S-7	CA	50/5"	>50	0.4 0.4					>>■	 Groundwater measured at 22.31 ft BGS ATD (borehole depth 22.5 ft)
					722.0 23.0	S-9	CA	50/6"	>50	0.3 0.5					>>■	
		Boring completed at 23.0 ft.														
25																
30																
35																
40																

BOREHOLE RECORD 073-93074-02.013 RESERVE SILICA LDA.GPJ GLDR_WA.GDT 6/10/13

1 in to 3 ft
 DRILLING CONTRACTOR: Cascade Drilling Inc.
 DRILLER: S. Stivers

LOGGED: S. Morgan
 CHECKED: D. Findley
 DATE: 1/12/2011



RECORD OF BOREHOLE B-12

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotasonic
 DRILLING DATE: 10/25/2016
 DRILL RIG: DB 360

DATUM: NAD 88
 COORDINATES: N: 126,354 E: 1,353,239

ELEVATION: 758.97
 INCLINATION: -90
 WELL TAG: BKH 464

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

DEPTH (Ft)	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS					
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40				GRAPHIC			
					DEPTH (Ft)						PL MC LL 20 40 60 80							
0	Rotasonic	0.0 - 2.0 FILL - MINE SPOILS, (GP-GM) GRAVEL, fine to coarse, some silt; brown; non-cohesive, moist, loose.			757.0 2.0										Flush Mount Monument			
		2.0 - 4.5 FILL - MINE SPOILS, (SM) SILTY SAND, some gravel, fine; dark brown to brown, thin laminations; non-cohesive, moist, compact.			754.5 4.5											Medium (3/8") Bentonite Seal, 2" Schedule 40 PVC Riser		
5		4.5 - 20.0 FILL - CEMENT KILN DUST, trace wood ash, trace coal fragments; light gray; non-cohesive, dry to moist, dense. 4.5 ft: Odor in core barrel, tested pH ~12 (mixture of DI water and soil)																
10			15 ft: Hole staying open, sample sticking to core barrel															
15																		
20		Boring completed at 20.0 ft.			739.0 20.0													
25																		
30																		
35																		
40																		

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: S. Morgan
 DATE: 11/21/2016



RECORD OF BOREHOLE B-13

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
 DRILLING DATE: 10/25/2016
 DRILL RIG: DB 360

DATUM: NAD 88
 COORDINATES: not surveyed

ELEVATION: 761
 INCLINATION: -90
 WELL TAG:

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30		
					DEPTH (Ft)						PL	MC	LL		

0	Rotosonic	0.0 - 1.5 FILL - MINE SPOILS, (GP) GRAVEL, fine to coarse, some sand; brown, non-cohesive, moist, loose.	GP		759.5												Backfilled with Medium (3/8") Bentonite Chips
		1.5 - 3.0 FILL - MINE SPOILS, (CL) CLAY, some sand, some silt, trace gravel, trace coal fragments; brown; cohesive, moist, stiff.	CL		758.0												
		1.5 ft to 3 ft: Trace shale, coal tailings/fill			3.0												
5		3.0 - 10.0 FILL - CEMENT KILN DUST, some coal fragments; brown, mottled; non-cohesive, moist, dense.															
		3 ft: Trace sandstone (fine grained), brown tailings/fill															
		5 ft: pH ~12 (mixture of DI water and soil)															
10		10.0 - 20.0 FILL - CEMENT KILN DUST, trace coal fragments, trace wood fragments; gray; non-cohesive, moist, dense.			751.0												
					10.0												
15																	
20			Boring completed at 20.0 ft.			741.0											
					20.0												
25																	
30																	
35																	
40																	

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: S. Morgan
 DATE: 11/21/2016



Backfilled with
 Medium (3/8")
 Bentonite
 Chips

RECORD OF BOREHOLE B-14

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension DRILLING METHOD: Rotasonic
PROJECT NUMBER: 1520304-01 DRILLING DATE: 10/25/2016
LOCATION: Access Rd East of LDA DRILL RIG: DB 360

DATUM: NAD 88
COORDINATES: not surveyed

ELEVATION: 767
INCLINATION: -90
WELL TAG:

DEPTH (Ft)	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS			
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40				GRAPHIC	
					DEPTH (Ft)						PL MC LL 20 40 60 80					
0	Rotasonic	0.0 - 1.5 FILL - MINE SPOILS, (SP) SAND, some gravel, fine to coarse; brown to gray; non-cohesive, moist, loose.	SP		765.5											
		1.5 - 4.0 FILL - MINE SPOILS, (SM) SILTY SAND, fine, some gravel, trace coal fragments; brown to gray; non-cohesive, moist, dense.	SM		1.5											
		4.0 - 5.0 FILL - MINE SPOILS, (ML) Sandy SILT, some clay; brown mottled gray; cohesive, m < PL, stiff.	ML		763.0											
5		5.0 - 8.5 FILL - CEMENT KILN DUST, trace clay, trace coal fragments; gray; non-cohesive, moist			762.0											
					5.0											
		8.5 - 11.0 FILL - MINE SPOILS, (SM) SILTY SAND, fine, trace coal fragments; orange-brown mottled gray, fine laminations; non-cohesive, moist, dense.			758.5											
10		11.0 - 20.0 FILL - CEMENT KILN DUST; gray, fine laminations; non-cohesive, moist, dense.			756.0											
					11.0											
15			15 ft to 20 ft: Trace coal fragments, last material in core barrel wet.													
20		Boring completed at 20.0 ft.			747.0											
					20.0											
25																
30																
35																
40																

1 in to 5 ft
DRILLING CONTRACTOR: Cascade Drilling
DRILLER: D. Rider

LOGGED: J. Miller
CHECKED: S. Morgan
DATE: 11/21/2016



Backfilled with
Medium (3/8")
Bentonite
Chips



Depth to water at time of
drilling

Backfilled with
Medium (3/8")
Bentonite
Chips



Depth to water at time of
drilling

1 in to 5 ft
DRILLING CONTRACTOR: Cascade Drilling
DRILLER: D. Rider

LOGGED: J. Miller
CHECKED: S. Morgan
DATE: 11/21/2016



RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0_DATA_TEMPLATE.GDT 4/10/18

RECORD OF BOREHOLE B-15

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension DRILLING METHOD: Rotasonic
PROJECT NUMBER: 1520304-01 DRILLING DATE: 10/25/2016
LOCATION: Access Rd East of LDA DRILL RIG: DB 360

DATUM: NAD 88
COORDINATES: N: 126,528 E: 1,353,232

ELEVATION: 775.83
INCLINATION: -90
WELL TAG: BKH 465

DEPTH (Ft)	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS					
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT								
					DEPTH (Ft)						10	20	30	40				
0	Rotasonic	0.0 - 2.0 FILL - MINE SPOILS, (GP) GRAVEL, fine to coarse, some sand; brownish-gray; non-cohesive, dry, loose.	GP		773.8												Flush Mount Monument Medium (3/8") Bentonite Seal, 2" Schedule 40 PVC Riser 10/20 Silica Sand 0.010-inch Slot Schedule 40 PVC Screen	
		2.0 - 4.0 FILL - MINE SPOILS, (SP) SAND, fine to medium, some gravel, fine; gray to brown; non-cohesive, moist, compact.	SP		771.8													
		4.0 - 5.0 FILL - MINE SPOILS, (ML) Sandy SILT, trace gravel, trace coal fragments; brown, mottled; cohesive, m < PL, very stiff.	ML		770.8													
5		5.0 - 7.0 FILL - MINE SPOILS, (SP) SAND, fine to coarse, trace silt, trace gravel; non-cohesive, moist, loose.	SP		768.8													
		7.0 - 10.0 FILL - MINE SPOILS, (SM) SILTY SAND, fine to medium, trace coal fragments, trace wood fragments; non-cohesive, moist, compact.	SM		765.8													
10		10.0 - 12.0 FILL - MINE SPOILS, (ML) Sandy SILT, trace coal fragments, trace fine gravel; olive gray mottled gray; cohesive, w < PL, stiff.	ML		763.8													
		12.0 - 13.0 FILL - MINE SPOILS, (ML) SILT, some sand, trace gravel; gray; cohesive, w < PL, firm.	ML		762.8													
		13.0 - 14.5 FILL - MINE SPOILS, (ML) Sandy SILT, trace gravel; orange-brown; cohesive, w < PL, firm.	ML		761.3													
15		14.5 - 15.0 FILL - CEMENT KILN DUST; gray; non-cohesive, moist, dense.			760.8													
		Boring completed at 15.0 ft.																
20																		
25																		
30																		
35																		
40																		

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

1 in to 5 ft
DRILLING CONTRACTOR: Cascade Drilling
DRILLER: D. Rider

LOGGED: J. Miller
CHECKED: S. Morgan
DATE: 11/21/2016



RECORD OF BOREHOLE B-16

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension DRILLING METHOD: Rotosonic
PROJECT NUMBER: 1520304-01 DRILLING DATE: 10/26/2016
LOCATION: Access Rd East of LDA DRILL RIG: DB 360

DATUM: NAD 88
COORDINATES: not surveyed

ELEVATION: 781
INCLINATION: -90
WELL TAG:

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES					PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40		
					DEPTH (Ft)						PL	MC	LL			
0	Rotosonic	0.0 - 2.0 FILL - MINE SPOILS, (GP) GRAVEL, fine to coarse, some silt, trace cobble; brown; non-cohesive, moist, loose.	GP		779.0										Backfilled with Medium (3/8") Bentonite Chips	
		2.0 - 5.0 FILL - MINE SPOILS, (SM) SILTY SAND, fine, some gravel, trace coal fragments, trace wood; gray to brown; non-cohesive, moist, compact.	SM		2.0											
5			5.0 - 10.0 FILL - MINE SPOILS, (SM) SILTY SAND, some coal fragments, trace gravel; dark brown mottled black; non-cohesive, moist, compact.	SM		776.0										
			10.0 - 12.0 FILL - MINE SPOILS, (ML) Sandy SILT; dark brown mottled brown, fine laminations; cohesive, m < PL, soft.	ML		771.0										
10			12.0 - 13.0 FILL - MINE SPOILS, (ML) SILTY, trace fine sand; gray, cohesive, moist, very stiff.	ML		769.0										
			13.0 - 15.0 FILL - MINE SPOILS, (SM) SILTY SAND, trace gravel, trace coal fragments; dark gray mottled brown; non-cohesive, moist, compact.	SM		768.0										
15			15.0 - 17.0 FILL - MINE SPOILS, (ML) Sandy SILT, some coal fragments, trace gravel; dark brownish-gray, cohesive, firm.	ML		766.0										
			17.0 - 19.0 FILL - MINE SPOILS, (SP) SAND, some silt, trace gravel, trace coal; orange-brown; non-cohesive, moist	SP		764.0										
20			19.0 - 20.0 FILL - CEMENT KILN DUST, trace coal fragments; gray; non-cohesive, moist	SM		762.0										
			20.0 - 22.0 FILL - MINE SPOILS, (SP-SM) SAND, some silt; brownish gray, musty odor; non-cohesive, wet, loose.	SM		761.0										
25			22.0 - 25.0 FILL - CEMENT KILN DUST, some silt, some sand, trace gravel; gray, finely laminated; non-cohesive, moist.	SM		759.0										
			25.0 - 30.0 FILL - MINE SPOILS, (SM) SILTY SAND, trace gravel; fill debris (brick, asbestos); non-cohesive, moist, compact.	SM		756.0										
30			Boring completed at 30.0 ft.			751.0										
						30.0										
35																
40																

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

1 in to 5 ft
DRILLING CONTRACTOR: Cascade Drilling
DRILLER: D. Rider

LOGGED: J. Miller
CHECKED: S. Morgan
DATE: 11/21/2016



RECORD OF BOREHOLE B-17

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension DRILLING METHOD: Rotosonic
PROJECT NUMBER: 1520304-01 DRILLING DATE: 10/26/2016
LOCATION: Access Rd East of LDA DRILL RIG: DB 360

DATUM: NAD 88
COORDINATES: not surveyed

ELEVATION: 792
INCLINATION: -90
WELL TAG:

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	
					DEPTH (Ft)						PL	MC	LL	
0	Rotosonic	0.0 - 5.0 FILL - MINE SPOILS, (GP) GRAVEL, fine to coarse, some sand, some silt, trace cobbles; brown to gray; non-cohesive, loose.	GP											Backfilled with Medium (3/8") Bentonite Chips
5		5.0 - 7.0 FILL - MINE SPOILS, (SM) SILTY SAND, fine, trace gravel; brown; non-cohesive, moist, loose.	SM		787.0 5.0									
		7.0 - 9.0 FILL - MINE SPOILS, (ML) Sandy SILT, trace gravel; dark brown mottled black; cohesive, firm.	ML		785.0 7.0									
		9.0 - 10.0 FILL - MINE SPOILS, (ML) SILT, trace sand; light gray; cohesive, m < PL, firm.	ML		783.0 9.0									
10		10.0 - 13.0 FILL - MINE SPOILS, (SP-SM) SAND, some silt, trace gravel; brown mottled gray; non-cohesive, compact	SP-SM		782.0 10.0									
		13.0 - 15.0 FILL - MINE SPOILS, (ML) SILT, some clay, trace sand, trace gravel; black to dark brown, finely laminated; cohesive, m < PL, stiff.	ML		779.0 13.0									
15		15.0 - 21.0 FILL - MINE SPOILS, (SM) SILTY SAND, trace gravel; dark brown; non-cohesive, moist, compact.	SM		777.0 15.0									
		15 ft to 20 ft: Water in core barrel above sample												
20		21.0 - 23.0 FILL - MINE SPOILS, (ML) Sandy SILT, some woody debris; brown mottled gray; non-cohesive, moist	ML		771.0 21.0									
		23.0 - 24.0 FILL - MINE SPOILS, (ML) SILT; gray, cohesive, firm.	ML		769.0 23.0									
		24.0 - 25.0 FILL - MINE SPOILS, (ML) SILT; black; cohesive, dry, soft.	ML		768.0 24.0									
25		25.0 - 29.0 (ML) Sandy SILT, trace gravel; reddish-brown, [BEDROCK?]; cohesive, w < PL, soft.	ML		767.0 25.0									
		29.0 - 30.0 (ML) Sandy SILT; gray with black specks, [BEDROCK?]; cohesive, w < PL, soft.	ML		763.0 29.0									
30		29 ft: pH 7 (mixture of DI water and soil) Boring completed at 30.0 ft.			762.0 30.0									

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0_DATA_TEMPLATE.GDT 4/10/18

1 in to 5 ft
DRILLING CONTRACTOR: Cascade Drilling
DRILLER: D. Rider

LOGGED: J. Miller
CHECKED: S. Morgan
DATE: 11/21/2016



RECORD OF BOREHOLE B-19

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
 DRILLING DATE: 10/26/2016
 DRILL RIG: DB 360

DATUM: NAD 88
 COORDINATES: not surveyed

ELEVATION: 760
 INCLINATION: -90
 WELL TAG:

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40	
					DEPTH (Ft)										
0	Rotosonic	0.0 - 2.0 FILL - MINE SPOILS, (ML) Sandy SILT, trace gravel; cohesive, moist, soft.	ML		758.0										
		2.0 - 20.0 FILL - CEMENT KILN DUST, trace coal fragments; gray; non-cohesive, moist, dense.			2.0										
5															
10		10 ft to 15 ft: Putrid odor													
15															
20		Boring completed at 20.0 ft.			740.0 20.0										
25															
30															
35															
40															

Backfilled with
Medium (3/8")
Bentonite
Chips



Depth to water at time of
drilling

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0_DATA_TEMPLATE.GDT 4/10/18

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: S. Morgan
 DATE: 11/21/2016



RECORD OF BOREHOLE B-19A

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
 DRILLING DATE: 10/26/2016
 DRILL RIG: DB 360

DATUM: NAD 88
 COORDINATES: not surveyed

ELEVATION: 760
 INCLINATION: -60
 WELL TAG:

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30	40	
					DEPTH (Ft)										
0	Rotosonic	0.0 - 1.0 FILL - MINE SPOILS, (ML) Sandy SILT; wet.	ML		759.1										
		1.0 - 10.0 FILL - CEMENT KILN DUST, trace coal fragments, trace silt, trace clay; gray; non-cohesive, moist, dense.			1.0										
5															
10		Boring completed at 10.0 ft.			751.3 10.0										
15															
20															
25															
30															
35															
40															

Backfilled with
Medium (3/8")
Bentonite
Chips

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: S. Morgan
 DATE: 11/21/2016



RECORD OF BOREHOLE B-20

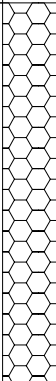
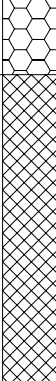
SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
 DRILLING DATE: 10/26/2016
 DRILL RIG: DB 360

DATUM: NAD 88
 COORDINATES: not surveyed

ELEVATION: 775
 INCLINATION: -80
 WELL TAG:

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30			40
					DEPTH (Ft)						PL	MC	LL			
0	Rotosonic	0.0 - 10.0 FILL - MINE SPOILS, (CL) CLAY, some silt, trace sand; brown to dark brown; cohesive, moist. 1" cobble caught in bit	CL													Backfilled with Medium (3/8") Bentonite Chips
5																
10		10.0 - 12.0 FILL - MINE SPOILS, (ML) CLAYEY SILT, trace sand, trace gravel; cohesive, moist, stiff.	ML		765.2 10.0											
15		12.0 - 20.0 FILL - CEMENT KILN DUST; gray; non-cohesive, moist, dense.				763.2 12.0										
20		Boring completed at 20.0 ft.			755.3 20.0											
25																
30																
35																
40																

Backfilled with
Medium (3/8")
Bentonite
Chips

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0_DATA_TEMPLATE.GDT 4/10/18

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: S. Morgan
 DATE: 11/21/2016



RECORD OF BOREHOLE B-21

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
 DRILLING DATE: 12/11/2017
 DRILL RIG: Terrasonic 150

DATUM: NAD 88
 COORDINATES: N: 126,239 E: 1,353,336

ELEVATION: 783.25
 INCLINATION: -90
 WELL TAG: BKH 466

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30		
					DEPTH (Ft)										
0	Rotosonic	0.0 - 1.0 Silty SAND (SM), Fine to Medium Sand, Few 6" Cobbles, Brown, Loose, Moist	SM		782.3									Flush Mount Monument Medium (3/8") Bentonite Seal, 2" Schedule 40 PVC Riser 10/20 Silica Sand 0.010-inch Slot Schedule 40 PVC Screen 11.21' DTW after drilling	
1.0		1.0 - 8.0 Silty SAND (SM), Fine to Medium Sand, Trace Fine to Coarse Gravel, Brown, Compact, Moist	SM												
8.0		8.0 - 13.0 Clayey SAND (SC), Fine to Medium Sand, Some Silt, Trace Fine Gravel, Brown, Compact, Moist -Becomes Wet	SC		775.3										
13.0		13.0 - 20.0 SANDSTONE, Fine-grained with Silt, Weathered, Weak, Orange/Gray Mottled, Dry to Moist, Driller Note: Tough drilling at 13'	Sandstone		770.3										
20.0		Boring completed at 20.0 ft.			763.3										
20.0					20.0										
25															
30															
35															
40															

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: G. Zimmerman
 DATE: 4/5/2018



RECORD OF BOREHOLE B-22

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
 DRILLING DATE: 12/12/2017
 DRILL RIG: Terrasonic 150

DATUM: NAD 88
 COORDINATES: N: 126,280 E: 1,353,344

ELEVATION: 788.36
 INCLINATION: -90
 WELL TAG:

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0_DATA_TEMPLATE.GDT 4/10/18

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30			40
					DEPTH (Ft)						PL	MC	LL			
											20	40	60			80
0	Rotosonic	0.0 - 2.0 Silty SAND (SM), Fine to Coarse Sand, Trace Fine Gravel, Dark Brown, Loose, Moist	SM		786.4											Backfilled with Medium (3/8") Bentonite Chips
		2.0 - 11.0 Silty SAND (SM), Fine Sand, Some Fine to Coarse Gravel, Rounded, Trace Cobbles, Trace Charcoal, Brown, Loose, Moist	SM		2.0											
5																
		- becomes wet			777.4											
		11.0 - 20.0 Fine Grained SANDSTONE, Some Silt, Weathered, Weak, Yellowish Brown, Moist			11.0											
15																
		- reddish-yellow, yellowish-brown, light gray mottled	Sandstone													
20		Boring completed at 20.0 ft.			768.4											
					20.0											
25																
30																
35																
40																

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: G. Zimmerman
 DATE: 4/5/2018



RECORD OF BOREHOLE B-23

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotasonic
 DRILLING DATE: 12/11/2017
 DRILL RIG: Terrasonic 150

DATUM: NAD 88
 COORDINATES: N: 126,387 E: 1,353,381

ELEVATION: 809.41
 INCLINATION: -90
 WELL TAG:

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30		40
					DEPTH (Ft)						PL	MC	LL		
0	Rotasonic	0.0 - 5.0 Silty SAND (SM), Fine to Coarse Sand, Some Fine Gravel, Compact, Dark Brown, Moist	SM		804.4										Backfilled with Medium (3/8") Bentonite Chips
5		5.0 - 10.0 Sandy SILT (ML), Fine to Coarse Sand, Some Fine to Coarse Gravel, Brown, Firm to Stiff, Moist	ML		5.0										
		8.5 - 9.5 - wood fragments			799.4										
10		10.0 - 11.5 Silty SAND (SM), Fine to Medium Sand, Trace Fine Gravel, Roots, Compact, Brown, Gray, Wet	SM		797.9										
		11.5 - 16.0 CLAY (CL), Blocky, Yellowish-Brown/Gray Mottled, Stiff, Dry	CL		11.5										
15		15.0 - 16.0 - increase Sand			793.4										
		16.0 - 19.0 COAL, Weak, Black, Dry	COAL		16.0										
20		19.0 - 21.0 CLAY (CL), Some Coal, Laminated, Yellowish-Brown, Stiff, Dry	CL		790.4										
	21.0 - 25.0 COAL, Weak, Black, Dry	COAL		788.4											
25		Boring completed at 25.0 ft.			784.4										
					25.0										
30															
35															
40															

18 95 DTW after drilling
on 12/12/17

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: G. Zimmerman
 DATE: 4/5/2018



RECORD OF BOREHOLE B-24

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
 DRILLING DATE: 12/11/2017
 DRILL RIG: Terrasonic 150

DATUM: NAD 88
 COORDINATES: N: 126,464 E: 1,353,353

ELEVATION: 810.03
 INCLINATION: -90
 WELL TAG: BKH 467

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40				
					DEPTH (Ft)						PL	MC	LL		
0	Rotosonic	0.0 - 10.0 Silty SAND (SM), Fine to Medium Sand, Some Fine Gravel, Trace Clay, Brown to Dark Brown, Compact, Moist	SM												Flush Mount Monument Medium (3/8") Bentonite Seal, 2" Schedule 40 PVC Riser 10/20 Silica Sand 0.010-inch Slot Schedule 40 PVC Screen 9.9' DTW After well installation
5															
10		-Trace Coal Clasts 10.0 - 12.0 Silty SAND (SM), Fine to Medium Sand, Trace Fine Gravel, Dark Gray, Loose, Moist to Wet	SM		800.0 10.0										
15		12.0 - 15.0 Poorly Graded SAND (SP), Some Silt, Yellowish Brown/Light Gray Mottled, Wet	SP		798.0 12.0										
20		15.0 - 20.0 Fine grained SANDSTONE, Weathered, Yellowish Brown/Light Gray Mottled, Weak, Moist	SS		795.0 15.0										
20		Boring completed at 20.0 ft.			790.0 20.0										
25															
30															
35															
40															

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: G. Zimmerman
 DATE: 4/5/2018



RECORD OF BOREHOLE B-25

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
 PROJECT NUMBER: 1520304-01
 LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotasonic
 DRILLING DATE: 12/11/2017
 DRILL RIG: Terrasonic 150

DATUM: NAD 88
 COORDINATES: N: 126,546 E: 1,353,359

ELEVATION: 807.10
 INCLINATION: -90
 WELL TAG:

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0 DATA_TEMPLATE.GDT 4/10/18

DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10	20	30		40
					DEPTH (Ft)						PL	MC	LL		
0	Rotasonic	0.0 - 3.0 Silty SAND (SM), Fine to Coarse Sand, some Fine Gravel, Dark Gray, Compact, Dry	SM		804.1										Backfilled with Medium (3/8") Bentonite Chips
		3.0 - 7.5 Sandy SILT (ML), some Fine to Coarse Gravel, 7" Cobbles, Dense, Moist	ML		3.0										
5															
		7.5 - 18.0 COAL, Weak, Black, Dry	COAL		799.6										
10															
		- Drilling tough													
15		18.0 - 23.0 SHALE, some Coal, Friable, Weak, Black, Dry	Shale		789.1										
20					18.0										
		23.0 - 25.0 SHALE, some Coal, some Silt, Friable, Laminated, Weak, Black, Dark Gray, Dry	Shale		784.1										
25		Boring completed at 25.0 ft.			782.1										
					25.0										
30															
35															
40															

Backfilled with
Medium (3/8")
Bentonite
Chips

23.6 DTW After Drilling on
12/12/17

1 in to 5 ft
 DRILLING CONTRACTOR: Cascade Drilling
 DRILLER: D. Rider

LOGGED: J. Miller
 CHECKED: G. Zimmerman
 DATE: 4/5/2018



RECORD OF BOREHOLE B-26

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension DRILLING METHOD: Rotosonic
PROJECT NUMBER: 1520304-01 DRILLING DATE: 12/12/2017
LOCATION: Access Rd East of LDA DRILL RIG: Terrasonic 150

DATUM: NAD 88
COORDINATES: N: 126,616 E: 1,353,348

ELEVATION: 804.08
INCLINATION: -90
WELL TAG:

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0_DATA_TEMPLATE.GDT 4/10/18

SOIL PROFILE														SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC	
DEPTH (Ft)	BORING METHOD	DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40												
					DEPTH (Ft)						PL MC LL 20 40 60 80												
0	Rotosonic	0.0 - 2.0 Silty SAND (SM), Fine to Coarse Sand, Trace Gravel, Brown/Black/Gray Mottled, Loose, Moist	SM		802.1																		
		2.0 - 5.0 Poorly Graded SAND with Silt (SP-SM), Fine Sand, Gray to Light Gray, Loose, Moist-Wet	SP-SM		2.0																		
5		5.0 - 8.0 SILT (ML), Fine Laminations, Light Gray, Dry	ML		799.1																		
		7.0 - 8.0 pH 7- 8			796.1																		
		8.0 - 25.0 SILTSTONE, Trace Fine Sand, Laminated, <2mm Coal Beds, Gray, Dark Gray, Very Stiff, Dry			8.0																		
10																							
15			-Increase Shale, Trace Coal, Tight Drilling																				
20			-becomes Hard																				
			-Increase thickness of silt beds																				
25			Boring completed at 25.0 ft.			779.1 25.0																	
30																							
35																							
40																							

Backfilled with
Medium (3/8")
Bentonite
Chips

22.00 DTW after drilling on
12/12/17

1 in to 5 ft
DRILLING CONTRACTOR: Cascade Drilling
DRILLER: D. Rider

LOGGED: J. Miller
CHECKED: G. Zimmerman
DATE: 4/5/2018



RECORD OF BOREHOLE B-27

SHEET 1 of 1

PROJECT: Ravensdale Trench Extension
PROJECT NUMBER: 1520304-01
LOCATION: Access Rd East of LDA

DRILLING METHOD: Rotosonic
DRILLING DATE: 12/12/2017
DRILL RIG: Terrasonic 150

DATUM: NAD 88
COORDINATES: N: 126,342 E: 1,353,360

ELEVATION: 803.64
INCLINATION: -90
WELL TAG: BKH 463

RECORD OF BOREHOLE 15-20304 HOLCIM RAVENSDALE BOREHOLE LOGS.GPJ SPARKLE 1.0_DATA_TEMPLATE.GDT 4/10/18

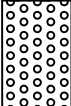
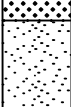
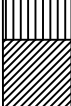
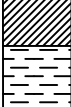
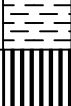
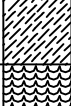
DEPTH (Ft)	BORING METHOD	SOIL PROFILE				SAMPLES				PENETRATION RESISTANCE BLOWS / ft ♦				NOTES WATER LEVELS GRAPHIC		
		DESCRIPTION	USCS	GRAPHIC LOG	ELEV.	NUMBER	TYPE	BLOWS per 6 in 140 lb hammer 30 inch drop	N	REC ATT	10 20 30 40					
					DEPTH (Ft)						PL MC LL					
											20 40 60 80					
0	Rotosonic	0.0 - 17.0 Silty SAND (SM), Fine to Coarse Sand, Trace Fine Gravel, Trace Wood Fragments, Trace Shale, Dark Brown/Yellow Brown Mottled, Loose, Moist (Fill)	SM												Flush Mount Monument	
5		-Trace Coal													Medium (3/8") Bentonite Seal, 2" Schedule 40 PVC Riser	
10																
15																
17.0		17.0 - 22.0 Poorly Graded SAND (SP), Fine Sand, Trace Silt, Compact, Yellowish Brown, Wet	SP		786.6 17.0											
20																
22.0		22.0 - 25.0 Fine Grained SANDSTONE, Weak, Yellowish Brown, Dry	Sandstone		781.6 22.0											
25		Boring completed at 25.0 ft.					778.6 25.0									
30																
35																
40																

14.03' DTW After well
Installation 12/13/17

1 in to 5 ft
DRILLING CONTRACTOR: Cascade Drilling
DRILLER: D. Rider

LOGGED: J. Miller
CHECKED: G. Zimmerman
DATE: 4/5/2018



Coarse-Grained Soils - More than 50% ⁽¹⁾ Retained on No. 200 Sieve		Gravels - More than 50% ⁽¹⁾ of Coarse Fraction Retained on No. 4 Sieve		GW	Well-graded gravel and gravel with sand, little to no fines
		Gravels - More than 50% ⁽¹⁾ of Coarse Fraction Retained on No. 4 Sieve		GP	Poorly-graded gravel and gravel with sand, little to no fines
		Gravels - More than 50% ⁽¹⁾ of Coarse Fraction Retained on No. 4 Sieve		GM	Silty gravel and silty gravel with sand
		Gravels - More than 50% ⁽¹⁾ of Coarse Fraction Retained on No. 4 Sieve		GC	Clayey gravel and clayey gravel with sand
		Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve		SW	Well-graded sand and sand with gravel, little to no fines
		Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve		SP	Poorly-graded sand and sand with gravel, little to no fines
		Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve		SM	Silty sand and silty sand with gravel
		Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve		SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% ⁽¹⁾ or More Passes No. 200 Sieve		Silt and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
				CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
				OL	Organic clay or silt of low plasticity
		Silt and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
				CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
				OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils				PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency		
Coarse-Grained Soils	Density	SPT ⁽²⁾ blows/foot
	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50
Fine-Grained Soils	Consistency	SPT ⁽²⁾ blows/foot
	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Component Definitions	
Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

⁽³⁾ Estimated Percentage	
Percentage by Weight	Modifier
<5	Trace
5 to 15	Slightly (sandy, silty, clayey, gravelly)
15 to 30	Sandy, silty, clayey, gravelly
30 to 49	Very (sandy, silty, clayey, gravelly)

Moisture Content	
Dry - Absence of moisture, dusty, dry to the touch	
Slightly Moist - Perceptible moisture	
Moist - Damp but no visible water	
Very Moist - Water visible but not free draining	
Wet - Visible free water, usually from below water table	

Symbols	
Blows/6" or portion of 6" 10 15 20 2.0" OD Split-Spoon Sampler (SPT) Bulk sample Grab Sample Portion not recovered	Sampler Type Description Continuous Push Non-Standard Sampler 3.0" OD Thin-Wall Tube Sampler (including Shelby tube)

(1) Percentage by dry weight (2) (SPT) Standard Penetration Test (ASTM D-1586) (3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488) (4) Depth of groundwater ATD = At time of drilling Static water level (date)	⁽⁵⁾ Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488) BGS = below ground surface
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Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.



Reserve Silica--Ravensdale - 160315

Environmental Exploration Log

Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road;
E side of road

Coordinates (est)

Exploration Number

E:1352855 N:127898 (est)

AB-05

Contractor

Equipment

Sampling Method

Ground Surface (GS) Elev. (NAVD88)

Holocene Drilling

Rotary drill rig

Autohammer; 140 lb hammer; 30" drop

702.6296'(est)

Operator

Exploration Method(s)
8.5-in OD Hollow-stem
Auger

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Keven Doyle

5/15/2017

NA

6' (ATD)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
700					PID= 0.2 Blows (non-SPT)= 27,39,20 Sheen= Slight		FILL Dense, moist, brown, slightly silty SAND (SW-SM); fine to coarse gravel, medium to coarse sand, with brick fragments, slight odor of mothballs	
					PID= 0.0 SPT= 6,6,6 Sheen= None			
					PID= 4.4 Blows (non-SPT)= 3,5,9 Sheen= Slight		Bits of charcoal; no more coarse gravel	
5					PID= 0.1 SPT= 11,6,7 Sheen= None		Dense, moist, brown, gravelly silty SAND (SM); subrounded gravel	5
		5/15/2017			PID= 0.1 Blows (non-SPT)= 9,12,19 Sheen= None		Dense, moist, brown, gravelly, sandy SILT (ML); pockets of iron-oxide weathering	
					Blows (non-SPT)= 50/6"		Hard, wet, brown-gray, slightly gravelly silty SAND (SM); fine to medium sand	
695		Backfilled with hydrated bentonite chips						
10			AB-05-9.0	Total Pb, Total As, SPLP Pb, SPLP As	PID= 0.1 Blows (non-SPT)= 47,50/3" Sheen= None PID= 0.1 SPT= 50/4"		Dense, wet to moist, brown, gravelly, sandy SILT (ML)	10
							Bottom of exploration at 10.5 ft. bgs.	
							Note: Refusal on bedrock or concrete at 10.5' bgs	
690								
15								15
685								
20								20
680								

Legend

- ☐ No Soil Sample Recovery
- ☒ Split Barrel 3" X 2.375" (Mod Cal)
- ☒ Split Barrel 2" X 1.375" (SPT)

Water Level

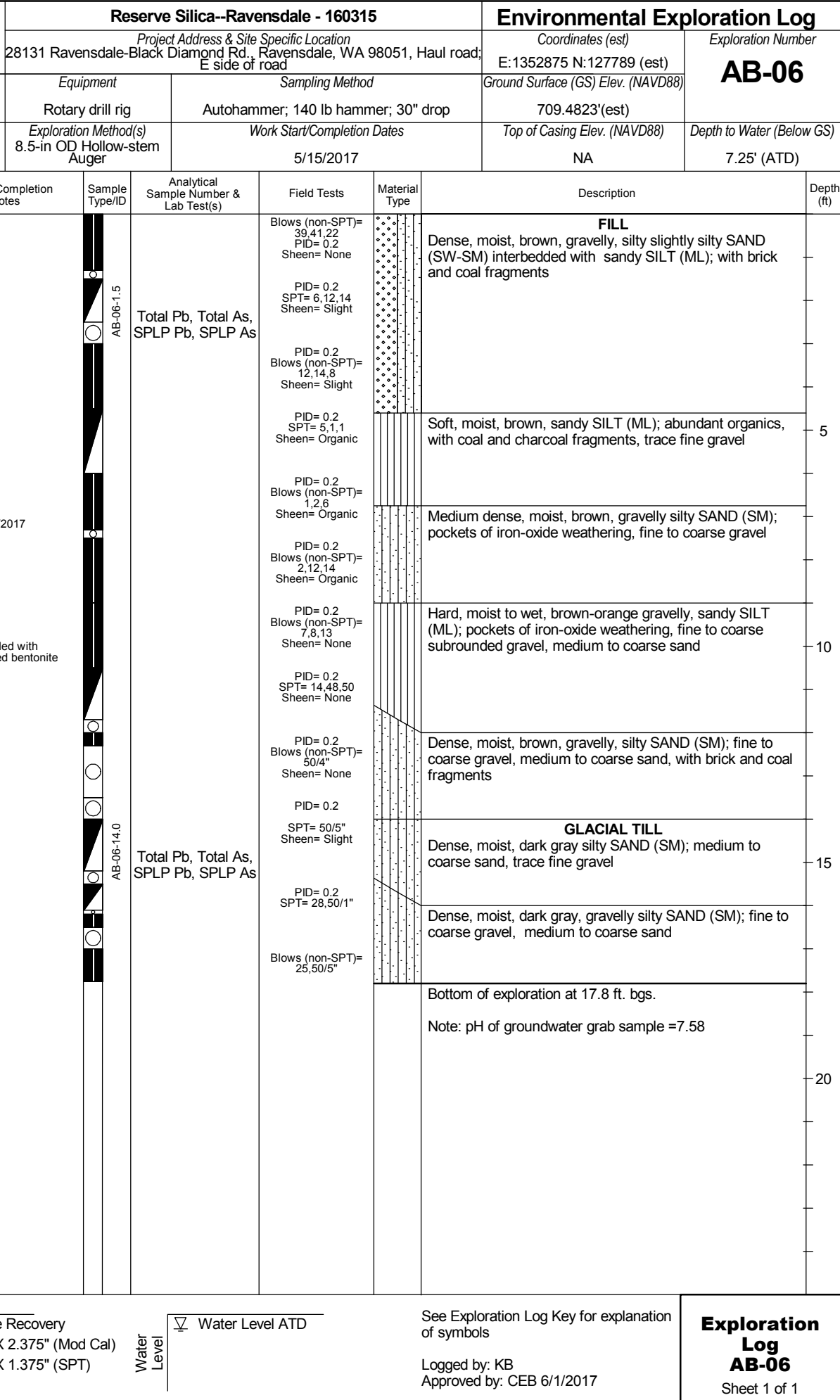
▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

Exploration Log
AB-05

Sheet 1 of 1





Reserve Silica--Ravensdale - 160315

Environmental Exploration Log

Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road;
E side of road

Coordinates (est)
E:1352896 N:127651 (est)

Exploration Number

AB-07

Contractor
Holocene Drilling

Equipment
Rotary drill rig

Sampling Method
Autohammer; 140 lb hammer; 30" drop

Ground Surface (GS) Elev. (NAVD88)
717.6884'(est)

Operator
Keven Doyle

Exploration Method(s)
8.5-in OD Hollow-stem
Auger

Work Start/Completion Dates
5/15/2017

Top of Casing Elev. (NAVD88)
NA

Depth to Water (Below GS)
11.5' (ATD)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
715			AB-07-1.5	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 38,22,29 PID= 0.1 Sheen= None SPT= 26,11,6 PID= 0.2 Sheen= None		FILL Dense, moist, brown, gravelly slightly silty SAND (SW-SM); fine to coarse gravel, some cement kiln dust, fine gravel-sized slag	
5					Blows (non-SPT)= 9,11,8 PID= 0.2 Sheen= None SPT= 2,3,3 PID= 0.2 Sheen= None		Medium dense, moist, orange-yellow, slightly silty SAND (SP); charcoal fragments, medium to coarse sand	5
710					Blows (non-SPT)= 3,5,6 PID= 0.2 Sheen= None Blows (non-SPT)= 2,3,4 PID= 0.2 Sheen= None		Contains some coarse, subrounded gravel	
10		Backfilled with hydrated bentonite chips 5/15/2017			SPT= 2,3,5 PID= 0.2 Sheen= None SPT= 1,2,3 PID= 0.2 Sheen= None		Interbedded coarse white sand	10
705					SPT= 4,3,4 PID= 0.2 Sheen= None Blows (non-SPT)= 5,9,18 PID= 0.2 Sheen= None		Abundant woody debris Soft, moist, green-brown, slightly gravelly, silty SAND (SM); subrounded, fine gravel	
15					PID= 0.2 Sheen= None Blows (non-SPT)= 9,18,32		Dense, moist, orange-brown, sandy SILT (ML); pockets of iron-oxide weathering, coal fragments	15
700							Bottom of exploration at 18 ft. bgs. Note: pH of groundwater grab sample =6.79	
20								20
695								

Legend

- No Soil Sample Recovery
- Split Barrel 3" X 2.375" (Mod Cal)
- Split Barrel 2" X 1.375" (SPT)

Water Level

Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

Exploration Log
AB-07

Sheet 1 of 1



Reserve Silica--Ravensdale - 160315

Environmental Exploration Log

Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road;
W side of road

Coordinates (est)
E:1352874 N:127517 (est)
Ground Surface (GS) Elev. (NAVD88)
723.6216'(est)

Exploration Number
AB-08

Contractor
Holocene Drilling

Equipment
Rotary drill rig

Sampling Method
Autohammer; 140 lb hammer; 30" drop

Operator
Keven Doyle

Exploration Method(s)
8.5-in OD Hollow-stem
Auger

Work Start/Completion Dates
5/15/2017

Top of Casing Elev. (NAVD88)
NA

Depth to Water (Below GS)
No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
720			AB-08-1.5	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 15, 17, 15 PID= 0.2 Sheen= None SPT= 10, 9, 6 PID= 0.2 Sheen= None SPT= 5, 5, 5 PID= 0.2 Sheen= None		FILL Dense, moist, brown, gravelly, slightly silty SAND (SW-SM); fine to coarse gravel, fine, medium, and coarse sand, gravel-sized slag fragments Medium dense, moist, orange-beige slightly silty SAND (SP); medium to coarse sand, trace fine gravel, trace woody debris and coal fragments	5
715			AB-08-7.5	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 5, 5, 5 PID= 0.2 Sheen= None Blows (non-SPT)= 6, 8, 9 PID= 0.2 Sheen= None SPT= 2, 3, 4 PID= 0.2 Sheen= None SPT= 2, 3, 3 PID= 0.2 Sheen= None		Medium dense, moist, orange-brown silty SAND (SM); abundant coal fragments Medium dense, moist, orange-beige slightly silty SAND (SP); medium to coarse sand, trace fine gravel, trace woody debris and coal fragments	10
710			AB-08-11.5		Blows (non-SPT)= 4, 4, 4 PID= 0.2 Sheen= None SPT= 3, 3, 2 PID= 0.2 Sheen= None SPT= 2, 2, 2 PID= 0.2 Sheen= None		Medium dense, moist, green-brown silty SAND (SM); abundant woody debris, coal fragments, and brick fragments	15
705			AB-08-18.0		Blows (non-SPT)= 3, 4, 4 PID= 0.2 Sheen= None SPT= 3, 3, 4 PID= 0.2 Sheen= None PID= 0.2 Sheen= Organic		Abundant coal fragments Becomes more organic-rich	20
700							Bottom of exploration at 19.5 ft. bgs.	

Legend

- ☐ No Soil Sample Recovery
- ☒ Split Barrel 3" X 2.375" (Mod Cal)
- ☒ Split Barrel 2" X 1.375" (SPT)

Water Level

No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

Exploration Log
AB-08

Sheet 1 of 1

**Reserve Silica--Ravensdale - 160315****Environmental Exploration Log**Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road;
center of road

Coordinates (est)

E:1352887 N:127413 (est)

Exploration Number

AB-09

Contractor

Holocene Drilling

Equipment

Rotary drill rig

Sampling Method

Autohammer; 140 lb hammer; 30" drop

Ground Surface (GS) Elev. (NAVD88)

724.8403'(est)

Operator

Keven Doyle

Exploration Method(s)

8.5-in OD Hollow-stem
Auger

Work Start/Completion Dates

5/16/2017

Top of Casing Elev. (NAVD88)

NA

Depth to Water (Below GS)

12.25' (ATD)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
5	720		AB-09-1.0	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 48,28,27 PID= 0.1 Sheen= None SPT= 16,11,17 PID= 0.3 Sheen= None		FILL Dense, moist, gray-brown, silty, sandy slightly silty GRAVEL (GP-GM); fine to coarse gravel, medium to coarse sand Dense, moist, orange, slightly silty, gravelly SAND (SW); fine to coarse gravel, fine gravel-sized slag, medium to coarse sand	
			AB-09-3.0		Blows (non-SPT)= 5,7,11 PID= 30.7 Sheen= Slight			
			AB-09-5.0	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 19,27,27 PID= 0.5 Sheen= None Blows (non-SPT)= 10,11,5 PID= 0.4 Sheen= None SPT= 4,4,4 PID= 0.4 Sheen= None SPT= 8,9,10 PID= 0.4 Sheen= None		Loose, moist, white SAND (SP); coarse sand, strong odor of mothballs, coal fragments Dense, moist, gray-brown sandy, silty GRAVEL (GM) interbedded with loose, moist, orange and white SAND (SP); coal fragments Loose, moist, yellow-gray silty SAND (SM); medium to coarse sand Interbeds of white coarse sand, small bits of coal	5
10	715	Backfilled with hydrated bentonite chips			Blows (non-SPT)= 5,6,9 PID= 0.4 Sheen= None SPT= 2,2,2 PID= 0.3 Sheen= None SPT= 1,1,1 PID= 0.3 Sheen= None		Loose, wet, yellow-brown silty SAND (SM) interbedded with medium dense, wet, yellow, organic-rich SAND (SP); fine to medium sand, coal fragments and wood debris, exhibits rapid dilatancy	
15	710	5/15/2017			Blows (non-SPT)= 1,1,1 PID= 0.3 Sheen= None SPT= 1,1,1 PID= 0.3 Sheen= None		QUATERNARY WETLAND Very soft, wet, brown silty SAND (SM); organic-rich, fine to medium sand	15
20	705		AB-09-18.0		SPT= 1,1,2 PID= 0.3 Sheen= None		Very soft, wet, brown PEAT (PT); fine to medium sand Bottom of exploration at 19.5 ft. bgs.	20
700								

Legend

- ☐ No Soil Sample Recovery
- ☒ Split Barrel 3" X 2.375" (Mod Cal)
- ☒ Split Barrel 2" X 1.375" (SPT)
- ☒ Split Barrel 3.25" X 2.375" (D&M)

Water
Level

▽ Water Level ATD

See Exploration Log Key for explanation
of symbolsLogged by: KB
Approved by: CEB 6/1/2017**Exploration
Log
AB-09**

Sheet 1 of 1

**Reserve Silica--Ravensdale - 160315****Environmental Exploration Log**Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road;
center E of road

Coordinates (est)

E:1352892 N:127284 (est)

Exploration Number

AB-10

Contractor

Holocene Drilling

Equipment

Rotary drill rig

Sampling Method

Autohammer; 140 lb hammer; 30" drop

Ground Surface (GS) Elev. (NAVD88)

731.2477'(est)

Operator

Keven Doyle

Exploration Method(s)

8.5-in OD Hollow-stem
Auger

Work Start/Completion Dates

5/16/2017

Top of Casing Elev. (NAVD88)

NA

Depth to Water (Below GS)

9' (ATD)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
730					Blows (non-SPT)= 48,42,47 PID= 0.3 Sheen= None		FILL Dense, moist, gray, gravelly, silty slightly silty SAND (SW-SM); gravel-sized slag fragments	
					SPT= 12,10,9 PID= 0.3 Sheen= None		Medium dense, moist, orange, gravelly, silty SAND (SP) interbedded with white SAND (SP); fine to coarse gravel, with sandstone gravel	
5					Blows (non-SPT)= 5,5,9 PID= 0.3 Sheen= Slight			
					Blows (non-SPT)= 6,6,7 PID= 3.3 Sheen= Slight			
725					Blows (non-SPT)= 4,6,7 PID= 0.3 Sheen= None			
					SPT= 3,2,3 PID= 0.4 Sheen= Slight			
10					Blows (non-SPT)= 2,3,2 PID= 0.4 Sheen= None		Medium dense, moist, gray, slightly gravelly silty SAND (SM); abundant coal fragments, fine, medium, and coarse sand, fining downward	
					SPT= 2,3,5 PID= 0.4 Sheen= None			
720					Blows (non-SPT)= 9,8,12 PID= 0.4 Sheen= None		Medium dense, moist, gray SAND (SP); clean with coal fragments	
					Blows (non-SPT)= 4,10,12 PID= 0.4 Sheen= None		Medium dense, moist, gray, slightly gravelly silty SAND (SM); abundant coal fragments, fine, medium, and coarse sand, fining downward	
15					SPT= 12,11,11 PID= 0.4 Sheen= None		Dense, moist, orange-beige, silty SAND (SM) interbedded with white SAND (SP); coal fragments, medium to coarse sand	
					Blows (non-SPT)= 8,10,11 PID= 0.4 Sheen= None		Brick and coal fragments	
					Blows (non-SPT)= 2,5,6 PID= 0.4 Sheen= None			
20							Bottom of exploration at 19.5 ft. bgs.	
710								

Legend

- ☐ No Soil Sample Recovery
☐ Split Barrel 3" X 2.375" (Mod Cal)
☐ Split Barrel 2" X 1.375" (SPT)
☐ Split Barrel 3.25" X 2.375" (D&M)

Water
Level

▽ Water Level ATD

See Exploration Log Key for explanation
of symbolsLogged by: KB
Approved by: CEB 6/1/2017**Exploration
Log
AB-10**

Sheet 1 of 1



Reserve Silica--Ravensdale - 160315

Environmental Exploration Log

Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road;
center W of road

Coordinates (est)
E:1352881 N:127169 (est)
Ground Surface (GS) Elev. (NAVD88)
731.1889'(est)

Exploration Number

AB-11

Contractor
Holocene Drilling

Equipment
Rotary drill rig

Sampling Method
Autohammer; 140 lb hammer; 30" drop

Operator

Keven Doyle

Exploration Method(s)
8.5-in OD Hollow-stem
Auger

Work Start/Completion Dates

5/16/2017

Top of Casing Elev. (NAVD88)

NA

Depth to Water (Below GS)

19' (Static)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
730			AB-11-1.5	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 32,36,27 PID= 0.3 Sheen= None		FILL Dense, moist, gray-brown, silty, sandy GRAVEL (GW); includes coarse gravel-sized slag, mixed with coal fragments and some orange sand	
					Blows (non-SPT)= 14,12,8 PID= 0.3 Sheen= None		Medium dense, moist, orange slightly silty SAND (SP) interbedded with white SAND (SP); trace fine gravel, medium to coarse sand	
					Blows (non-SPT)= 7,7,4 PID= 0.3 Sheen= Organic		Soft, moist, black, silty SAND (SM); primarily coal fragments, trace fine gravel	
5			AB-11-5.0	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 42,22,27 PID= 0.3 Sheen= Organic		Dense, moist, gray-black silty SAND (SM) interbedded with orange SAND (SP); mixture of slag fragments and coal fragments	5
725					Blows (non-SPT)= 6,8,9 PID= 0.3 Sheen= None		Medium dense, moist, orange, slightly silty SAND (SP) interbedded with white SAND (SP); coal fragments	
					Blows (non-SPT)= 9,7,22 PID= 0.3 Sheen= None		Interbedded white sand up to 4" thick Interbedded coal up to 6" thick	
10		Backfilled with hydrated bentonite chips	AB-11-10.0		Blows (non-SPT)= 48,42,12 PID= 0.3 Sheen= None		Interbedded cement kiln dust up to 4" thick	10
720					Blows (non-SPT)= 15,13,10 PID= 0.3 Sheen= None			
					Blows (non-SPT)= 1,2,2 PID= 0.3 Sheen= None			
15			AB-11-15.0	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 4,9,16 PID= 0.3 Sheen= Organic		Medium dense, moist, orange SAND (SP) interbedded with gray SILT (ML); trace coarse gravel, coal fragments	15
715					Blows (non-SPT)= 9,16,12 PID= 0.3 Sheen= None			
					Blows (non-SPT)= 8,12,10 PID= 0.3 Sheen= None			
			AB-11-18.0		Blows (non-SPT)= 4,7,10 PID= 0.3 Sheen= None			
20		▼ 5/15/2017					Bottom of exploration at 19.5 ft. bgs. Note: pH of groundwater grab sample =12.67	20
710								

Legend

- No Soil Sample Recovery
- Split Barrel 3" X 2.375" (Mod Cal)
- Split Barrel 2" X 1.375" (SPT)
- Split Barrel 3.25" X 2.375" (D&M)

Water Level

▼ Static Water Level

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

Exploration Log
AB-11

Sheet 1 of 1



Reserve Silica--Ravensdale - 160315

Environmental Exploration Log

Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Haul road;
W side of road by pullout

Coordinates (est)
E:1352878 N:127048 (est)
Ground Surface (GS) Elev. (NAVD88)
741.7656'(est)

Exploration Number
AB-12

Contractor
Holocene Drilling

Equipment
Rotary drill rig

Sampling Method
Autohammer; 140 lb hammer; 30" drop

Operator
Keven Doyle

Exploration Method(s)
8.5-in OD Hollow-stem
Auger

Work Start/Completion Dates
5/16/2017

Top of Casing Elev. (NAVD88)
NA

Depth to Water (Below GS)
No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
740			AB-12-1.0	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 48,39,28 PID= 0.4 Sheen= None SPT= 13,11,11 PID= 0.4 Sheen= None SPT= 6,10,6 PID= 0.4 Sheen= None		FILL Dense, moist, brown slightly silty GRAVEL (GP-GM) Dense, moist, black, silty SAND (SM); contains bits of slag, coal, and sandstone Soft, dry, white Fill; cement kiln dust Dense, moist, black, silty SAND (SM); contains bits of slag, coal, and sandstone	
5			AB-12-5.0	Total Pb, Total As, SPLP Pb, SPLP As	Blows (non-SPT)= 2,6,10 PID= 0.4 Sheen= None SPT= 3,6,10 PID= 0.4 Sheen= None SPT= 2,4,5 PID= 0.4 Sheen= None		Medium dense, moist, orange, slightly silty SAND (SP) interbedded with coarse, white SAND (SP); bits of coal Some interbeds of gray, silty sand with wood fragments	5
735			AB-12-10.0		Blows (non-SPT)= 9,7,10 PID= 0.4 Sheen= Organic		Loose, moist, brownish-black WOODY DEBRIS Fill	10
10		Backfilled with hydrated bentonite chips	AB-12-13.0		Blows (non-SPT)= 5,10,13 PID= 0.4 Sheen= Organic SPT= 3,5,6 PID= 0.4 Sheen= Organic			
730			AB-12-18.0		Blows (non-SPT)= 9,9,12 PID= 2.1 Sheen= Organic SPT= 6,6,5 PID= 8.4 Sheen= Organic SPT= 4,5,6 PID= 4.8 Sheen= Organic			15
15					Blows (non-SPT)= 5,6,5 PID= 9.1 Sheen= Organic			
725								
20							Bottom of exploration at 19.5 ft. bgs.	20
720								

Legend

- ☐ No Soil Sample Recovery
- ☒ Split Barrel 3" X 2.375" (Mod Cal)
- ☒ Split Barrel 2" X 1.375" (SPT)
- ☒ Split Barrel 3.25" X 2.375" (D&M)

Water Level

No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by: CEB 6/1/2017

Exploration Log
AB-12

Sheet 1 of 1

		Reserve Silica--Ravensdale - 160315				Excavation Log			
		<i>Project Address & Site Specific Location</i> 28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, Near haul road				<i>Coordinates (Lat,Lon WGS84)</i> 47.342, -121.993 (est)		<i>Exploration Number</i> ATP-1	
<i>Contractor</i> N/A		<i>Equipment</i> Excavator		<i>Sampling Method</i> Grab		<i>Ground Surface (GS) Elev.</i> NA		ATP-1	
<i>Operator</i> Dean		<i>Exploration Method(s)</i> Test Pit		<i>Work Start/Completion Dates</i> 4/5/2018		<i>Top of Casing Elev.</i> NA			
Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description		Depth (ft)
1		 Backfilled with spoils		ATP-1-Slag High pH Leachable Pb, As, Fe, Mn			FILL Moist, gray, gravelly, silty SAND (SM); fine to medium sand, fine gravel.		1
2							Increased slag fragments between 1 and 3 feet bgs.		2
3							Bottom of exploration at 3 ft. bgs. Note: Test pit terminated at refusal.		3
4									4

Legend
 Grab sample



No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: KB
Approved by:

Exploration Log ATP-1
Sheet 1 of 1

**Reserve Silica--Ravensdale - 160315****Excavation Log**

Project Address & Site Specific Location
28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, W side of
haul road near bascourse pile

Coordinates (Lat,Lon WGS84)

47.344, -121.993 (est)

Exploration Number

ATP-2

Contractor

N/A

Equipment

Excavator

Sampling Method

Grab

Ground Surface (GS) Elev.

NA

Operator

Dean

Exploration Method(s)

Test Pit

Work Start/Completion Dates

4/5/2018

Top of Casing Elev.

NA

Depth to Water (Below GS)

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description	Depth (ft)
1		Backfilled with spoils					FILL Moist, gray, sandy GRAVEL (GP); fine to coarse sand, fine angular gravel; (road basecourse).	1
2							Moist, yellow-orange, silty SAND (SM); fine to coarse sand, with charcoal and slag fragments.	2
3								3
4								4
5				ATP-2-Slag High pH Leachable Pb, As			Moist, gray, Fill; bricks, concrete, plastic debris.	5
							Bottom of exploration at 5.5 ft. bgs.	

Legend

 Grab sample

Water
Level

No Water Encountered

See Exploration Log Key for explanation
of symbols

Logged by: KB
Approved by:

**Exploration
Log
ATP-2**

Sheet 1 of 1

		Reserve Silica--Ravensdale - 160315				Excavation Log			
		<i>Project Address & Site Specific Location</i> 28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, E side of haul road				<i>Coordinates (Lat,Lon WGS84)</i> 47.343, -121.993 (est)		<i>Exploration Number</i> ATP-3	
<i>Contractor</i> N/A		<i>Equipment</i> Excavator		<i>Sampling Method</i> Grab		<i>Ground Surface (GS) Elev.</i> NA		ATP-3	
<i>Operator</i> Dean		<i>Exploration Method(s)</i> Test Pit		<i>Work Start/Completion Dates</i> 4/5/2018		<i>Top of Casing Elev.</i> NA			
Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description		Depth (ft)
1		 Backfilled with spoils					FILL Moist, gray, sandy GRAVEL (GP); fine to coarse sand, fine angular gravel, (road basecourse).		1
							Moist, yellow-orange, silty SAND (SM); fine to coarse sand, with charcoal and slag fragments.		2
2				ATP-3-Slag High pH Leachable Pb, As, Fe, Mn					3
3									4
4						Bottom of exploration at 4 ft. bgs.			4

Legend

 Grab sample

Water Level

No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: KB

Approved by:

Exploration Log

ATP-3

Sheet 1 of 1

OLD STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\RESERVE SILICA- 160315.GPJ March 28, 2019

		Reserve Silica--Ravensdale - 160315				Excavation Log				
		<i>Project Address & Site Specific Location</i> 28131 Ravensdale-Black Diamond Rd., Ravensdale, WA 98051, West side of haul road				<i>Coordinates (Lat,Lon WGS84)</i> 47.343, -121.993 (est)		<i>Exploration Number</i> ATP-4		
<i>Contractor</i> N/A		<i>Equipment</i> Excavator		<i>Sampling Method</i> Grab		<i>Ground Surface (GS) Elev.</i> NA		ATP-4		
<i>Operator</i> Dean		<i>Exploration Method(s)</i> Test Pit		<i>Work Start/Completion Dates</i> 4/5/2018		<i>Top of Casing Elev.</i> NA				
Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Analytical Sample Number & Lab Test(s)	Field Tests	Material Type	Description		Depth (ft)	
1		 Backfilled with spoils		ATP-4-Slag High pH Leachable Pb, As			FILL Moist, gray, gravelly, silty SAND (SM); fine to medium sand, fine gravel.		1	
2								Slag fragments between 1 and 3 feet bgs.		2
3								Bottom of exploration at 3 ft. bgs. Note: Test pit terminated at refusal.		3
4									4	

Legend

 Grab sample

Water Level

No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: KB

Approved by:

Exploration Log

ATP-4

Sheet 1 of 1

Sheet 1 of 2

ELEVATION: 739.9 ft (Ground)
COORDINATES: N: 127080.1 ft E: 1352891.6 ft
COORD SYS: SP WA North FIPS 4601 Ft
HORIZ DATUM: NAD83
HOLE LOC: East of MWB-2LDA on Haul Road

[illegible]

Continued on Next Page

HAMMER TYPE:

REV:

LOGGED: T. Dogget
CHECKED: J. Johnson

DATE: Sep 22, 2021
DATE: Sep 29, 2021

Sheet 2 of 2

CLIENT:	Holcim Inc	DATE:	September 22, 2021	ELEVATION:	739.9 ft (Ground)
PROJECT:	Ravensdale RI Drilling			COORDINATES:	N: 127080.1 ft E: 1352891.6 ft
PROJECT NO:	152030402	INCLINATION:	90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Ravensdale, WA	CONTRACTOR:	Cascade	HORZ DATUM:	NAD83
				HOLE LOC:	East of MWB-2LDA on Haul Road

[illegible]

HAMMER TYPE:

REV:

LOGGED: T. Dogget

DATE: Sep 22, 2021

CHECKED: J. Johnson

DATE: Sep 29, 2021

RECORD OF BOREHOLE: MW-7A

Sheet 1 of 1

CLIENT: Holcim Inc

PROJECT: Ravensdale RI Drilling

PROJECT NO: 152030402

LOCATION: Ravensdale, WA

DATE: September 22, 2021

INCLINATION: 90.0°

CONTRACTOR: Cascade

ELEVATION: 592.2 ft (Ground)

COORDINATES: N: 128440.2 ft E: 1352282.3 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: North of Infiltration Pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT					GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30-in drop					H Plastic & Liquid Limits (%) O Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	ORGANIC CONTENT %	PENETRATION RESISTANCE BLOWS/FT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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1	100cc Compact Crawler Sonic		Vegetated topsoil.			0.0	1	SC	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

RECORD OF BOREHOLE: MW-8A

Sheet 1 of 2

CLIENT: Holcim Inc

PROJECT: Ravensdale RI Drilling

PROJECT NO: 152030402

LOCATION: Ravensdale, WA

DATE: September 22, 2021

INCLINATION: 90.0°

CONTRACTOR: Cascade

ELEVATION: 601.1 ft (Ground)

COORDINATES: N: 128207.1 ft E: 1352128.9 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Northwest of Infiltration Pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT					GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30-in drop					H Plastic & Liquid Limits (%) O Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES	ORGANIC CONTENT %	PENETRATION RESISTANCE BLOWS/FT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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1	100cc Compact Crawler Sonic		Topsoil; roots. - 0.1 ft: top layer loose and pushed out of core	SM		0.0	1	SC	20																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

Continued on Next Page

HAMMER TYPE:

REV:

RECORD OF BOREHOLE: MW-8A

Sheet 2 of 2

CLIENT: Holcim Inc

PROJECT: Ravensdale RI Drilling

PROJECT NO: 152030402

LOCATION: Ravensdale, WA

DATE: September 22, 2021

INCLINATION: 90.0°

CONTRACTOR: Cascade

ELEVATION: 601.1 ft (Ground)

COORDINATES: N: 128207.1 ft E: 1352128.9 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORZ DATUM: NAD83

HOLE LOC: Northwest of Infiltration Pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT			GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS						
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30-in drop					N-VALUE	H Plastic & Liquid Limits (%) ○ Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES		ORGANIC CONTENT %	▲ PENETRATION RESISTANCE BLOWS/FT										
							NUMBER	TYPE	REC %	BLOWS																			
26	100cc Compact Crawler	Sonic	(SM) SILTY SAND and coarse subrounded gravels and trace cobbles; greenish gray, loose, dry; trace subangular gravels. (RECESSIONAL OUTWASH)	SM		571.1	5	SC	100																29.0 - 30.0 ft bgs: hydrated medium bentonite chips backfill				
27																													
28																													
29																													
30																													
31			End of hole at 30.00 ft.																										
32																													
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RECORD OF BOREHOLE: MW-9A

Sheet 1 of 1

CLIENT:	Holcim Inc	DATE:	September 24, 2021	ELEVATION:	695.2 ft (Ground)
PROJECT:	Ravensdale RI Drilling			COORDINATES:	N: 127021.9 ft E: 1352544.2 ft
PROJECT NO:	152030402	INCLINATION:	90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Ravensdale, WA	CONTRACTOR:	Cascade	HORZ DATUM:	NAD83
				HOLE LOC:	Southeast of South Pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES					WATER CONTENT		GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30-in drop					N-VALUE	H Plastic & Liquid Limits (%) O Water Content (%) NP Nonplastic	GRAVEL	SAND	FINES		ORGANIC CONTENT %	PENETRATION RESISTANCE BLOWS/FT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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HAMMER TYPE:	REV:
LOGGED: T. Dogget	DATE: Sep 24, 2021
CHECKED: J. Johnson	DATE: Sep 29, 2021

RECORD OF BOREHOLE: MW-10A

Sheet 1 of 2

CLIENT: Holcim Inc	DATE: September 21, 2021	ELEVATION: 695.5 ft (Ground)
PROJECT: Ravensdale RI Drilling		COORDINATES: N: 127299.3 ft E: 1352539.5 ft
PROJECT NO: 152030402	INCLINATION: 90.0°	COORD SYS: SP WA North FIPS 4601 Ft
LOCATION: Ravensdale, WA	CONTRACTOR: Cascade	HORZ DATUM: NAD83
		HOLE LOC: Southwest of South Pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES					WATER CONTENT					GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30-in drop				N-VALUE	Plastic & Liquid Limits (%) Water Content (%) Nonplastic					GRAVEL	SAND	FINES		ORGANIC CONTENT %	PENETRATION RESISTANCE BLOWS/FT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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HAMMER TYPE:

REV:

LOGGED: T. Dogget

DATE: Sep 21, 2021

CHECKED: J. Johnson

DATE: Sep 29, 2021

RECORD OF BOREHOLE: MW-10A

Sheet 2 of 2

CLIENT: Holcim Inc	DATE: September 21, 2021	ELEVATION: 695.5 ft (Ground)
PROJECT: Ravensdale RI Drilling		COORDINATES: N: 127299.3 ft E: 1352539.5 ft
PROJECT NO: 152030402	INCLINATION: 90.0°	COORD SYS: SP WA North FIPS 4601 Ft
LOCATION: Ravensdale, WA	CONTRACTOR: Cascade	HORZ DATUM: NAD83
		HOLE LOC: Southwest of South Pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES					WATER CONTENT		GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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26	100cc Compact Crawler	Sonic	(SM) SILTY SAND with some coarse subrounded gravels; olive gray, compact, damp. (TILL)	SM		665.5	7	SC	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		

HAMMER TYPE:	LOGGED: T. Dogget	DATE: Sep 21, 2021
	CHECKED: J. Johnson	DATE: Sep 29, 2021

RECORD OF BOREHOLE: P-15

Sheet 1 of 2

CLIENT:	Holcim Inc	DATE:	September 23, 2021	ELEVATION:	756.0 ft (Ground)
PROJECT:	Ravensdale RI Drilling			COORDINATES:	N: 127062.5 ft E: 1352957.0 ft
PROJECT NO:	152030402	INCLINATION:	90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Ravensdale, WA	CONTRACTOR:	Cascade	HORZ DATUM:	NAD83
				HOLE LOC:	North of Haul Road and P-11

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE				SAMPLES					WATER CONTENT		GRADATION %			ORGANIC CONTENT %	ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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Continued on Next Page

HAMMER TYPE:

REV:

LOGGED: T. Dogget

DATE: Sep 23, 2021

CHECKED: J. Johnson

DATE: Sep 29, 2021

RECORD OF BOREHOLE: P-15

Sheet 2 of 2

CLIENT: Holcim Inc

PROJECT: Ravensdale RI Drilling

PROJECT NO: 152030402

LOCATION: Ravensdale, WA

DATE: September 23, 2021

INCLINATION: 90.0°

CONTRACTOR: Cascade

ELEVATION: 756.0 ft (Ground)

COORDINATES: N: 127062.5 ft E: 1352957.0 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORIZ DATUM: NAD83

HOLE LOC: North of Haul Road and P-11

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT					GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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26	100cc Compact Crawler Sonic		(ML) SILT; light gray, uniformly graded, homogeneous, dense to compact, moist; cement kiln dust. (FILL, CKD) (ML) SILT; light gray, uniformly graded, homogeneous, dense to compact, wet; cement kiln dust. (FILL, CKD)	ML		730.0	6	SC	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

HAMMER TYPE:

REV:

LOGGED: T. Dogget

CHECKED: J. Johnson

DATE: Sep 23, 2021

DATE: Sep 29, 2021

RECORD OF BOREHOLE: P-16

Sheet 1 of 1

CLIENT: Holcim Inc

PROJECT: Ravensdale RI Drilling

PROJECT NO: 152030402

LOCATION: Ravensdale, WA

DATE: September 21, 2021

INCLINATION: 90.0°

CONTRACTOR: Cascade

ELEVATION: 700.8 ft (Ground)

COORDINATES: N: 127120.4 ft E: 1352776.9 ft

COORD SYS: SP WA North FIPS 4601 Ft

HORIZ DATUM: NAD83

HOLE LOC: North of South Pond

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT					GRADATION %			ADDITIONAL LAB TESTING	SPT N Value	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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RECORD OF BOREHOLE: P-17

Sheet 1 of 1

CLIENT:	Holcim Inc	DATE:	September 24, 2021	ELEVATION:	718.3 ft (Ground)
PROJECT:	Ravensdale RI Drilling			COORDINATES:	N: 126190.2 ft E: 1353033.9 ft
PROJECT NO:	152030402	INCLINATION:	90.0°	COORD SYS:	SP WA North FIPS 4601 Ft
LOCATION:	Ravensdale, WA	CONTRACTOR:	Cascade	HORZ DATUM:	NAD83
				HOLE LOC:	West of MW-3LDA

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE			SAMPLES					WATER CONTENT					GRADATION %			ADDITIONAL LAB TESTING	SPT N Value				GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
			DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30-in drop					H Plastic & Liquid Limits (%) O Water Content (%) NP Nonplastic					GRAVEL	SAND		FINES	ORGANIC CONTENT %	▲ PENETRATION RESISTANCE BLOWS/FT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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HAMMER TYPE:		REV:	
LOGGED: T. Dogget	DATE: Sep 24, 2021	CHECKED: J. Johnson	DATE: Sep 29, 2021

Appendix D.2: Soil Sample Log for Background, Delineation, and Decision Unit Soil Samples

Table D.2.1: Background Soil Sample Log

Sample ID	Time	Date	Latitude	Longitude	Sample Description
BA-1-020123	11:41	2/1/2023	47.341865	-121.9945	0-2": Medium brown, fine to medium SAND, trace clay, silt, gravel and organics (roots, decayed leaves), moist. (SM)
BA-2-020123	11:39	2/1/2023	47.34191	-121.9943	0-2": Dark brown, fine to medium SAND, trace clay, silt, gravel and organics (roots, decayed leaves), moist. (SM)
BA-3-020123	11:29	2/1/2023	47.342013	-121.9946	0-2": Dark brown, Clayey SILT, trace sand and gravel, moist (ML)
BA-4-020123	11:33	2/1/2023	47.34201	-121.9943	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-5-020123	11:20	2/1/2023	47.342109	-121.9944	0-2": Medium brown, Silty fine to medium SAND, trace clay, gravel and organics (roots, decayed leaves). Moist. (SM)
BA-6-020123	11:12	2/1/2023	47.342197	-121.9945	0-2": Dark brown, Clayey SILT, trace sand. Moist. (ML)
BA-7-020123	11:08	2/1/2023	47.342286	-121.9945	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-8-020123	11:24	2/1/2023	47.342059	-121.9944	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-9-020123	11:37	2/1/2023	47.341945	-121.9944	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-10-020123	10:59	2/1/2023	47.342358	-121.9946	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-11-020123	10:52	2/1/2023	47.342378	-121.9945	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-12-020123	10:47	2/1/2023	47.342441	-121.9946	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-13-020123	10:42	2/1/2023	47.342517	-121.9944	0-2": Dark brown Silty fine to medium SAND, trace clay, gravel and organics (roots, decayed leaves), moist (SM)
BA-14-020123	10:37	2/1/2023	47.342585	-121.9944	0-2": Moderate brown to dark brown, fine to medium SAND, trace clay, gravel and organics (roots, decayed leaves), moist (SM)
BA-15-020123	10:33	2/1/2023	47.342613	-121.9943	0-2": Moderate brown to dark brown, fine to medium SAND, trace clay, gravel and organics (roots, decayed leaves), moist (SM)
BA-16-020123	10:25	2/1/2023	47.342683	-121.9943	0-2": Dark brown Silty fine to medium SAND, trace clay, gravel and organics (roots, decayed leaves), moist (SM)
BA-17-020123	10:09	2/1/2023	47.342686	-121.9946	0-2": Moderate brown Silty fine to medium SAND, trace clay, gravel and organics (roots, decayed leaves), moist (SM)
BA-18-020123	10:02	2/1/2023	47.342736	-121.9944	0-2": Dark brown and yellow brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-19-020123	9:57	2/1/2023	47.342587	-121.9945	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-20-020123	9:48	2/1/2023	47.342192	-121.9943	0-2": Dark brown, Clayey SILT, trace sand, gravel and organics (roots, decayed leaves), moist (ML)
BA-20-020123D	9:50	2/1/2023	47.342192	-121.9943	BA-20-020123 Duplicate

Table D.2.2: Delineation Soil Sample Log

Sample ID	Time	Date	Latitude	Longitude	Sample Description
DS-1-013123	11:20	1/31/2023	47.34259	-121.9935	0-4": Brown to dark brown, fine to medium SAND, trace gravel and organics. Moist. (SM)
DS-2-013123	11:21	1/31/2023	47.342313	-121.9937	0-4": Brown, fine to medium SAND, trace sub-rounded to sub-angular gravel, trace organics. Moist. (SM)
DS-3-013123	11:30	1/31/2023	47.342388	-121.9941	0-4": Dark brown, fine to medium SAND, trace gravel and organics. Moist. (SM)
DS-4-013123	11:33	1/31/2023	47.342585	-121.9938	0-4": Dark brown and brown, fine to medium SAND, trace gravel and organics. Moist. (SM)
DS-5-013123	11:40	1/31/2023	47.34267	-121.9935	0-4": Brown to dark brown, fine to medium SAND, trace clay, gravel and organics. Moist. (SM)
DS-6-013123	11:43	1/31/2023	47.342916	-121.9935	0-4": Dark brown and brown, fine to medium SAND, trace clay, gravel and organics. Moist. (SM)
DS-7-013123	11:47	1/31/2023	47.343193	-121.9938	0-4": Dark brown and brown, fine to medium SAND with clay, trace organics. Moist. (SM)
DS-7D-041323	11:45	4/13/2023			deeper soil sample collected at DS-7 location 0 - 8" Dark brown, fine to medium SAND, trace coal frag, trace roots, (SW) FILL 8 - 14" moderate yellowish brown, weathered sandstone, wet below 10-inches, sample collected 10-12-inches bgs
DS-8-013123	11:53	1/31/2023	47.343568	-121.994	0-4": Dark brown and brown fine to medium SAND, trace clay, gravel and organics. Moist. (SM)
DS-9-013123	11:58	1/31/2023	47.343809	-121.9941	0-4": Dark brown and brown fine to medium SAND, trace clay, gravel and organics. Moist. (SM)
DS-10-013123	12:02	1/31/2023	47.344044	-121.9941	0-4": Brown fine to coarse SAND with gravel, trace organics. Moist. (SM)
DS-11-013123	12:06	1/31/2023	47.344077	-121.9938	0-4": Brown fine to medium SAND, trace gravel and organics. Moist. (SM)
DS-12-013123	12:30	1/31/2023	47.344093	-121.9935	0-4": Brown fine to medium SAND, trace gravel and organics. Moist. (SM)
DS-12-013123D	11:48	1/31/2023	47.344093	-121.9935	DS-12-013123 Duplicate
DS-13-013123	12:35	1/31/2023	47.343947	-121.9935	0-3": Dark brown, silty fine SAND, trace fine gravel and organics. Moist (SM) 3"-4": Yellow brown, weathered sandstone. Dry.
DS-14-013123	12:42	1/31/2023	47.343761	-121.9933	0-4": Dark brown, silty fine SAND, trace coarse gravel and organics. Moist. (SM) Sample taken inside fence.
DS-15-013123	12:44	1/31/2023	47.343615	-121.9933	0-4": Dark brown and brown, silty fine SAND, trace gravel and organics. Moist. (SM) Sample taken inside fence.
DS-16-013123	12:48	1/31/2023	47.343408	-121.9932	0-4": Dark brown, silty fine SAND, trace coarse gravel and organics. Moist. (SM) Sample taken inside fence.
DS-17-013123	12:55	1/31/2023	47.342734	-121.9932	0-4": Dark brown silty fine to medium SAND, trace gravel and organics. Moist. (SM) Sample taken inside fence.
DS-18-013123	13:02	1/31/2023	47.342537	-121.9932	0-4": Yellow brown, silty fine to medium SAND, trace gravel and organics. Moist. (SM) Sample taken inside fence.
DS-19-013123	13:10	1/31/2023	47.342347	-121.9933	0-4": Brown, silty fine to medium SAND, trace gravel and organics. Moist. (SM)
DS-20-013123	13:30	1/31/2023	47.342545	-121.9932	0-4": Dark brown, silty fine to medium SAND, trace gravel, with organics. Moist. (SM)
DS-21-041323	11:25	4/13/2023	47.343046	-121.9939	Surface forest leaves, roots - not included in sample 0.5 - 4" brown to dark brown, Sandy SILT, trace fine to course subrounded Gravel, trace roots, damp (ML-SM)
DS-22-041323	11:35	4/13/2023	47.343217	-121.994	Surface forest leaves, roots - not included in sample 0.5 - 4" brown to dark brown, Sandy SILT, trace fine to course subrounded Gravel, trace roots, damp (ML-SM)
DS-23-041323	12:14	4/13/2023	47.344143	-121.9942	Surface forest leaves, roots - not included in sample 0.5 - 4" dark brown, Silty SAND, trace fine subangular Gravel, trace roots, damp (SM) FILL
DS-24-041323	12:40	4/13/2023	47.344211	-121.9939	Surface forest leaves, roots - not included in sample 0.5 - 4" dark brown, Silty SAND, trace to little fine subrounded Gravel, wood pieces, moist (SM) FILL
DS-25-041323	13:30	4/13/2023	47.342096	-121.9934	0-4": Moderate yellowish brown, fine to course SAND, trace f. Gravel, damp (SW)
DS-26	12:10	6/19/2023	47.34441	-121.994	0-4": Dark brown, Silty fine to course SAND, trace subangular gravel, little roots (SM), damp, forest topsoil
DS-27	13:00	6/19/2023	47.341891	-121.9933	0-4" - moderate brown at surface below 1-inch mod yellowish brown, Silty fine SAND, (SM) less silt than DS-26, trace roots, damp weathered sandstone, FILL
DS-28	13:20	6/19/2023	47.341533	-121.9932	0-4" - grass at surface, mod yellowish brown, Silty fine SAND, trace roots (SM) damp weathered sandstone, FILL

Table D.2.3: Decision Unit Soil Sample Log

Sample ID	Time	Date	Latitude	Longitude	Sample Description
DU-1D-013123	8:33	1/31/2023	47.34334	-121.9935	0-6": Dark brown, sandy SILT, trace organics. Moist. (ML-SM) FILL 6"-12": Brown, fine to medium SAND, trace clay and gravel (up to 3cm). Moist. Sample interval 8 to 12 inches bgs
DU-2D-013123	8:48	1/31/2023	47.343433	-121.9936	0-4": Medium gray, Clayey SILT, trace sand and organics. Moist. (ML-SM) FILL 4"-12": Medium brown, fine to medium SAND, little sub-rounded to sub-angular trace gravel (up to 6cm) (SP). Moist. Sample interval 8 to 12 inches bgs
DU-3D-013123	9:05	1/31/2023	47.343475	-121.9937	0-4": Medium to dark gray clayey SILT, trace sand and organics. Moist. (ML) FILL 4"-16": Moderate yellow brown, fine to coarse SAND, trace sub-rounded to sub-angular gravel, coal and sandstone fragments. Moist. FILL 16"-18": Light gray, fine silty SAND. Moist. Sampled interval between 6"-12".
DU-4D-013123	9:13	1/31/2023	47.343502	-121.9936	0-4": Medium to dark gray, Clayey SILT, trace sand and organics. (ML) Moist. FILL 6-12": Yellow brown, fine to coarse SAND, trace sub-rounded to sub-angular gravel, coal fragments. Moist. FILL 8"-12": Sampled interval.
DU-5D-013123	9:21	1/31/2023	47.343508	-121.9936	0-16": Fine to coarse SAND, trace sub-rounded to sub-angular gravel. Modern ceramic debris at 16". Moist. FILL 16"-17": Brown gray Clayey SILT, trace sand. (ML) Moist. 8"-12": Sampled Interval.
DU-6D-013123	9:35	1/31/2023	47.343499	-121.9936	0-14": Yellowish brown, fine to coarse SAND, trace clay, trace sub-rounded to sub-angular gravel, coal and sandstone fragments. Moist. FILL 14"-18": Moderate yellow brown fine to coarse SAND, trace gravel. Moist. 8-12": Sampled Interval.
DU-7D-013123	9:51	1/31/2023	47.343695	-121.9937	0-10": Yellow brown, fine to coarse SAND, trace sub-rounded to sub-angular gravel, coal fragments. Moist. FILL 8"-12": Sampled interval. Yellowish brown, fine to coarse SAND, some clay. Moist.
DU-7D-013123D	10:28	1/31/2023	47.343695	-121.9937	Duplicate of DU-7D-013123D
DU-8D-013123	10:00	1/31/2023	47.343789	-121.9937	0-3": Dark gray to gray, Clayey SILT, trace sand. Moist. FILL 3"-11": Yellowish brown, fine-coarse SAND, sub-rounded to sub-angular trace gravel, coal fragments. Moist. FILL 8"-12": Sampled Interval. Wet. Water at 11".
DU-9D-013123	10:13	1/31/2023	47.343847	-121.9938	0-14": Yellowish brown to brown, fine to coarse SAND, sub-rounded to sub-angular trace gravel, coal fragments. Moist. FILL 14"-16": Yellowish brown, fine to medium silty SAND. Wet. Water at 14". 8-12" Sample Interval
DU-10D-013123	10:22	1/31/2023	47.343881	-121.9936	0-4": Brown and yellowish brown, Clayey SILT, trace sand. Moist. FILL 6"-12": Sampled Interval. Yellowish brown, fine to coarse SAND, trace coal fragments. Moist. FILL